



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

IFB No. **16-39 West Middle School HVAC and Electrical Renovations**

DATE: **March 7, 2016**

OFFERS WILL BE RECEIVED UNTIL: **2:00 P.M. (CDST) on Tuesday, April 5, 2016**

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RE: **IFB No. 16-39 West Middle School HVAC and Electrical Renovations.** The purpose of this Invitation for Bid (IFB) is to solicit bids for the replacement of electrical panels, lighting and the boiler at West Middle School, 1900 N. Rockton venue, Rockford, IL 61103.

IFB Opening: **Tuesday, April 5, 2016 at 2:00 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 3<sup>rd</sup> floor prior to coming to the 6<sup>th</sup> 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](http://www.rps205.com).

**A MANDATORY PRE-BID MEETING WILL BE CONDUCTED ON, TUESDAY, MARCH 15, 2016 AT 3:30 P.M. (CDST), AT WEST MIDDLE SCHOOL, 1900 N. ROCKTON AVENUE, ROCKFORD, IL 61103 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](mailto:tamara.pugh@rps205.com).

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Rockford Public School District 205  
IFB 16-39 West Middle School HVAC and Electrical Renovations

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## **INVITATION TO BID**

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<b>Project</b>	West Middle School HVAC and Electrical Renovations
<b>Location</b>	West Middle School 1900 N. Rockton Avenue Rockford, Illinois 61103
<b>Owner</b>	Rockford Public School District 205 501 Seventh Street Rockford, Illinois 61104
<b>Project Architect</b>	Larson & Darby 4949 Harrison Avenue Suite 100 Rockford, Illinois 61108
<b>Bid Scope</b>	Replacement of electrical panels, lighting and the boiler at West Middle School, 1900 N. Rockton Avenue, Rockford, IL 61103
<b>Bid Due Date</b>	2:00 P.M. (CDST), Tuesday, April 5, 2016
<b>Pre-Bid Meeting</b>	Mandatory Meeting: 3:30 PM (CDST), Tuesday, March 15, 2016; at West Middle School, 1900 N. Rockton Avenue, IL 61103, meet in the library.
<b>Addendums</b>	Last RFI accepted; 4:30 P.M. (CDST), March 31, 2016 Last addendum issued; 4:30 P.M. (CDST), April 1, 2016
<b>Other Key Dates</b>	Tuesday, April 12, 2016; RPS Board Meeting Wednesday, April 12, 2016; Award / Notice to Proceed
<b>Bid Security</b>	5% of Base Bid.

## **INVITATION TO BID**

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### **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](http://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](mailto: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](mailto: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 16-39 West Middle School HVAC and Electrical 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:

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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 7<sup>th</sup> Street  
Rockford, IL 61104

# **LATE BIDS CANNOT BE ACCEPTED!**

## **SEALED BID PROPOSAL**

**BID NO.: 16-39**

**OPENING DATE: April 5, 2016**

**OPENING TIME: 2:00 PM (CDST)**

**DESCRIPTION: West Middle School HVAC and Electrical 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 A201 as 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.

§ 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.

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

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

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

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

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

§ 4.1.7 Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. The Bidder shall provide evidence of legal authority to perform within the jurisdiction of the Work. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further give the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached certifying the agent's authority to bind the Bidder.

#### § 4.2 BID SECURITY

§ 4.2.1 Each Bid shall be accompanied by a bid security in the form and amount required if so stipulated in the Instructions to Bidders. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. The amount of the bid security shall not be forfeited to the Owner in the event the Owner fails to comply with Section 6.2.

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

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

#### § 4.3 SUBMISSION OF BIDS

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

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

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

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

#### § 4.4 MODIFICATION OR WITHDRAWAL OF BID

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

§ 4.4.2 Prior to the time and date designated for receipt of Bids, a Bid submitted may be modified or withdrawn by notice to the party receiving Bids at the place designated for receipt of Bids. Such notice shall be in writing over the

signature of the Bidder. Written confirmation over the signature of the Bidder shall be received, and date- and time-stamped by the receiving party on or before the date and time set for receipt of Bids. A change shall be so worded as not to reveal the amount of the original Bid.

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

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

## **ARTICLE 5 CONSIDERATION OF BIDS**

### **§ 5.1 OPENING OF BIDS**

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.

§ 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.

**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](mailto: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 statutes, 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 this 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

	<u>CATEGORY 1 CONTRACTS</u>	<u>CATEGORY 2 CONTRACTS</u>
a. Bodily injury:	\$1,000,000.00 each person \$1,000,000.00 each occurrence \$1,000,000.00 aggregate	\$2,000,000.00 each person \$2,000,000.00 each occurrence \$4,000,000.00 aggregate
b. Property damage:	\$1,000,000.00 each occurrence \$1,000,000.00 aggregate	\$1,000,000.00 each occurrence \$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<br>\$1,000,000.00 each occurrence |
| b. | Property Damage: | \$1,000,000.00 each occurrence<br>\$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:

<u>CATEGORY 1</u>	<u>CATEGORY 2</u>
\$3,000,000.00 each occurrence \$3,000,000.00 aggregate	\$5,000,000.00 each occurrence \$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](http://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](mailto: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 0.800		BLD		31.790	32.790	1.5	1.5	2.0	8.420	15.17	0.000
ASBESTOS ABT-MEC 0.000		BLD		18.950	0.000	1.5	1.5	2.0	2.700	3.350	0.000
BOILERMAKER 0.400		BLD		47.070	51.300	2.0	2.0	2.0	6.970	18.13	0.000
BRICK MASON 0.640		BLD		37.050	39.800	1.5	1.5	2.0	9.230	12.57	0.000
CARPENTER 0.600		BLD		37.890	42.060	1.5	1.5	2.0	9.300	12.70	0.000
CARPENTER 0.490		HWY		42.630	44.380	1.5	1.5	2.0	8.600	11.00	0.000
CEMENT MASON 0.500		ALL		35.740	38.490	1.5	1.5	2.0	9.750	14.04	0.000
CERAMIC TILE FNSHER 0.560		BLD		32.850	0.000	1.5	1.5	2.0	8.600	5.210	0.000
COMMUNICATION TECH 0.760		BLD		36.440	40.080	1.5	1.5	2.0	10.39	12.09	0.000
ELECTRIC PWR EQMT OP 0.380		ALL		37.890	51.480	1.5	1.5	2.0	5.000	11.75	0.000
ELECTRIC PWR EQMT OP 0.390		HWY		39.220	53.290	1.5	1.5	2.0	5.000	12.17	0.000
ELECTRIC PWR GRNDMAN 0.290		ALL		29.300	51.480	1.5	1.5	2.0	5.000	9.090	0.000
ELECTRIC PWR GRNDMAN 0.300		HWY		30.330	53.290	1.5	1.5	2.0	5.000	9.400	0.000
ELECTRIC PWR LINEMAN 0.450		ALL		45.360	51.480	1.5	1.5	2.0	5.000	14.06	0.000
ELECTRIC PWR LINEMAN 0.470		HWY		46.950	53.290	1.5	1.5	2.0	5.000	14.56	0.000
ELECTRIC PWR TRK DRV 0.300		ALL		30.340	51.480	1.5	1.5	2.0	5.000	9.400	0.000
ELECTRIC PWR TRK DRV 0.310		HWY		31.400	53.290	1.5	1.5	2.0	5.000	9.730	0.000
ELECTRICIAN 0.860		BLD		42.960	47.260	1.5	1.5	2.0	10.39	17.47	0.000
ELEVATOR CONSTRUCTOR 0.600		BLD		46.830	52.680	2.0	2.0	2.0	13.57	14.51	3.770
GLAZIER 1.250		BLD		35.980	37.980	1.5	1.5	1.5	10.30	8.200	0.000
HT/FROST INSULATOR 0.480		BLD		33.930	38.550	0.0	0.0	0.0	7.950	14.77	0.000
IRON WORKER 0.500		ALL		36.290	38.100	2.0	2.0	2.0	10.24	23.19	0.000
LABORER 0.800		BLD		31.790	32.790	1.5	1.5	2.0	8.420	15.17	0.000
LABORER 0.800		HWY		34.340	35.090	1.5	1.5	2.0	8.420	17.42	0.000
LABORER, SKILLED 0.800		HWY		36.990	37.740	1.5	1.5	2.0	8.420	17.42	0.000
LATHER 0.600		BLD		37.890	42.060	1.5	1.5	2.0	9.300	12.70	0.000
MACHINIST 0.000		BLD		45.350	47.850	1.5	1.5	2.0	7.260	8.950	1.850
MARBLE FINISHERS 0.560		BLD		32.850	0.000	1.5	1.5	2.0	8.600	5.210	0.000
MARBLE MASON 0.590		BLD		35.530	35.780	1.5	1.5	2.0	8.600	7.520	0.000
MATERIAL TESTER I 0.800		ALL		33.560	0.000	1.5	1.5	2.0	8.240	16.39	0.000
MATERIALS TESTER II 0.800		ALL		33.560	0.000	1.5	1.5	2.0	8.240	16.39	0.000
MILLWRIGHT 0.500		BLD		37.220	40.940	1.5	1.5	2.0	9.050	15.00	0.000
OPERATING ENGINEER 1.300		BLD	1	48.300	47.800	2.0	2.0	2.0	17.55	11.80	2.350
OPERATING ENGINEER 1.300		BLD	2	43.100	47.800	2.0	2.0	2.0	17.55	11.80	2.350

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

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, cession 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, concrete burning machine operator, coring machine operator, plaster tender, underpinning and shoring of buildings, pump men, manhole and catch basin, dirt and stone tamper, hose men on concrete pumps, hazardous waste worker, lead base paint abatement worker, lining of pipe, refueling machine, assisting on direct boring machine, the work of laying 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; Cretex 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 yards; 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.

§ 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.

§ 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

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.

### § 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 Contractor, 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;

- .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.

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

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

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

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

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

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

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

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

### § 3.13 USE OF SITE

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

### § 3.14 CUTTING AND PATCHING

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

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

### § 3.15 CLEANING UP

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

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

### § 3.16 ACCESS TO WORK

The Contractor shall provide the Owner, its 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.

## 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

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

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.

## 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:

- .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.

§ 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.

§ 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.

§ 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

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

.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.

### § 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:

- .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

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

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.

## **§ 12.2.2 AFTER SUBSTANTIAL COMPLETION**

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

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

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

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

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

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

## **§ 12.3 ACCEPTANCE OF NONCONFORMING WORK**

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

## **ARTICLE 13 MISCELLANEOUS PROVISIONS**

### **§ 13.1 GOVERNING LAW**

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

### **§ 13.2 SUCCESSORS AND ASSIGNS**

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

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

### § 13.3 WRITTEN NOTICE

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

### § 13.4 RIGHTS AND REMEDIES

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

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

### § 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner 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

- .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

- .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 either 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.

### § 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)*

FORM FOR REFERENCE

**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

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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

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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

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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](http://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

## FORM FOR REFERENCE

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.

## FORM FOR REFERENCE

**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

## FORM FOR REFERENCE

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:**  
**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**

**ROCKFORD PUBLIC SCHOOLS**  
**REQUIRED BID FORMS CHECK LIST**  
**Bid/RFP/RFQ No.: 16-39 West Middle School HVAC and Electrical**  
**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	<input type="checkbox"/>	5% of Base Bid
Bid Form	<input type="checkbox"/>	
Bid Rigging Certification	<input type="checkbox"/>	
Minority and Women Owned Business Concern Representation	<input type="checkbox"/>	
Certificate Regarding Debarment, Suspension, Ineligibility, and Voluntary Exclusion	<input type="checkbox"/>	
Certificate Regarding Lobbying	<input type="checkbox"/>	
OFAC Compliance	<input type="checkbox"/>	
Vendor Conflict of Interest Disclosure Form	<input type="checkbox"/>	
Certified Cleared Employee List	<input type="checkbox"/>	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	<input type="checkbox"/>	
AIA Document A305-1986 Contractor's Qualification Statement	<input type="checkbox"/>	
Form W-9 Department of the Treasury Internal Revenue Service	<input type="checkbox"/>	

**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.**

<input type="checkbox"/> Certificate of Liability Insurance	<input type="checkbox"/> Performance Bond (100% of contract)
<input type="checkbox"/> AIA Document A101-2007 Standard Form of Agreement between Owner and Contractor (as revised by owner)	<input type="checkbox"/> Labor and Material Payment Bond (100% of contract)

WEST MIDDLE SCHOOL  
HVAC AND ELECTRICAL RENOVATIONS  
ROCKFORD PUBLIC SCHOOLS 205  
ROCKFORD, ILLINOIS

DOCUMENT 00 41 00 – BID FORM

TO: Executive Director of Budgeting and Purchasing  
Rockford Board of Education  
School District No. 205  
501 Seventh Street, 6<sup>th</sup> Floor Conference Room  
Rockford, Illinois 61104

BID SUBMITTED BY:

CONTRACTOR: \_\_\_\_\_

TELEPHONE: \_\_\_\_\_

DATE: \_\_\_\_\_

A. BASE BIDS

The Undersigned Bidder, having inspected the construction site and having familiarized themselves with the conditions likely to be encountered affecting the cost and schedule of the Work, and having thoroughly familiarized themselves with the Bidding Documents; hereby proposes to provide all labor, material, tools, equipment, utilities, transportation, supervision and services required for the proper execution of the entire Work required, in strict accordance with the Contract Documents for WEST MIDDLE SCHOOL HVAC AND ELECTRICAL RENOVATIONS, ROCKFORD, ILLINOIS, prepared by the Larson and Darby Group, for the Total Bid Amounts listed below:

BASE BID M: \_\_\_\_\_  
\_\_\_\_\_ DOLLARS \$ \_\_\_\_\_

M ALTERNATE BIDS

ALTERNATE NO. M1:

Base Bid: Existing heat exchanger will remain as is. No change.

Alternate Bid: Gas fired pool heater.

Add to the Base Bid the sum of:

\_\_\_\_\_  
\_\_\_\_\_ DOLLARS \$ \_\_\_\_\_

ALTERNATE NO. M2:

Base Bid: No change.

Alternate Bid: Provide and install Wireless Pneumatic Thermostats and associated required accessories as described on sheet M1.3.

WEST MIDDLE SCHOOL  
HVAC AND ELECTRICAL RENOVATIONS  
ROCKFORD PUBLIC SCHOOLS 205  
ROCKFORD, ILLINOIS

Add to the Base Bid the sum of:

\_\_\_\_\_  
\_\_\_\_\_ DOLLARS \$ \_\_\_\_\_

Unit Price for ADD or DEDUCT:

\_\_\_\_\_  
\_\_\_\_\_ DOLLARS \$ \_\_\_\_\_

ALTERNATE NO. M3:

Base Bid: No removal of any portion of the metal grate platform on the south side of the existing boilers.

Alternate Bid: Remove those portions as indicated on Drawing A1.1.

Add to the Base Bid the sum of:

\_\_\_\_\_  
\_\_\_\_\_ DOLLARS \$ \_\_\_\_\_

BASE BID E:

\_\_\_\_\_  
\_\_\_\_\_ DOLLARS \$ \_\_\_\_\_

E ALTERNATE BIDS

ALTERNATE E1: (Integrated nLIGHT system for T12 fixtures in base bid)

Under this alternate provide additional nLIGHT control system devices to integrate control system provided under Base Bid. The system shall consist of required nLIGHT hardware including bridges, gateways, CAT 5e cable, installation, testing, training, etc. This Alternate is applicable only to lighting fixtures and switches to be replaced under Base Bid.

Add Alternate Bid E1: Provide integrated nLIGHT system for (T12) lighting fixtures in base bid.

\_\_\_\_\_  
\_\_\_\_\_ DOLLARS \$ \_\_\_\_\_

WEST MIDDLE SCHOOL  
HVAC AND ELECTRICAL RENOVATIONS  
ROCKFORD PUBLIC SCHOOLS 205  
ROCKFORD, ILLINOIS

ALTERNATE E2: (Only 8' Long Fixtures replacing existing T12)

Under this alternate E4, replace existing fixtures having T12 lamps with only 8' long fixtures. Refer to drawings for specific rooms where this alternate applies.

Deduct Alternate Bid E4: Provide only 8' long fixtures in selected rooms.

\_\_\_\_\_

\_\_\_\_\_ DOLLARS \$ \_\_\_\_\_

M AND E COMBINED BID

State the price to provide the Work of Base Bid M and the Work of Base Bid E as a combined Bid.

\_\_\_\_\_

\_\_\_\_\_ DOLLARS \$ \_\_\_\_\_

COMPLETION TIME

1. The Undersigned Bidder states that if awarded the Contract, it shall achieve Final Completion of the Work in accord with the Contract as follows:
  - a. Start Work: June 7, 2016.
  - b. Substantial Completion: August 5, 2016.
  - c. Final Completion: August 12, 2016.

ADDENDUM RECEIPT

1. The Undersigned Bidder acknowledges receipt of Addenda # \_\_\_\_\_ through # \_\_\_\_\_.

SUBSTITUTION SHEET

1. All bids shall be based on the items, materials and manufacturers specified in the Specifications and/or as shown on the Drawings.
2. Bidders desiring to make substitutions for items or materials specified shall list such proposed substitutions below, together with the amount to be added to or deducted from the amounts of their Base Bid. All substitutions must have the same characteristics as items and materials specified and must be explicitly accepted by the Owner to be effective.

BRAND OR MAKE SPECIFIED	PROPOSED SUBSTITUTIONS	ADD	DEDUCT
		\$	\$
		\$	\$
		\$	\$

WEST MIDDLE SCHOOL  
HVAC AND ELECTRICAL RENOVATIONS  
ROCKFORD PUBLIC SCHOOLS 205  
ROCKFORD, ILLINOIS

PREVAILING WAGES

The Contractor shall pay and require each subcontractor to pay, not less than the general prevailing rate of hourly wages for work of a similar character in the locality in which the work is performed, and not less than general prevailing rate of hourly wages for legal holidays and overtime work, as determined by the Illinois Department of Labor, pursuant to the Illinois Revised Statutes, ch. 48, par. 39s-1 et. seq.

STATEMENT OF BIDDER'S BUSINESS ORGANIZATION

1. For Bid Submitted by an individual:

a. The Owner \_\_\_\_\_

2. For Bid submitted by a partnership:

a. Names of all the Partners

\_\_\_\_\_  
\_\_\_\_\_

3. For Bid submitted by a corporation:

a. Name and Title of Officers authorized to sign contracts:

_____	_____
	Title
_____	_____
	Title
_____	_____
	Title

CORPORATE SEAL

4. All Bidders:

a. Name of Firm \_\_\_\_\_

b. Official Address \_\_\_\_\_

c. Dated this \_\_\_\_\_ day of \_\_\_\_\_ 2016

WEST MIDDLE SCHOOL  
HVAC AND ELECTRICAL RENOVATIONS  
ROCKFORD PUBLIC SCHOOLS 205  
ROCKFORD, ILLINOIS

d. Name

---

e. Signature

---

END OF DOCUMENT 00 41 00 – BID FORM

**ROCKFORD PUBLIC SHOOOLS**  
**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 (ASIAP)  
American

☐ 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

**ROCKFORD BOARD OF EDUCATION**  
**SCHOOL DISTRICT #205**  
501 7<sup>TH</sup> 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)**

☐ Corporation

☐ Limited

☐ Partner(ship) \_\_\_\_\_ (one owner)

☐ Religious, Charitable, Educational or  
Governmental Agency (**circle one**)

☐ Sole Proprietorship (legal owner's name):  
\_\_\_\_\_

☐ Individual

☐ Other – Please identify: \_\_\_\_\_

**TAXPAYER (federal) ID# -- FEIN or Soc Sec**

(use the line corresponding to your legal status line)

FEIN: \_\_\_\_\_ - \_\_\_\_\_

FEIN: \_\_\_\_\_ - \_\_\_\_\_

FEIN: \_\_\_\_\_ - \_\_\_\_\_

FEIN: \_\_\_\_\_ - \_\_\_\_\_

FEIN: \_\_\_\_\_ - \_\_\_\_\_ or

SSN: \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_

Owner's Social Security Number

SSN: \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_

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<sup>®</sup> Document A305<sup>™</sup> – 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.

§ 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.)

§ 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;

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:

# **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.

Init.

**TABLE OF ARTICLES**

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

**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.

§ 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**

Init.

**§ 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 17<sup>th</sup> 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:

Init.

**§ 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).

Init.

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:**

**CONTRACTOR:**

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

**BY:** \_\_\_\_\_  
***ITS PRESIDENT***

**BY:** \_\_\_\_\_  
***ITS PRESIDENT***

**ATTEST:** \_\_\_\_\_  
***ITS SECRETARY***

**ATTEST:** \_\_\_\_\_  
***ITS SECRETARY***

Init.



# 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):
INSURED	E-MAIL ADDRESS:	
	INSURER(S) AFFORDING COVERAGE	
	NAIC #	
	INSURER A:	
	INSURER B:	
	INSURER C:	
	INSURER D:	
INSURER E:		
INSURER F:		

## 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 SUBR INSR: WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS
	<b>GENERAL LIABILITY</b>					EACH OCCURRENCE \$
	<input type="checkbox"/> COMMERCIAL GENERAL LIABILITY					DAMAGE TO RENTED PREMISES (Ea occurrence) \$
	<input type="checkbox"/> CLAIMS-MADE <input type="checkbox"/> OCCUR					MED EXP (Any one person) \$
						PERSONAL & ADV INJURY \$
						GENERAL AGGREGATE \$
	GEN'L AGGREGATE LIMIT APPLIES PER:					PRODUCTS - COMP/OP AGG \$
	<input type="checkbox"/> POLICY <input type="checkbox"/> PROJECT <input type="checkbox"/> LOC					\$
	<b>AUTOMOBILE LIABILITY</b>					COMBINED SINGLE LIMIT (Ea accident) \$
	<input type="checkbox"/> ANY AUTO					BODILY INJURY (Per person) \$
	<input type="checkbox"/> ALL OWNED AUTOS	<input type="checkbox"/> SCHEDULED AUTOS				BODILY INJURY (Per accident) \$
	<input type="checkbox"/> HIRED AUTOS	<input type="checkbox"/> NON-OWNED AUTOS				PROPERTY DAMAGE (Per accident) \$
						\$
	<b>UMBRELLA LIAB</b>	<input type="checkbox"/> OCCUR				EACH OCCURRENCE \$
	<b>EXCESS LIAB</b>	<input type="checkbox"/> CLAIMS-MADE				AGGREGATE \$
	DED <input type="checkbox"/> RETENTION \$					\$
	<b>WORKERS COMPENSATION AND EMPLOYERS' LIABILITY</b>					WC STATUTORY LIMITS <input type="checkbox"/> OTHER <input type="checkbox"/>
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICE/MEMBER EXCLUDED? <input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> 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)

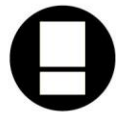
## CERTIFICATE HOLDER

## CANCELLATION

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

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



**Larson & Darby Group**  
Architects Engineers Planners

## PROJECT MANUAL

WEST MIDDLE SCHOOL  
HVAC AND ELECTRICAL RENOVATIONS  
1900 NORTH ROCKTON AVENUE, ROCKFORD, IL 61103  
**ROCKFORD PUBLIC SCHOOLS 205**

# PROJECT MANUAL

FOR

## WEST MIDDLE SCHOOL HVAC AND ELECTRICAL RENOVATIONS 1900 NORTH ROCKTON AVENUE, ROCKFORD, IL 61103 ROCKFORD PUBLIC SCHOOLS 205

PROJECT NO.: 25107

DATE: February 29, 2016

BY:

LARSON & DARBY GROUP  
4949 HARRISON AVENUE, SUITE 100  
P.O. BOX 5207

Illinois Design Firm Registration Number: 184-000280

ARCHITECTS-ENGINEERS-INTERIORS  
ROCKFORD, ILLINOIS 61108  
ROCKFORD, ILLINOIS 61125-0207

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STEPHEN M. NELSON  
Licensed Architect  
LIC. EXPIRES: 11/30/2016

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Date

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RAED SALEM  
Registered Professional Engineer  
LIC. EXPIRES: 11/30/2017

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Date

DOCUMENT 007300 – SUPPLEMENTARY CONDITIONS

1. CHANGE ORDER MARK-UPS: Add the following to provisions regarding Change Order mark-ups in the Conditions of the Contract:
  - A. 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 Contractor's Subcontractors, five percent of the amount due the Subcontractors.
    - .3 For each Subcontractor involved, for Work performed by that Subcontractor's own forces, five percent of the cost.
    - .4 For each Subcontractor involved, for Work performed by the Subcontractor's Subsubcontractors, five percent of the amount due the Sub-subcontractor.
    - .5 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also.

END OF DOCUMENT 007300

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SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY OF WORK

- A. Project: HVAC and electrical renovations at West Middle School, 1900 North Rockton Avenue, Rockford, IL 61103.
- B. Owner: Rockford Public Schools District 205.
- C. The Work includes but is not limited to the following:
  - 1. HVAC renovation and related electrical Work.
- D. Work Under Other Contracts:
  - 1. 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.

1.2 WORK RESTRICTIONS

- A. Contractor's Use of Premises: During construction, Contractor will have limited use of site and building indicated.
  - 1. Owner will occupy premises during construction. Perform construction only during normal working hours (7 AM to 4 PM Monday thru Friday, other than holidays), unless otherwise agreed to in advance by Owner. Clean up work areas and return to a useable condition at the end of each work period.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 10 00

SECTION 01 20 00 - PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 ALLOWANCES

- A. Allowances shall include cost to Contractor of specific products and materials ordered by Owner under allowance and shall include taxes, freight, and delivery to Project site. Allowances are specified in the Bid Form.
- B. Obtain three proposals for each allowance and submit to Architect with recommendations. Purchase products and systems selected by Owner.
- C. Advise Architect of the date when selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- D. Submit invoices to show cost of products furnished under each allowance. Reconciliation of Allowance amounts with actual costs will be by Change Order.

1.2 ALTERNATES

- A. An alternate is an amount proposed by bidder for certain work that may be added to or deducted from the Base Bid amount if Owner accepts the Alternate. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate the Alternate into the Work. No other adjustments are made to the Contract Sum.
- B. Allowances are specified in the Bid Form.

1.3 UNIT PRICES

- A. A unit price is an amount proposed by bidders and stated on the Bid Form as a price per unit of measurement for work added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased. Unit prices are specified in the Bid Form.
- B. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 20 00

## SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 PROJECT MANAGEMENT AND COORDINATION

- A. Coordinate construction to ensure efficient and orderly installation of each part of the Work.
- B. Schedule and conduct progress meetings at Project site at regular intervals. Notify Owner and Architect of meeting dates and times. Require attendance of each subcontractor or other entity concerned with current progress or involved with planning or coordination of future activities.
  - 1. Record minutes and distribute to everyone concerned, including Owner and Architect.

#### 1.2 SUBMITTAL PROCEDURES

- A. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 1. 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.
  - 2. Submit three copies of each submittal. Architect will return one copy.
  - 3. Architect will return submittals, without review, received from sources other than Contractor.
- B. Place a permanent label or title block on each submittal for identification. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect. Include the following information on the label:
  - 1. Project name.
  - 2. Date.
  - 3. Name and address of Contractor.
  - 4. Name and address of subcontractor or supplier.
  - 5. Number and title of appropriate Specification Section.
- C. Identify deviations from the Contract Documents on submittals.
- D. Contractor's Construction Schedule Submittal Procedure: Submit two copies of schedule within 10 working days after date established for Commencement of the Work.

### PART 2 - PRODUCTS

#### 2.1 ACTION SUBMITTALS

- A. Product Data: Mark each copy to show applicable products and options. Include the following:
  - 1. Manufacturer's written recommendations, product specifications, and installation instructions.
  - 2. Wiring diagrams showing factory-installed wiring.
  - 3. Printed performance curves and operational range diagrams.
  - 4. Testing by recognized testing agency.
  - 5. Compliance with specified standards and requirements.
- B. 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. Submit on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches. Include the following:
  - 1. Dimensions and identification of products.
  - 2. Fabrication and installation drawings and roughing-in and setting diagrams.

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3. Wiring diagrams showing field-installed wiring.
4. Notation of coordination requirements.
5. Notation of dimensions established by field measurement.

- C. Samples: Submit Samples for review of kind, color, pattern, and texture and for a comparison of these characteristics between submittal and actual component as delivered and installed. Include name of manufacturer and product name on label.
1. If variation is inherent in material or product, submit at least three sets of paired units that show variations.

## 2.2 INFORMATION SUBMITTALS

- A. Qualification Data: Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- B. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

## 2.3 DELEGATED DESIGN

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

## 2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type schedule within 10 days of date established for the Notice of Award.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

## PART 3 - EXECUTION

### 3.1 SUBMITTAL REVIEW

- A. 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. Architect will review each action submittal, make marks to indicate corrections or modifications required, stamp and mark as appropriate to indicate action taken, and return copies less those retained.

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3.2 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Distribute copies of approved schedule to Owner, Architect, subcontractors, testing and inspecting agencies, and parties identified by Contractor with a need-to-know schedule responsibility. When revisions are made, distribute updated schedules to the same parties.
- B. Updating: At monthly intervals, update schedule to reflect actual construction progress and activities.
  - 1. As the Work progresses, indicate Actual Completion percentage for each activity.

END OF SECTION 01 30 00

## SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. Use Charges: Cost or use charges for temporary facilities shall be included in the Contract Sum.
- B. Use water and electric power from Owner's existing system without metering and without payment of use charges.
- C. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

### PART 2 - PRODUCTS (Not Applicable)

### PART 3 - EXECUTION

#### 3.1 TEMPORARY UTILITIES

- A. Sanitary Facilities: Contractor may use existing toilets when the building is not occupied by students.
- B. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
  - 1. Connect temporary service to Owner's existing power source, as directed by Owner.

#### 3.2 TEMPORARY SUPPORT FACILITIES

- A. Provide field offices, storage and fabrication sheds, and other support facilities as necessary for construction operations.
- B. Provide waste-collection containers in sizes adequate to handle waste from construction operations. Collect waste daily and, when containers are full, legally dispose of waste off-site. Comply with requirements of authorities having jurisdiction.
- C. Install project identification and other signs in locations approved by Owner to inform the public and persons seeking entrance to Project.

#### 3.3 TEMPORARY SECURITY AND PROTECTION FACILITIES

- A. Provide temporary environmental protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- B. Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- C. Provide temporary enclosures for protection of construction and workers from inclement weather and for containment of heat.

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- D. Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
- E. Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- F. Furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
- G. Install and maintain temporary fire-protection facilities. Comply with NFPA 241.

3.4 TERMINATION AND REMOVAL

- A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
- B. Remove temporary facilities and controls no later than Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

END OF SECTION 01 50 00

## SECTION 01 60 00 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
- B. Product Substitutions: Substitutions include changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor after award of the Contract.
  - 1. Submit three copies of each request for product substitution.
  - 2. Submit requests within ten days after the Notice of Award.
  - 3. Do not submit unapproved substitutions on Shop Drawings or other submittals.
  - 4. Identify product to be replaced and show compliance with requirements for substitutions. Include a detailed comparison of significant qualities of proposed substitution with those of the Work specified, a list of changes needed to other parts of the Work required to accommodate proposed substitution, and any proposed changes in the Contract Sum or the Contract Time should the substitution be accepted.
  - 5. Architect will review the proposed substitution and notify Contractor of its acceptance or rejection.
- C. Comparable Product Requests:
  - 1. Submit three copies of each request for comparable product. Do not submit unapproved products on Shop Drawings or other submittals.
  - 2. Identify product to be replaced and show compliance with requirements for comparable product requests. Include a detailed comparison of significant qualities of proposed substitution with those of the Work specified.
  - 3. Architect will review the proposed product and notify Contractor of its acceptance or rejection.
- D. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Deliver products to Project site in manufacturer's original sealed container or packaging, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 3. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
  - 4. Store materials in a manner that will not endanger Project structure.
  - 5. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
- E. 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.

## PART 2 - PRODUCTS

### 2.1 PRODUCT OPTIONS

- A. Provide products that comply with the Contract Documents, are undamaged, and are new at the time of installation.
  - 1. Provide products complete with accessories, trim, finish, and other devices and components needed for a complete installation and the intended use and effect.
  - 2. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
- B. Product Selection Procedures:
  - 1. Where Specifications name a single product or manufacturer, provide the item indicated that complies with requirements, or Owner-approved equal.
  - 2. Where Specifications include a list of names of products or manufacturers, provide one of the items indicated that complies with requirements, or Owner-approved equal.
  - 3. Where Specifications include a list of names of products or manufacturers, accompanied by the term "available products" or "available manufacturers," provide one of the named items that complies with requirements, or Owner-approved equal. Comply with provisions for "comparable product requests" for consideration of an unnamed product.
  - 4. Where Specifications name a product as the "basis-of-design" and include a list of manufacturers, provide the named product, or Owner-approved equal. Comply with provisions for "comparable product requests" for consideration of an unnamed product by the other named manufacturers.
  - 5. Where Specifications name a single product as the "basis-of-design" and no other manufacturers are named, provide the named product or Owner-approved equal. Comply with provisions for "comparable product requests" for consideration of an unnamed product by another manufacturer.
- C. Unless otherwise indicated, Architect will select color, pattern, and texture of each product from manufacturer's full range of options that includes both standard and premium items.

## PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 60 00

## SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 CLOSEOUT SUBMITTALS

- A. Record Drawings: Maintain a set of prints of the Contract Drawings as Record Drawings. Mark to show actual installation where installation varies from that shown originally.
  - 1. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
- B. Operation and Maintenance Data: Submit one copy of manual. Organize data into three-ring binders with identification on front and spine of each binder, and envelopes for folded drawings. Include the following:
  - 1. Manufacturer's operation and maintenance documentation.
  - 2. Maintenance and service schedules.
  - 3. Maintenance service contracts.
  - 4. Emergency instructions.
  - 5. Spare parts list.
  - 6. Wiring diagrams.
  - 7. Copies of warranties.

### PART 2 - PRODUCTS (Not Applicable)

### PART 3 - EXECUTION

#### 3.1 EXAMINATION AND PREPARATION

- A. Examine substrates and conditions for compliance with manufacturer's written requirements including, but not limited to, surfaces that are sound, level, plumb, smooth, clean, and free of deleterious substances; substrates within installation tolerances; and application conditions within environmental limits. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to property survey and existing benchmarks.
- C. Take field measurements as required to fit the Work properly. Where fabricated products are to be fitted to other construction, verify dimensions by field measurement before fabrication and, when possible, allow for fitting and trimming during installation.

#### 3.2 CUTTING AND PATCHING

- A. Do not cut structural members or operational elements without prior written approval of Architect.
- B. Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- C. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

### 3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for installation. Anchor each product securely in place, accurately located and aligned with other portions of the Work. Clean exposed surfaces and protect from damage.
- B. Clean Project site and work areas daily, including common areas.

### 3.4 FINAL CLEANING

- A. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion:
  - 1. Remove labels that are not permanent.
  - 2. Clean transparent materials, including mirrors. Remove excess glazing compounds. Replace chipped or broken glass.
  - 3. Clean exposed finishes to a dust-free condition, free of stains, films, and foreign substances. Sweep concrete floors broom clean.
  - 4. Vacuum carpeted surfaces and wax resilient flooring.
  - 5. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication. Clean plumbing fixtures. Clean light fixtures, lamps, globes, and reflectors.
  - 6. Clean Project site, yard, and grounds, in areas disturbed by construction activities. Sweep paved areas; remove stains, spills, and foreign deposits. Rake grounds to a smooth, even-textured surface.

### 3.5 CLOSEOUT PROCEDURES

- A. Substantial Completion: Before requesting Substantial Completion inspection, complete the following:
  - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  - 2. Advise Owner of pending insurance changeover requirements.
  - 3. Submit specific warranties, maintenance service agreements, and similar documents.
  - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 5. Submit Record Drawings and Specifications, operation and maintenance manuals, and similar final record information.
  - 6. Deliver tools, spare parts, extra materials, and similar items.
  - 7. Make final changeover of permanent locks and deliver keys to Owner.
  - 8. Complete startup testing of systems.
  - 9. Remove temporary facilities and controls.
  - 10. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
  - 11. Complete final cleaning requirements, including touchup painting.
  - 12. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will proceed with inspection or advise Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will advise Contractor of items that must be completed or corrected before certificate will be issued.
- C. Request inspection for Final Completion, once the following are complete:
  - 1. Submit a copy of Substantial Completion inspection list stating that each item has been completed or otherwise resolved for acceptance.

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2. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- D. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
- E. Submit a written request for final inspection for acceptance. On receipt of request, Architect will proceed with inspection or advise Contractor of unfulfilled requirements. Architect will prepare final Certificate for Payment after inspection or will advise Contractor of items that must be completed or corrected before certificate will be issued.

3.6 DEMONSTRATION AND TRAINING

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system. Include a detailed review of the following:
  1. Include instruction for basis of system design and operational requirements, review of documentation, emergency procedures, operations, adjustments, troubleshooting, maintenance, and repairs.

END OF SECTION 01 70 00

## SECTION 02 41 19 - SELECTIVE DEMOLITION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Demolition and removal of selected portions of building or structure.
  - 2. Salvage of existing items to be reused or recycled.

#### 1.2 MATERIALS OWNERSHIP

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

#### 1.3 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, and for dust control. Indicate proposed locations and construction of barriers.
- B. Schedule of selective demolition activities with starting and ending dates for each activity.
- C. Predemolition photographs or video.
- D. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Inventory of items that have been removed and salvaged.

#### 1.6 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

#### 1.7 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: It is not expected that hazardous materials will be encountered in the Work.

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1. Hazardous materials in connection with existing windows will be removed by Owner's separate Environmental Demolition Contractor 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.
- G. Arrange selective demolition schedule so as not to interfere with Owner's operations.
- 1.8 WARRANTY
- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

## 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. 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.
- C. Inventory and record the condition of items to be removed and salvaged.

### 3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

### 3.3 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. Arrange to shut off utilities with utility companies.
  3. 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.
  4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
    - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

### 3.4 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.
- 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.
- C. Remove temporary barricades and protections where hazards no longer exist.

### 3.5 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. 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.
  2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  4. Maintain fire watch during and after flame-cutting operations.
  5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

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6. Dispose of demolished items and materials promptly.
- 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:
  1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.
  4. Transport items to Owner's storage area designated by Owner.
  5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
  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.

3.6 CLEANING

- A. Remove demolition waste materials from Project site
  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.
- B. Burning: Do not burn demolished materials.
- C. 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 02 41 19

## SECTION 05 50 00 - METAL FABRICATIONS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Miscellaneous steel framing and supports.

#### 1.2 ACTION 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.]

### PART 2 - PRODUCTS

#### 2.1 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- D. Abrasive-Surface Floor Plate: Steel plate [with abrasive granules rolled into surface] [or] [with abrasive material metallurgically bonded to steel].
- E. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

#### 2.2 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
  - 2. Material for Exterior Locations: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

#### 2.3 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.

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- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

## 2.4 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
- C. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
- E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

## 2.5 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

## 2.6 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.

## 2.7 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - 1. Shop prime with universal shop primer unless indicated.
- C. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

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

#### 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.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 50 00

## SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. Work includes but is not limited to the following:
  - 1. Blocking and nailers.
- B. Submittals: Model code evaluation reports for treated wood.

### PART 2 - PRODUCTS

#### 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: Provide dressed lumber, S4S, marked with grade stamp of inspection agency.

#### 2.2 TREATED MATERIALS

- A. Preservative-Treated Materials: AWWA C2.
  - 1. Use treatment containing no arsenic or chromium.
  - 2. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
  - 3. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- B. Provide preservative-treated materials for items indicated on Drawings, and the following:
  - 1. Concealed members in contact with masonry or concrete.
- C. Fire-Retardant-Treated Materials: Comply with performance requirements in AWWA C20.
  - 1. Use Exterior type for exterior locations and where indicated.
  - 2. Identify with appropriate classification marking of a testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Provide fire-retardant treated materials for items indicated on Drawings.

#### 2.3 LUMBER

- A. Miscellaneous Lumber: Construction, or No. 2 grade with 19 percent maximum moisture content of any species. Provide for nailers, blocking, and similar members.

#### 2.4 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: Plywood, Exposure 1, C-D Plugged, fire-retardant treated, not less than 1/2 inch thick.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Set miscellaneous rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

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- B. Securely attach miscellaneous rough carpentry to substrates.

END OF SECTION 06 10 53

## SECTION 07 84 13 - PENETRATION FIRESTOPPING

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data and product certificates signed by manufacturer certifying that products furnished comply with requirements.
- B. Provide firestopping systems with fire-resistance ratings indicated by reference to UL designations as listed in its "Fire Resistance Directory," or to designations of another testing agency acceptable to authorities having jurisdiction.
- C. Provide through-penetration firestopping systems with F-ratings indicated, as determined according to ASTM E 814, but not less than fire-resistance rating of construction penetrated.
  - 1. Provide through-penetration firestopping systems with T-ratings as well as F-ratings, as determined according to ASTM E 814, where indicated.
- D. For exposed firestopping, provide products with flame-spread indexes of less than 25 and smoke-developed indexes of less than 450, as determined according to ASTM E 84.

### PART 2 - PRODUCTS

#### 2.1 FIRESTOP SYSTEMS

- A. Any through-penetration firestop systems that are classified by UL or acceptable to the AHJ for the applications may be used.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install firestopping systems to comply with requirements listed in testing agency's directory for indicated fire-resistance rating.
- B. Identification: Identify through-penetration firestop systems with permanent labels attached to surfaces adjacent to firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
  - 1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb."
  - 2. Classification/listing designation of applicable testing and inspecting agency.
  - 3. Through-penetration firestop system manufacturer's name and product name.

END OF SECTION 07 84 13

## SECTION 07 92 00 - JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data and color Samples.
- B. Environmental Limitations: Do not proceed with installation of joint sealants when ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F.

### PART 2 - PRODUCTS

#### 2.1 JOINT SEALANTS

- A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under service and application conditions.
- B. Sealant for General Exterior Use:
  - 1. Single-component, nonsag urethane sealant, ASTM C 920, Type S; Grade NS; Class 25; Uses NT, M, A, and O.
  - 2. Basis of design: Tremco Dymonic FC, or Owner-approved equal
- C. Sealant for Interior Use at Perimeters of Door and Window Frames:
  - 1. Latex sealant, single-component, nonsag, mildew-resistant, paintable, acrylic-emulsion sealant complying with ASTM C 834.
- D. Acoustical Sealant for Concealed Joints:
  - 1. Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.

#### 2.2 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer.
- B. Cylindrical Sealant Backings: ASTM C 1330, of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Comply with ASTM C 1193.
- B. Comply with ASTM C 919 for use of joint sealants in acoustical applications.

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END OF SECTION 07 92 00

## SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Transition fittings.
  - 3. Sleeves.
  - 4. Equipment installation requirements common to equipment sections.
  - 5. Painting and finishing.
  - 6. Supports and anchorages.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- D. The following are industry abbreviations for plastic materials:
  - 1. PVC: Polyvinyl chloride plastic.
- E. The following are industry abbreviations for rubber materials:
  - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 2. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

## 1.6 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces.

## PART 2 - PRODUCTS

### 2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### 2.2 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- E. Solvent Cements for Joining Plastic Piping:
  - 1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

### 2.3 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install escutcheons for penetrations of walls, ceilings, and floors.
- K. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
    - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
    - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
  - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint.
- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

- M. Verify final equipment locations for roughing-in.
- N. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. PVC Nonpressure Piping: Join according to ASTM D 2855.
- I. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

### 3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

#### 3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

#### 3.5 PAINTING

- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

#### 3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- B. Field Welding: Comply with AWS D1.1.

END OF SECTION 220500

## SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Liquid-in-glass thermometers.
  - 2. Thermowells.

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Flo Fab Inc.
    - b. Palmer Wahl Instrumentation Group.
    - c. Terice, H. O. Co.
    - d. Weiss Instruments, Inc.
    - e. Winters Instruments - U.S.
  - 2. Standard: ASME B40.200.
  - 3. Case: Cast aluminum; 9-inch nominal size unless otherwise indicated.
  - 4. Case Form: Adjustable angle unless otherwise indicated.
  - 5. Tube: Glass with magnifying lens and blue or red organic liquid.
  - 6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
  - 7. Window: Glass.
  - 8. Stem: Aluminum and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  - 9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
  - 10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

#### 2.2 THERMOWELLS

- A. Thermowells:

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1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Type: Stepped shank unless straight or tapered shank is indicated.
5. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
6. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
7. Bore: Diameter required to match thermometer bulb or stem.
8. Insertion Length: Length required to match thermometer bulb or stem.
9. Lagging Extension: Include on thermowells for insulated piping and tubing.
10. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install thermowells with socket extending a minimum of 2 inches into fluid and in vertical position in piping tees.
- B. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- C. Install thermometers in the following locations:
  1. Outlet of each domestic hot-water storage tank.

#### 3.2 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

#### 3.3 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Hot-Water: 0 to 250 deg F and 0 to 150 deg C.

END OF SECTION 220519

SECTION 220523 – GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Bronze ball valves.
  - 2. Iron, single-flange butterfly valves.
  - 3. Bronze swing check valves.
- B. Related Sections:
  - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
  - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. RS: Rising stem.
- F. SWP: Steam working pressure.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 2. ASME B31.1 for power piping valves.
  - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set gate valves closed to prevent rattling.
  - 4. Set ball valves open to minimize exposure of functional surfaces.
  - 5. Set butterfly valves closed or slightly open.
  - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
  - 1. Handwheel: For valves other than quarter-turn types.
  - 2. Handlever: For quarter-turn valves NPS 6 and smaller.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
  - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
  - 2. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
  - 1. Solder Joint: With sockets according to ASME B16.18.
  - 2. Threaded: With threads according to ASME B1.20.1.

### 2.2 BRASS BALL VALVES

- A. Two-Piece, Full-Port, Brass Ball Valves with Forged Brass or Bronze Trim:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Hammond Valve.
    - d. Kitz Corporation.
    - e. Milwaukee Valve Company.
    - f. Nibco Inc.: T-FP-600; S-FP-600.
    - g. Red-White Valve Corporation.
  - 2. Description:

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- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Two piece.
- e. Body Material: Forged brass or Bronze.
- f. Ends: Threaded or soldered.
- g. Seats: PTFE or TFE.
- h. Stem: Brass or Bronze.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

## 2.3 BRONZE SWING CHECK VALVES

- A. Class 150, Bronze Swing Check Valves with Bronze Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Valve, Inc.
    - b. Crane Co.; Crane Valve Group; Crane Valves.
    - c. Crane Co.; Crane Valve Group; Jenkins Valves.
    - d. Crane Co.; Crane Valve Group; Stockham Division.
    - e. Kitz Corporation.
    - f. Milwaukee Valve Company.
    - g. Nibco, Inc.
    - h. Red-White Valve Corporation.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 3.
    - b. CWP Rating: 300 psig.
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Soldered or Threaded.
    - f. Disc: Bronze.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.

### 3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball or butterfly.
  - 2. Throttling Service: Ball valves.
  - 3. Check Valves:
    - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
  - 1. For Copper Tubing, NPS 4" and Smaller: Soldered ends except where additional valve-end options are indicated in valve schedules below.
  - 2. For Grooved-End Copper Tubing: Valve ends may be grooved.

### 3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 3 and Smaller:
  - 1. Ball Valves: Two piece, full port, brass or bronze with bronze trim.
  - 2. Bronze Swing Check Valves: Class 150, bronze disc.
- B. Pipe NPS 4 and Larger:
  - 1. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following hangers and supports for plumbing system piping and equipment:
  - 1. Steel pipe hangers and supports.
  - 2. Fastener systems.
  - 3. Pipe positioning 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."

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
  - 1. AAA Technology & Specialties Co., Inc.
  - 2. Bergen-Power Pipe Supports.
  - 3. B-Line Systems, Inc.; a division of Cooper Industries.
  - 4. Carpenter & Paterson, Inc.
  - 5. Empire Industries, Inc.
  - 6. ERICO/Michigan Hanger Co.
  - 7. Globe Pipe Hanger Products, Inc.
  - 8. Grinnell Corp.
  - 9. GS Metals Corp.
  - 10. National Pipe Hanger Corporation.
  - 11. PHD Manufacturing, Inc.
  - 12. PHS Industries, Inc.
  - 13. Piping Technology & Products, Inc.
  - 14. Tolco Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

## 2.2 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Manufacturers:
    - a. Hilti, Inc.
    - b. ITW Ramset/Red Head.
    - c. Masterset Fastening Systems, Inc.
    - d. MKT Fastening, LLC.
    - e. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Manufacturers:
    - a. B-Line Systems, Inc.; a division of Cooper Industries.
    - b. Empire Industries, Inc.
    - c. Hilti, Inc.
    - d. ITW Ramset/Red Head.
    - e. MKT Fastening, LLC.
    - f. Powers Fasteners.

## 2.3 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Manufacturers:
  - 1. C & S Mfg. Corp.
  - 2. HOLDRITE Corp.; Hubbard Enterprises.
  - 3. Samco Stamping, Inc.

## 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. 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.

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2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
  3. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  4. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
  5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
  6. 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.
  7. 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.
  8. 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.
- F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- G. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  2. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  3. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- H. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.

- c. Heavy (MSS Type 33): 3000 lb.
- 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- I. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
- J. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

### 3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.
- C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- D. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- E. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- F. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- G. Insulated Piping: Comply with the following:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
  - 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.

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- b. NPS 4: 12 inches long and 0.06 inch thick.
- c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
- d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
- e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
- 5. Pipes NPS 8 and Larger: Include wood inserts.
- 6. Insert Material: Length at least as long as protective shield.
- 7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Pipe labels.
  - 2. Valve tags.

1.3 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 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.

2.2 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - 1. Valve-tag schedule shall be included in operation and maintenance data.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

#### 3.2 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. Near major equipment items and other points of origination and termination.
  - 5. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 6. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- B. Pipe Label Color Schedule:
  - 1. Domestic Water Piping:
    - a. Background Color: Yellow.
    - b. Letter Color: Black.
  - 2. Gas Piping:
    - a. Background Color: Yellow.
    - b. Letter Color: Black.

#### 3.3 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; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
  - 1. Valve-Tag Size and Shape:
    - a. Cold Water: 1-1/2 inches, round.
    - b. Hot Water: 1-1/2 inches, round.
    - c. Gas: 1-1/2 inches, round.
  - 2. Valve-Tag Color:
    - a. Cold Water: Natural.
    - b. Hot Water: Natural.
    - c. Gas: Natural.
  - 3. Letter Color:
    - a. Cold Water: Black.
    - b. Hot Water: Black.
    - c. Gas: Black.

END OF SECTION 220553

## SECTION 220700 - PLUMBING INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Insulation Materials:
    - a. Mineral fiber.
  - 2. Insulating cements.
  - 3. Adhesives.
  - 4. Mastics.
  - 5. Lagging adhesives.
  - 6. Sealants.
  - 7. Factory-applied jackets.
  - 8. Tapes.
  - 9. Securements.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

#### 1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### 1.5 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

## 1.6 SCHEDULING

- A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Johns Manville; Micro-Lok.
    - b. Knauf Insulation; 1000(Pipe Insulation.
    - c. Owens Corning; Fiberglas Pipe Insulation.
  - 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

### 2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Insulco, Division of MFS, Inc.; Triple I.
    - b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Insulco, Division of MFS, Inc.; SmoothKote.
    - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
    - c. Rock Wool Manufacturing Company; Delta One Shot.

### 2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.

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- C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-35.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
    - c. ITW TACC, Division of Illinois Tool Works; CB-50.
    - d. Marathon Industries, Inc.; 590.
    - e. Mon-Eco Industries, Inc.; 55-40.
    - f. Vimasco Corporation; 749.
  - 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
  - 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-30.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-35.
    - c. ITW TACC, Division of Illinois Tool Works; CB-25.
    - d. Marathon Industries, Inc.; 501.
    - e. Mon-Eco Industries, Inc.; 55-10.
  - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
  - 3. Service Temperature Range: 0 to 180 deg F.
  - 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
  - 5. Color: White.

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-52.
    - b. Foster Products Corporation, H. B. Fuller Company; 81-42.
    - c. Marathon Industries, Inc.; 130.
    - d. Mon-Eco Industries, Inc.; 11-30.
    - e. Vimasco Corporation; 136.
  - 2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.
  - 3. Service Temperature Range: Minus 50 to plus 180 deg F.

4. Color: White.

## 2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

## 2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
    - b. Compac Corp.; 104 and 105.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

## 2.8 SECUREMENTS

- A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

## 2.9 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
  1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
  3. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
  2. Testing agency labels and stamps.
  3. Nameplates and data plates.
  4. Manholes.
  5. Handholes.
  6. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
- C. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies.

### 3.5 TANK, AND VESSEL INSULATION INSTALLATION

- A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
  2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
  3. Protect exposed corners with secured corner angles.
  4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
    - a. Do not weld anchor pins to ASME-labeled pressure vessels.
    - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    - d. Do not overcompress insulation during installation.

- e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
  - f. Impale insulation over anchor pins and attach speed washers.
  - g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
  6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
  7. Stagger joints between insulation layers at least 3 inches.
  8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
  9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
  10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

### 3.6 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating

- cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

### 3.7 MINERAL-FIBER INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  2. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
  3. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
  4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
  2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.

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2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Insulation Installation on Storm Sewer Piping:

1. Insulation shall not be required beyond 1'-0" of first vertical pipe from horizontal.

3.8 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Underground piping.
  2. Chrome-plated pipes and fittings unless otherwise called for or there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
1. All Pipe Sizes: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Hot and Recirculated Hot Water:
1. All Pipe Sizes: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.10 EQUIPMENT INSULATION SCHEDULE

- A. Domestic hot-water storage tank insulation shall be the following:
1. Mineral-Fiber Pipe and Tank: 3 inches thick.

END OF SECTION 220700

## SECTION 221116 - DOMESTIC WATER PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes domestic water piping inside the building.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing domestic water piping systems with 125 psig, unless otherwise indicated.

#### 1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

#### 2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Types L, water tube, drawn temper.
  - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
  - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
  - 4. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
    - a. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.
  - 5. Press Fittings: Fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAMPO PS 117. Sealing elements for fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by the fitting manufacturer.

## 2.3 VALVES

- A. Bronze and cast-iron, general-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

## PART 3 - EXECUTION

### 3.1 PIPE AND FITTING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Grooved joints may be used on aboveground grooved-end piping.
- D. Aboveground Domestic Water Piping: Use the following piping materials for each size range:
  - 1. NPS 1 and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
  - 2. NPS 1 and Smaller: Hard copper tube, Type L; copper press fittings; and press connections.
  - 3. NPS 1-1/4 and NPS 1-1/2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
  - 4. NPS 1-1/4 and NPS 1-1/2: Hard copper tube, Type L; copper press fittings; and press connections.
  - 5. NPS 2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
  - 6. NPS 2: Hard copper tube, Type L; copper press fittings; and press connections.
  - 7. NPS 2: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
  - 8. NPS 2-1/2 to NPS 3-1/2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
  - 9. NPS 2-1/2 to NPS 3-1/2: Hard copper tube, Type L; copper press fittings; and press connections.
  - 10. NPS 2-1/2 to NPS 3-1/2: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
  - 11. NPS 4 to NPS 6: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
  - 12. NPS 4 to NPS 6: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.

### 3.2 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use bronze ball valves.
  - 2. Drain Duty: Hose-end drain valves.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 and smaller.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
  - 1. Install hose-end drain valves at low points in water mains, risers, and branches.

### 3.3 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

### 3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- C. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- D. Press Connections: Tubing shall be fully inserted into the fitting then pressed using the tool approved by the manufacturer, according to the fitting manufacturer's written instructions.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Pipe hanger and support devices are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet: MSS Type 49, spring cushion rolls, if indicated.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.

### 3.7 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
  - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
  - 2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
    - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
  - 3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
  - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping as follows:
  - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
  - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
  - 6. Prepare reports for tests and required corrective action.

### 3.8 ADJUSTING

- A. Perform the following adjustments before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Open throttling valves to proper setting.
  - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
    - b. Adjust calibrated balancing valves to flows indicated.
  - 5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
  - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.

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7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.9 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
  1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
  2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221116

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following for soil, waste, and vent piping inside the building:
  - 1. Pipe, tube, and fittings.
  - 2. Special pipe fittings.

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
  - 1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
    - a. Manufacturers:
      - 1) ANACO.
      - 2) Fernco, Inc.
      - 3) Ideal Div.; Stant Corp.
      - 4) Mission Rubber Co.
      - 5) Tyler Pipe; Soil Pipe Div.

## 2.3 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
  - 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

## 2.4 SPECIAL PIPE FITTINGS

- A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
  - 1. Manufacturers:
    - a. Dallas Specialty & Mfg. Co.
    - b. Fernco, Inc.
    - c. Logan Clay Products Company (The).
    - d. Mission Rubber Co.
    - e. NDS, Inc.
    - f. Plastic Oddities, Inc.
  - 2. Sleeve Materials:
    - a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
    - b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
    - c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

## PART 3 - EXECUTION

### 3.1 EXCAVATION AND BACKFILL

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
  - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
- C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.
  - 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for Record Documents.
  - 3. Testing and inspecting underground utilities.
  - 4. Removing trash and debris.
  - 5. Removing temporary shoring and bracing, and sheeting.
  - 6. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- E. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

- F. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
- G. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- H. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
  - 1. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

### 3.2 PIPING APPLICATIONS

- A. Aboveground, soil and waste piping shall be any of the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless cast-iron soil pipe and fittings standard, shielded, stainless-steel couplings; and hubless-coupling joints.
  - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 4. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- B. Aboveground, vent piping shall be any of the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
  - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 4. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- C. Underground, soil, waste, and vent piping shall be any of the following:
  - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
  - 2. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 3. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

### 3.3 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- C. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

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- D. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- E. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
  - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Sanitary Drainage Piping: 1 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- F. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- G. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- H. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### 3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- D. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Install individual, straight, horizontal piping runs according to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- C. Support vertical piping and tubing at base and at each floor.

- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  - 4. NPS 6: 60 inches with 3/4-inch rod.
  - 5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
  - 2. NPS 3: 48 inches with 1/2-inch rod.
  - 3. NPS 4 and 5: 48 inches with 5/8-inch rod.
  - 4. NPS 6: 48 inches with 3/4-inch rod.
  - 5. NPS 8 to NPS 12: 48 inches with 7/8-inch rod.
- H. Install supports for vertical PVC piping every 48 inches.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
  - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.

### 3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
  5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  6. Prepare reports for tests and required corrective action.

### 3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
  - 1. Cleanouts.
  - 2. Floor drains.
  - 3. Miscellaneous sanitary drainage piping specialties.

1.3 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.

1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.5 COORDINATION

- A. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. See schedule on drawings.

2.2 FLOOR DRAINS

- A. See schedule on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

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- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate at each change in direction of piping greater than 45 degrees.
  - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  - 4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  - 1. Position floor drains for easy access and maintenance.
  - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
  - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- G. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- H. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- I. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### 3.3 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

## SECTION 221616 - NATURAL-GAS PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Pipes, tubes, and fittings.
  - 2. Piping and tubing joining materials.
  - 3. Valves.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
  - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Piping specialties.
  - 2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.

#### 1.6 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

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- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
  - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
  - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

2.2 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.3 MANUAL GAS SHUTOFF VALVES

- A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
  - 1. CWP Rating: 125 psig.
  - 2. Threaded Ends: Comply with ASME B1.20.1.
  - 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
  - 4. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
  - 5. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- B. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
  - 1. CWP Rating: 125 psig.
  - 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
  - 3. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- C. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Flowserve.
    - b. Homestead Valve; a division of Olson Technologies, Inc.
    - c. McDonald, A. Y. Mfg. Co.
    - d. Milliken Valve Company.
    - e. Mueller Co.; Gas Products Div.
    - f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.

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2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Operator: Square head or lug type with tamperproof feature where indicated.
7. Pressure Class: 125 psig.
8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.
- I. Verify final equipment locations for roughing-in.
- J. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- K. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

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1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- L. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- M. Connect branch piping from top or side of horizontal piping.
- N. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- O. Do not use natural-gas piping as grounding electrode.

### 3.3 VALVE INSTALLATION

- A. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

### 3.4 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
  1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
  2. Cut threads full and clean using sharp dies.
  3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
  4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
  5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
  1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
  2. Bevel plain ends of steel pipe.
  3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
  1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

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4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.6 LABELING AND IDENTIFYING

- A. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for piping and valve identification.

3.7 PAINTING

- A. Paint exposed, exterior gas piping, valves, and piping specialties, except components, with factory-applied paint or protective coating.
  1. Alkyd System: MPI EXT 5.1D.
    - a. Prime Coat: Alkyd anticorrosive metal primer.
    - b. Topcoat: Exterior alkyd enamel (flat).
    - c. Color: Yellow.
- B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

3.9 PIPING SCHEDULE

- A. NPS 2 and smaller, and/or less than 1.0 PSI operating pressure shall be the following:
  1. Steel pipe with malleable-iron fittings and threaded joints.
- B. NPS 2-1/2 and larger, and/or operating pressure 1.0 PSI or greater shall be the following:
  1. Steel pipe with wrought-steel fittings and welded joints.

3.10 VALVE SCHEDULE

- A. Distribution piping valves shall be one of the following:
  1. Cast-iron, lubricated plug valve.
- B. Valves in branch piping for single appliance shall be one of the following:
  1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION 221616

## SECTION 223400 - FUEL-FIRED DOMESTIC WATER HEATERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Commercial, coil-type, finned-tube, gas-fired, water heaters.
  - 2. Water heater accessories.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated.
- B. Shop Drawings:
  - 1. Wiring Diagrams: For power, signal, and control wiring.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.
- C. ASME Compliance:
  - 1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
  - 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

#### 1.6 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## PART 2 - PRODUCTS

### 2.1 COMMERCIAL, FINNED-TUBE, GAS-FIRED, WATER HEATERS

- A. Commercial, Coil-Type, Finned-Tube, Gas-Fired, Domestic-Water Heaters:
1. See schedule on drawings.
  2. Description: Packaged unit with water heater, separate hot-water storage tank, pump, piping, and controls.
  3. Heater Construction: ASME code with 160-psig working-pressure rating for domestic-water heater.
    - a. Heat Exchanger: Helix or spiral, finned-copper-tube coils with bronze headers.
    - b. Connections: Factory fabricated of materials compatible with heater. Attach to heater before testing.
      - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
      - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
  4. Heater Appurtenances:
    - a. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire boiler except connections and controls.
    - b. Jacket: Steel with enameled finish.
    - c. Burner: For use with coil-type, finned-tube, gas-fired, domestic-water heaters and natural-gas fuel.
    - d. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, intermittent electronic-ignition system.
    - e. Temperature Control: Adjustable, storage-tank temperature-control fitting and flow switch, interlocked with circulator and burner.
    - f. Safety Control: Automatic, high-temperature-limit cutoff device or system.
  5. Support: Steel base or skids.
  6. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, separately coupled in-line pump as defined in HI 1.1-1.2 and HI 1.3. Include mechanical seals, 125-psig minimum working-pressure rating, and 225 deg F continuous-water-temperature rating.
  7. Piping: Copper tubing; copper, solder-joint fittings; and brazed or flanged joints.
  8. Mounting: Domestic-water heater, tank, and accessories factory mounted on skids.

### 2.2 WATER HEATER ACCESSORIES

- A. Expansion Tanks:
1. See schedule on drawings.
  2. Description: ASME rated, steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm.
- B. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.
- C. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.
- D. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water

heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

- E. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

## 2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

## PART 3 - EXECUTION

### 3.1 WATER HEATER INSTALLATION

- A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base.
  1. Maintain manufacturer's recommended clearances.
  2. Arrange units so controls and devices that require servicing are accessible.
  3. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
- B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
  1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 15110 "Valves."
- C. Install gas-fired, domestic-water heaters according to NFPA 54.
  1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
- D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains.
- F. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
- G. Fill domestic-water heaters with water.

### 3.2 CONNECTIONS

- A. Comply with requirements for domestic-water piping specified in Section 15140 "Domestic Water Piping."

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- B. Comply with requirements for gas piping specified in Section 15194 " Fuel Gas Piping."
- C. Drawings indicate general arrangement of piping, fittings, and specialties.
- D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, domestic-water heaters.

END OF SECTION 223400

## SECTION 223413 - POTABLE-WATER STORAGE TANKS

### 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. Insulated, steel, potable-water storage tanks.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water storage tanks.
  - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

#### 1.4 QUALITY ASSURANCE

- A. ASME Compliance for Steel Tanks: Fabricate and label steel, ASME-code, potable-water storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.
- B. Comply with NSF 61, "Drinking Water System Components - Health Effects," for potable-water storage tanks. Include appropriate NSF marking.

#### 1.5 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

### PART 2 - PRODUCTS

#### 2.1 INSULATED, STEEL, POTABLE-WATER STORAGE TANKS

- 1. See schedule on drawings.
- B. Construction: ASME code, steel, constructed with nontoxic welded joints, for 125-psig working pressure.
- C. Tappings: Factory-fabricated steel, welded to tank before testing and labeling.
  - 1. NPS 2 and Smaller: ASME B1.20.1, with female thread.
  - 2. NPS 2-1/2 and Larger: ASME B16.5, flanged.
- D. Specialties and Accessories: Include tappings in tank and the following:
  - 1. Temperature and Pressure relief valve.
  - 2. Thermometer.

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- E. Horizontal Tank Supports: Factory-fabricated steel legs or steel skirt, welded to tank before testing and labeling.
- F. Tank Interior Finish: Materials and thicknesses complying with NSF 61 barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.
  - 1. Coating: Glass.
- G. Insulation: Field-installed fiberglass; surrounding entire tank except connections and other openings; suitable for tank operating temperature; and complying with ASHRAE/IESNA 90.1.
- H. Jacket: Steel, with manufacturer's standard finish unless otherwise indicated.

## 2.2 SOURCE QUALITY CONTROL

- A. Test and inspect potable-water storage tanks according to the following tests and inspections and prepare test reports:
  - 1. Pressure Testing for ASME-Code, Potable-Water Storage Tanks: Hydrostatically test to ensure structural integrity and freedom from leaks. Fill tanks with water, vent air, pressurize to 1-1/2 times tank pressure rating, disconnect test equipment, hold pressure for 30 minutes with no drop in pressure, and check for leaks.
- B. Repair or replace tanks that fail test with new tanks, and repeat until test is satisfactory.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install water storage tanks on concrete bases, level and plumb, firmly anchored. Arrange so devices needing servicing are accessible.
- B. Anchor tank supports and tanks to substrate.
- C. Install thermometer on water storage tank.
- D. Install the following devices on tanks where indicated:
  - 1. Temperature and pressure relief valves.
  - 2. Vacuum relief valves.
  - 3. Connections to accessories.
- E. After installing tanks with factory finish, inspect finishes and repair damages to finishes.

### 3.2 CONNECTIONS

- A. Install piping adjacent to potable-water storage tanks to allow service and maintenance.
- B. Connect water piping to water storage tanks with unions or flanges and with shutoff valves. Connect tank drains with shutoff valves and discharge over closest floor drains.
  - 1. General-duty valves are specified in Section 15110 "Valves."
    - a. Valves NPS 2 and Smaller: Ball.
    - b. Valves NPS 2-1/2 and Larger: Butterfly.

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- c. Drain Valves: NPS 3/4 gate or ball valve. Include outlet with, or nipple in outlet with, ASME B1.20.7, 3/4-11.5NH thread for garden-hose service, threaded cap, and chain.
- 2. Water Piping Connections: Make connections to dissimilar metals with dielectric fittings.

3.3 FIELD QUALITY CONTROL

- A. Perform the following final checks before filling:
  - 1. Test operation of tank accessories and devices.
  - 2. Verify that pressure relief valves have correct setting.
    - a. Manually operate pressure relief valves.
    - b. Adjust pressure settings.
  - 3. Verify that vacuum relief valves are correct size.
    - a. Manually operate vacuum relief valves.
    - b. Adjust vacuum settings.
- B. Filling Procedures: Follow manufacturer's written procedures. Fill tanks with water to operating level.

END OF SECTION 223413

## SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 Information for Bidders, and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

#### 1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Motor controllers.
  - 2. Torque, speed, and horsepower requirements of the load.
  - 3. Ratings and characteristics of supply circuit and required control sequence.
  - 4. Ambient and environmental conditions of installation location.

### PART 2 - PRODUCTS

#### 2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

#### 2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

## 2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
  - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
  - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

## 2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
  - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
  - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
  - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

## 2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.
  - 2. Split phase.
  - 3. Capacitor start, inductor run.
  - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

## PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 05 13

SECTION 23 05 16 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 Information for Bidders, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Pipe loops and swing connections.
  - 2. Alignment guides and anchors.

1.3 PERFORMANCE REQUIREMENTS

- A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.
- B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of expansion joint, from manufacturer.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For expansion joints to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. ASME Boiler and Pressure Vessel Code: Section IX.

## PART 2 - PRODUCTS

### 2.1 ALIGNMENT GUIDES AND ANCHORS

#### A. Alignment Guides:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Adscro Manufacturing LLC.
  - b. Advanced Thermal Systems, Inc.
  - c. Flex-Hose Co., Inc.
  - d. Flexicraft Industries.
  - e. Flex-Weld, Inc.
  - f. Hyspan Precision Products, Inc.
  - g. Metraflex, Inc.
  - h. Senior Flexonics Pathway.
  - i. Unisource Manufacturing, Inc.
  - j. U.S. Bellows, Inc.
2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.

#### B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A 36/A 36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
3. Washers: ASTM F 844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
  - a. Stud: Threaded, zinc-coated carbon steel.
  - b. Expansion Plug: Zinc-coated steel.
  - c. Washer and Nut: Zinc-coated steel.
5. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.
  - a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
  - b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
  - c. Washer and Nut: Zinc-coated steel.

## PART 3 - EXECUTION

### 3.1 EXPANSION-JOINT INSTALLATION

- A. Install expansion joints of sizes matching sizes of piping in which they are installed.

### 3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

- A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
- B. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.
- C. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.
- D. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

### 3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

- A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.
- B. Install one guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.
- C. Attach guides to pipe and secure guides to building structure.
- D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- E. Anchor Attachments:
  - 1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.
- F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
  - 1. Anchor Attachment to Steel Structural Members: Attach by welding.
  - 2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.
- G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 23 05 16

## SECTION 23 05 19 - METERS AND GAGES FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 Information for Bidders, and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Filled-system thermometers.
  - 2. Liquid-in-glass thermometers.
  - 3. Thermowells.
  - 4. Dial-type pressure gages.
  - 5. Gage attachments.
  - 6. Test plugs.
  - 7. Test-plug kits.

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 FILLED-SYSTEM THERMOMETERS

- A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Ashcroft Inc.
    - b. Marsh Bellofram.
    - c. Miljoco Corporation.
    - d. Palmer Wahl Instrumentation Group.
    - e. REOTEMP Instrument Corporation.
    - f. Terice, H. O. Co.

- g. Weiss Instruments, Inc.
- 2. Standard: ASME B40.200.
- 3. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
- 4. Element: Bourdon tube or other type of pressure element.
- 5. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
- 6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
- 7. Pointer: Dark-colored metal.
- 8. Window: Glass or plastic.
- 9. Ring: Metal.
- 10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device rigid, back and rigid, bottom; with ASME B1.1 screw threads.
- 11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
  - a. Design for Air-Duct Installation: With ventilated shroud.
  - b. Design for Thermowell Installation: Bare stem.
- 12. Accuracy: Plus or minus 1 percent of scale range.

## 2.2 LIQUID-IN-GLASS THERMOMETERS

### A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Terice, H. O. Co.
- 2. Standard: ASME B40.200.
- 3. Case: Cast aluminum; 6-inch nominal size.
- 4. Case Form: Back angle unless otherwise indicated.
- 5. Tube: Glass with magnifying lens and blue or red organic liquid.
- 6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
- 7. Window: Glass or plastic.
- 8. Stem: Aluminum or brass and of length to suit installation.
  - a. Design for Air-Duct Installation: With ventilated shroud.
  - b. Design for Thermowell Installation: Bare stem.
- 9. Connector: 3/4 inch, with ASME B1.1 screw threads.
- 10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

## 2.3 THERMOWELLS

### A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

## 2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AMETEK, Inc.; U.S. Gauge.
  - b. Ashcroft Inc.
  - c. Ernst Flow Industries.
  - d. Flo Fab Inc.
  - e. Marsh Bellofram.
  - f. Miljoco Corporation.
  - g. Noshok.
  - h. Palmer Wahl Instrumentation Group.
  - i. REOTEMP Instrument Corporation.
  - j. Tel-Tru Manufacturing Company.
  - k. Trerice, H. O. Co.
  - l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  - m. Weiss Instruments, Inc.
  - n. WIKA Instrument Corporation - USA.
  - o. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

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2.5 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
- B. Siphons: Loop-shaped section of brass pipe with NPS 1/4 or NPS 1/2 pipe threads.
- C. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.6 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Flow Design, Inc.
  - 2. Miljoco Corporation.
  - 3. National Meter, Inc.
  - 4. Peterson Equipment Co., Inc.
  - 5. Sisco Manufacturing Company, Inc.
  - 6. Trerice, H. O. Co.
  - 7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  - 8. Weiss Instruments, Inc.
- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.7 TEST-PLUG KITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Flow Design, Inc.
  - 2. Miljoco Corporation.
  - 3. National Meter, Inc.
  - 4. Peterson Equipment Co., Inc.
  - 5. Sisco Manufacturing Company, Inc.
  - 6. Trerice, H. O. Co.
  - 7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  - 8. Weiss Instruments, Inc.
- B. Furnish one test-plug kit(s) containing two thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

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- C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.
- D. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.
- E. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be at least 0 to 200 psig.
- F. Carrying Case: Metal or plastic, with formed instrument padding.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install thermowells with socket extending a minimum of 2 inches into fluid and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install valve and snubber in piping for each pressure gage for fluids (except steam).
- G. Install valve and syphon fitting in piping for each pressure gage for steam.
- H. Install test plugs in piping tees.
- I. Install connection fittings in accessible locations for attachment to portable indicators.
- J. Install thermometers in the following locations:
  - 1. Inlet and outlet of each hydronic zone.
  - 2. Inlet and outlet of each hydronic boiler.
  - 3. Inlet and outlet of each hydronic coil in air-handling units.
- K. Install pressure gages in the following locations:
  - 1. Discharge of each pressure-reducing valve.
  - 2. Steam headers and boilers.
  - 3. Suction and discharge of each pump.

#### 3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

### 3.3 ADJUSTING

- A. After installation, calibrate meters according to manufacturer's written instructions.
- B. Adjust faces of meters and gages to proper angle for best visibility.

### 3.4 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each hydronic zone shall be the following:
  - 1. Liquid-filled, bimetallic-actuated type.
  - 2. Direct-mounted, metal-case, vapor-actuated type.
  - 3. Compact-style, liquid-in-glass type.
  - 4. Direct-mounted, light-activated type.
  - 5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- B. Thermometers at inlet and outlet of each hydronic boiler shall be the following:
  - 1. Liquid-filled, bimetallic-actuated type.
  - 2. Direct-mounted, metal-case, vapor-actuated type.
  - 3. Compact-style, liquid-in-glass type.
  - 4. Direct-mounted, light-activated type.
  - 5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- C. Thermometers at inlet and outlet of each hydronic coil in air-handling units and built-up central systems shall be the following:
  - 1. Liquid-filled, bimetallic-actuated type.
  - 2. Direct-mounted, metal-case, vapor-actuated type.
  - 3. Compact-style, liquid-in-glass type.
  - 4. Direct-mounted, light-activated type.
  - 5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- D. Thermometer stems shall be of length to match thermowell insertion length.

### 3.5 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Heating, Hot-Water Piping: 0 to 250 deg F.
- B. Scale Range for Air Ducts: Minus 40 to plus 110 deg F.

### 3.6 PRESSURE-GAGE SCHEDULE

- A. Pressure gages at discharge of each pressure-reducing valve shall be the following:
  - 1. Liquid-filled Solid-front, pressure-relief, direct-mounted, metal case.
  - 2. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- B. Pressure gages at steam headers & boilers shall be the following:
  - 1. Liquid-filled Solid-front, pressure-relief, direct-mounted, metal case.

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- C. Pressure gages at suction and discharge of each pump shall be the following:
  - 1. Liquid-filled Solid-front, pressure-relief, direct-mounted, metal case.
  - 2. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Heating, Hot-Water Piping: 0 to 100 psi.
- B. Scale Range for Steam: 0 to 25 psi

END OF SECTION 23 05 19

SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions Division 00 Information for Bidders, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bronze angle valves.
2. Bronze ball valves.
3. Iron ball valves.
4. Iron, single-flange butterfly valves.
5. Bronze swing check valves.
6. Iron swing check valves.
7. Iron swing check valves with closure control.
8. Bronze gate valves.
9. Iron gate valves.
10. Bronze globe valves.
11. Iron globe valves.
12. Chainwheels.

B. Related Sections:

1. Section 23 05 53 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

#### 1.4 ACTION SUBMITTALS

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

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 2. ASME B31.1 for power piping valves.
  - 3. ASME B31.9 for building services piping valves.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set angle, gate, and globe valves closed to prevent rattling.
  - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
  - 5. Set butterfly valves closed or slightly open.
  - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
  - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
  - 2. Handwheel: For valves other than quarter-turn types.

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3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.
5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

## 2.2 BRONZE ANGLE VALVES

A. Class 125, Bronze Angle Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Hammond Valve.
  - b. Milwaukee Valve Company.
2. Description:
  - a. Standard: MSS SP-80, Type 1.
  - b. CWP Rating: 200 psig.
  - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
  - d. Ends: Threaded.
  - e. Stem and Disc: Bronze.
  - f. Packing: Asbestos free.
  - g. Handwheel: Malleable iron, bronze, or aluminum.

B. Class 125, Bronze Angle Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. American Valve, Inc.
  - b. NIBCO INC.
2. Description:

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- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded.
- e. Stem: Bronze.
- f. Disc: PTFE or TFE.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

## 2.3 BRONZE BALL VALVES

### A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Valve, Inc.
  - b. Conbraco Industries, Inc.; Apollo Valves.
  - c. NIBCO INC.
- 2. Description:
  - a. Standard: MSS SP-110.
  - b. CWP Rating: 400 psig.
  - c. Body Design: One piece.
  - d. Body Material: Bronze.
  - e. Ends: Threaded.
  - f. Seats: PTFE or TFE.
  - g. Stem: Bronze.
  - h. Ball: Chrome-plated brass.
  - i. Port: Reduced.

### B. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Valve, Inc.
  - b. Conbraco Industries, Inc.; Apollo Valves.
  - c. Crane Co.; Crane Valve Group; Crane Valves.
  - d. Hammond Valve.
  - e. Lance Valves; a division of Advanced Thermal Systems, Inc.
  - f. Legend Valve.
  - g. Milwaukee Valve Company.
  - h. NIBCO INC.
  - i. Red-White Valve Corporation.
  - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.
  - c. CWP Rating: 600 psig.
  - d. Body Design: Two piece.

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- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Bronze.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

C. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. American Valve, Inc.
  - b. Conbraco Industries, Inc.; Apollo Valves.
  - c. Crane Co.; Crane Valve Group; Jenkins Valves.
  - d. Crane Co.; Crane Valve Group; Stockham Division.
  - e. DynaQuip Controls.
  - f. Hammond Valve.
  - g. Lance Valves; a division of Advanced Thermal Systems, Inc.
  - h. Milwaukee Valve Company.
  - i. NIBCO INC.
2. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.
  - c. CWP Rating: 600 psig.
  - d. Body Design: Two piece.
  - e. Body Material: Bronze.
  - f. Ends: Threaded.
  - g. Seats: PTFE or TFE.
  - h. Stem: Bronze.
  - i. Ball: Chrome-plated brass.
  - j. Port: Regular.

D. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.; Apollo Valves.
  - b. DynaQuip Controls.
  - c. Hammond Valve.
  - d. Milwaukee Valve Company.
  - e. NIBCO INC.
  - f. Red-White Valve Corporation.
2. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.
  - c. CWP Rating: 600 psig.
  - d. Body Design: Three piece.
  - e. Body Material: Bronze.

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- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Bronze.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

## 2.4 IRON BALL VALVES

### A. Class 125, Iron Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Valve, Inc.
  - b. Conbraco Industries, Inc.; Apollo Valves.
  - c. Kitz Corporation.
  - d. Sure Flow Equipment Inc.
  - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-72.
  - b. CWP Rating: 200 psig.
  - c. Body Design: Split body.
  - d. Body Material: ASTM A 126, gray iron.
  - e. Ends: Flanged.
  - f. Seats: PTFE or TFE.
  - g. Stem: Stainless steel.
  - h. Ball: Stainless steel.
  - i. Port: Full.

## 2.5 IRON, SINGLE-FLANGE BUTTERFLY VALVES

### A. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
  - b. Bray Controls; a division of Bray International.
  - c. Conbraco Industries, Inc.; Apollo Valves.
  - d. Cooper Cameron Valves; a division of Cooper Cameron Corp.
  - e. Crane Co.; Crane Valve Group; Jenkins Valves.
  - f. Crane Co.; Crane Valve Group; Stockham Division.
  - g. DeZurik Water Controls.
  - h. Hammond Valve.
  - i. Kitz Corporation.
  - j. Milwaukee Valve Company.
  - k. NIBCO INC.
  - l. Norriseal; a Dover Corporation company.
  - m. Red-White Valve Corporation.
  - n. Spence Strainers International; a division of CIRCOR International.
  - o. Tyco Valves & Controls; a unit of Tyco Flow Control.

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p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 150 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Aluminum bronze.

B. 150 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
- b. Bray Controls; a division of Bray International.
- c. Conbraco Industries, Inc.; Apollo Valves.
- d. Cooper Cameron Valves; a division of Cooper Cameron Corp.
- e. Crane Co.; Crane Valve Group; Jenkins Valves.
- f. Crane Co.; Crane Valve Group; Stockham Division.
- g. DeZurik Water Controls.
- h. Hammond Valve.
- i. Kitz Corporation.
- j. Milwaukee Valve Company.
- k. NIBCO INC.
- l. Norriseal; a Dover Corporation company.
- m. Red-White Valve Corporation.
- n. Spence Strainers International; a division of CIRCOR International.
- o. Tyco Valves & Controls; a unit of Tyco Flow Control.
- p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 150 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: NBR.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Aluminum bronze.

2.6 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Valve, Inc.

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- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Division.
- e. Hammond Valve.
- f. Kitz Corporation.
- g. Milwaukee Valve Company.
- h. NIBCO INC.
- i. Powell Valves.
- j. Red-White Valve Corporation.
- k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- l. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 3.
- b. CWP Rating: 200 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.

2.7 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Crane Co.; Crane Valve Group; Stockham Division.
- d. Hammond Valve.
- e. Kitz Corporation.
- f. Legend Valve.
- g. Milwaukee Valve Company.
- h. NIBCO INC.
- i. Powell Valves.
- j. Red-White Valve Corporation.
- k. Sure Flow Equipment Inc.
- l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- m. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-71, Type I.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. NPS 14 to NPS 24, CWP Rating: 150 psig.
- d. Body Design: Clear or full waterway.
- e. Body Material: ASTM A 126, gray iron with bolted bonnet.
- f. Ends: Flanged.
- g. Trim: Bronze.
- h. Gasket: Asbestos free.

## 2.8 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

### A. Class 125, Iron Swing Check Valves with Lever and Weight-Closure Control:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Crane Co.; Crane Valve Group; Stockham Division.
  - d. Hammond Valve.
  - e. Milwaukee Valve Company.
  - f. NIBCO INC.
  - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-71, Type I.
  - b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
  - c. NPS 14 to NPS 24, CWP Rating: 150 psig.
  - d. Body Design: Clear or full waterway.
  - e. Body Material: ASTM A 126, gray iron with bolted bonnet.
  - f. Ends: Flanged.
  - g. Trim: Bronze.
  - h. Gasket: Asbestos free.
  - i. Closure Control: Factory-installed, exterior lever and weight.

## 2.9 BRONZE GATE VALVES

### A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Valve, Inc.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Crane Co.; Crane Valve Group; Jenkins Valves.
  - d. Crane Co.; Crane Valve Group; Stockham Division.
  - e. Hammond Valve.
  - f. Kitz Corporation.
  - g. Milwaukee Valve Company.
  - h. NIBCO INC.
  - i. Powell Valves.
  - j. Red-White Valve Corporation.
  - k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - l. Zy-Tech Global Industries, Inc.
2. Description:
  - a. Standard: MSS SP-80, Type 1.
  - b. CWP Rating: 200 psig.
  - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
  - d. Ends: Threaded or solder joint.
  - e. Stem: Bronze.

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- f. Disc: Solid wedge; bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

B. Class 125, RS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Valve, Inc.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Crane Co.; Crane Valve Group; Jenkins Valves.
  - d. Crane Co.; Crane Valve Group; Stockham Division.
  - e. Hammond Valve.
  - f. Kitz Corporation.
  - g. Milwaukee Valve Company.
  - h. NIBCO INC.
  - i. Powell Valves.
  - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - k. Zy-Tech Global Industries, Inc.
2. Description:
  - a. Standard: MSS SP-80, Type 2.
  - b. CWP Rating: 200 psig.
  - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
  - d. Ends: Threaded or solder joint.
  - e. Stem: Bronze.
  - f. Disc: Solid wedge; bronze.
  - g. Packing: Asbestos free.
  - h. Handwheel: Malleable iron, bronze, or aluminum.

2.10 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Crane Co.; Crane Valve Group; Stockham Division.
  - d. Flo Fab Inc.
  - e. Hammond Valve.
  - f. Kitz Corporation.
  - g. Legend Valve.
  - h. Milwaukee Valve Company.
  - i. NIBCO INC.
  - j. Powell Valves.
  - k. Red-White Valve Corporation.
  - l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - m. Zy-Tech Global Industries, Inc.
2. Description:

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- a. Standard: MSS SP-70, Type I.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. NPS 14 to NPS 24, CWP Rating: 150 psig.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Disc: Solid wedge.
- h. Packing and Gasket: Asbestos free.

B. Class 125, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Crane Co.; Crane Valve Group; Stockham Division.
- d. Flo Fab Inc.
- e. Hammond Valve.
- f. Kitz Corporation.
- g. Legend Valve.
- h. Milwaukee Valve Company.
- i. NIBCO INC.
- j. Powell Valves.
- k. Red-White Valve Corporation.
- l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- m. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-70, Type I.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. NPS 14 to NPS 24, CWP Rating: 150 psig.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Disc: Solid wedge.
- h. Packing and Gasket: Asbestos free.

2.11 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Stockham Division.
- c. Hammond Valve.
- d. Kitz Corporation.
- e. Milwaukee Valve Company.
- f. NIBCO INC.
- g. Powell Valves.
- h. Red-White Valve Corporation.

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- i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- j. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded or solder joint.
- e. Stem and Disc: Bronze.
- f. Packing: Asbestos free.
- g. Handwheel: Malleable iron, bronze, or aluminum.

B. Class 125, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Stockham Division.
- c. NIBCO INC.
- d. Red-White Valve Corporation.

2. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded or solder joint.
- e. Stem: Bronze.
- f. Disc: PTFE or TFE.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

2.12 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Crane Co.; Crane Valve Group; Stockham Division.
- d. Hammond Valve.
- e. Kitz Corporation.
- f. Milwaukee Valve Company.
- g. NIBCO INC.
- h. Powell Valves.
- i. Red-White Valve Corporation.
- j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- k. Zy-Tech Global Industries, Inc.

2. Description:

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- a. Standard: MSS SP-85, Type I.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Packing and Gasket: Asbestos free.

## 2.13 CHAINWHEELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Babbitt Steam Specialty Co.
  - 2. Roto Hammer Industries.
  - 3. Trumbull Industries.
- B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
  - 1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
  - 2. Attachment: For connection to ball, butterfly and plug valve stems.
  - 3. Sprocket Rim with Chain Guides: Ductile or cast iron, of type and size required for valve. Include zinc coating.
  - 4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.

- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install chainwheels on operators for ball, butterfly, gate, globe and plug valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.
- F. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.
  - 2. Plate-Type Check Valves: In horizontal or vertical position, between flanges.
  - 3. Lift Check Valves: With stem upright and plumb.

### 3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball, butterfly, or gate valves.
  - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
  - 3. Throttling Service except Steam: Globe, ball, or butterfly valves.
  - 4. Pump-Discharge Check Valves:
    - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
    - b. NPS 2-1/2 and Larger: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal-seat check valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
  - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
  - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
  - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
  - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  - 6. For Steel Piping, NPS 5 and Larger: Flanged ends.
  - 7. For Grooved-End Steel Piping except Steam and Steam Condensate Piping: Valve ends may be grooved.

### 3.5 HEATING-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:

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1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125, bronze disc.
3. Ball Valves: Two piece, full port, bronze with bronze trim.
4. Bronze Swing Check Valves: Class 125, bronze disc.
5. Bronze Gate Valves: Class 125, NRS.
6. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves, NPS 2-1/2 to NPS 10: Class 150.
3. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, EPDM seat, aluminum-bronze disc.
4. Iron, Single-Flange Butterfly Valves, NPS 14 to NPS 24: 150 CWP, EPDM seat, aluminum-bronze disc.
5. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12: [175] [300] CWP.
6. Iron Swing Check Valves: Class 125, metal seats.
7. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12: Class 125, lever and spring.
8. Iron, Grooved-End Check Valves, NPS 3 to NPS 12: 300 CWP.
9. Iron Gate Valves: Class 125, NRS.
10. Iron Globe Valves, NPS 2-1/2 to NPS 12: Class 125.

3.6 LOW-PRESSURE STEAM VALVE SCHEDULE (15 PSIG OR LESS)

A. Pipe NPS 2 and Smaller:

1. Bronze Angle Valves: Class 125, bronze disc.
2. Ball Valves: One piece, full port, bronze with bronze trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.
4. Bronze Gate Valves: Class 125, RS.
5. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves, NPS 2-1/2 to NPS 10: Class 150.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Gate Valves: Class 125, OS&Y.
5. Iron Globe Valves, NPS 2-1/2 to NPS 12: Class 125.

3.7 STEAM-CONDENSATE VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Angle Valves: Class 125, bronze disc.
2. Ball Valves: One piece, full port, bronze with bronze trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.
4. Bronze Gate Valves: Class 125, RS.
5. Bronze Globe Valves: Class 125, bronze disc.

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B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves, NPS 2-1/2 to NPS 10: Class 150.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Gate Valves: Class 125, OS&Y.
5. Iron Globe Valves, NPS 2-1/2 to NPS 12: Class 125.

END OF SECTION 23 05 23

## SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 Information for Bidders, and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Metal 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:

1. Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 23 05 16 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
3. Section 23 31 13 "Metal Ducts" for duct hangers and supports.

#### 1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

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3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 ACTION SUBMITTALS

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

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
  3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Stainless-Steel Pipe Hangers and Supports:
  1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

## 2.3 METAL FRAMING SYSTEMS

### A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Allied Tube & Conduit.
  - b. Cooper B-Line, Inc.
  - c. Flex-Strut Inc.
  - d. GS Metals Corp.
  - e. Thomas & Betts Corporation.
  - f. Unistrut Corporation; Tyco International, Ltd.
  - g. Wesanco, Inc.
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with intumed lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Electroplated zinc.
8. Paint Coating: Vinyl.
9. Plastic Coating: PVC.

### B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Anvil International; a subsidiary of Mueller Water Products Inc.
  - b. Empire Industries, Inc.
  - c. ERICO International Corporation.
  - d. Haydon Corporation; H-Strut Division.
  - e. NIBCO INC.
  - f. PHD Manufacturing, Inc.
  - g. PHS Industries, Inc.
2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with intumed lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Coating: Zinc.

## 2.4 THERMAL-HANGER SHIELD INSERTS

### A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.

2. Clement Support Services.
  3. ERICO International Corporation.
  4. National Pipe Hanger Corporation.
  5. PHS Industries, Inc.
  6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
  7. Piping Technology & Products, Inc.
  8. Rilco Manufacturing Co., Inc.
  9. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.5 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.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## 2.6 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
  2. Base: Plastic.
  3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.

4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

## 2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
  2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal 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 for individual pipe hangers.
  2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

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- C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.
- F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- G. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- H. Pipe Stand Installation:
  - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 72 00 "Roof Accessories" for curbs.
- I. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- K. 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.
- L. Install lateral bracing with pipe hangers and supports to prevent swaying.
- M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- N. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- P. Insulated Piping:
  - 1. Attach clamps and spacers to piping.

- a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
  - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
  - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
  - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
  - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
  - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
  - b. NPS 4: 12 inches long and 0.06 inch thick.
  - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
  - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
  - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.2 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 bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.3 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/D1.1M 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 so contours of welded surfaces match adjacent contours.

### 3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 09 91 13 "Exterior Painting"
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.

- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
  3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
  4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
  7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
  11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
  12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
  18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
  19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

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1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 23 05 29

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 Information for Bidders, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Duct labels.
  - 5. Stencils.
  - 6. Valve tags.
  - 7. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT LABELS

#### A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

#### B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: 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 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

#### C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

#### D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

### 2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Red.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

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- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

## 2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 incheshigh.

## 2.4 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Blue.
- C. Background Color: White .
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.

- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.

## 2.5 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
  - 1. Stencil Material: Fiberboard or metal.
  - 2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
  - 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

## 2.6 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  - 1. Tag Material: Brass, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - 1. Valve-tag schedule shall be included in operation and maintenance data.

## 2.7 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: Brass grommet and wire.
  - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
  - 4. Color: Yellow background with black lettering.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### 3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Section 09 91 23 "Interior Painting"
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.
  - 1. Identification Paint: Use for contrasting background.
  - 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Pipe Label Color Schedule:
  - 1. Heating Water Piping:
    - a. Background Color: Yellow.
    - b. Letter Color: Black.
  - 2. Low Pressure Steam and Condensate Piping:
    - a. Background Color: Yellow.
    - b. Letter Color: Black.

### 3.4 DUCT LABEL INSTALLATION

- A. Install plastic-laminated self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
  - 1. Blue: For supply ducts.
  - 2. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
  - 3. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.
- C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

### 3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
  - 1. Valve-Tag Size and Shape:
    - a. Steam & Condensate: 1-1/2 inches, round.
    - b. Hot Water: 1-1/2 inches, round.
    - c. Gas: 1-1/2 inches, round.
  - 2. Valve-Tag Color:
    - a. Steam & Condensate: Yellow.
    - b. Hot Water: Natural.
    - c. Gas: Yellow.
  - 3. Letter Color:
    - a. Steam & Condensate: Black.
    - b. Hot Water: Black.
    - c. Gas: Black.

### 3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 05 53

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 Information for Bidders, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Balancing Air Systems:
    - a. Constant-volume air systems.
  - 2. Balancing Hydronic Piping Systems:
    - a. Primary-secondary hydronic systems.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 INFORMATIONAL SUBMITTALS

- A. Certified TAB reports.
- B. Sample report forms.
- C. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.
  - 4. Dates of use.
  - 5. Dates of calibration.

## 1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC NEBB or TABB.
  - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC NEBB or TABB.
  - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC NEBB or TABB as a TAB technician.
- B. Certify TAB field data reports and perform the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

## 1.6 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

## 1.7 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 23 31 13 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
  - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
  - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
  - 1. Permanent electrical-power wiring is complete.
  - 2. Hydronic systems are filled, clean, and free of air.
  - 3. Automatic temperature-control systems are operational.
  - 4. Equipment and duct access doors are securely closed.
  - 5. Balance, smoke, and fire dampers are open.
  - 6. Isolating and balancing valves are open and control valves are operational.
  - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

### 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
  - 1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
  - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 33 00 "Air Duct Accessories."
  - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 13 "Duct Insulation," Section 23 07 16 "HVAC Equipment Insulation," and Section 23 07 19 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

### 3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 23 31 13 "Metal Ducts."

### 3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure total airflow.
    - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
  - 2. Measure fan static pressures as follows to determine actual static pressure:
    - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    - b. Measure static pressure directly at the fan outlet or through the flexible connection.
    - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
  - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

- a. Report the cleanliness status of filters and the time static pressures are measured.
  4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
  5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
  6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
  7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow of submain and branch ducts.
    - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
  2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
  3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
  2. Adjust patterns of adjustable outlets for proper distribution without drafts.

### 3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check liquid level in expansion tank.
3. Check makeup water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

### 3.7 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

- A. Balance the primary circuit flow first and then balance the secondary circuits.

### 3.8 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
  1. Manufacturer's name, model number, and serial number.
  2. Motor horsepower rating.
  3. Motor rpm.
  4. Efficiency rating.
  5. Nameplate and measured voltage, each phase.
  6. Nameplate and measured amperage, each phase.
  7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

### 3.9 PROCEDURES FOR BOILERS

- A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.
- B. Steam Boilers: Measure and record entering-water temperature and flow and leaving-steam pressure, temperature, and flow.

### 3.10 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
  1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 5 percent.
  2. Air Outlets and Inlets: Plus or minus 5 percent.
  3. Heating-Water Flow Rate: Plus or minus 5 percent.

### 3.11 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

### 3.12 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
  - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  - 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
  - 1. Pump curves.
  - 2. Fan curves.
  - 3. Manufacturers' test data.
  - 4. Field test reports prepared by system and equipment installers.
  - 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
  - 1. Title page.
  - 2. Name and address of the TAB contractor.
  - 3. Project name.
  - 4. Project location.
  - 5. Architect's name and address.
  - 6. Engineer's name and address.
  - 7. Contractor's name and address.
  - 8. Report date.
  - 9. Signature of TAB supervisor who certifies the report.
  - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  - 11. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  - 12. Nomenclature sheets for each item of equipment.
  - 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
  - 14. Notes to explain why certain final data in the body of reports vary from indicated values.
  - 15. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outdoor-, return-, and exhaust-air dampers.
    - b. Conditions of filters.

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- c. Cooling coil, wet- and dry-bulb conditions.
  - d. Face and bypass damper settings at coils.
  - e. Fan drive settings including settings and percentage of maximum pitch diameter.
  - f. Inlet vane settings for variable-air-volume systems.
  - g. Settings for supply-air, static-pressure controller.
  - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
  - 1. Quantities of outdoor, supply, return, and exhaust airflows.
  - 2. Water and steam flow rates.
  - 3. Duct, outlet, and inlet sizes.
  - 4. Pipe and valve sizes and locations.
  - 5. Terminal units.
  - 6. Balancing stations.
  - 7. Position of balancing devices.
- E. Fan Test Reports: For supply, return, and exhaust fans, include the following:
  - 1. Fan Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
    - g. Sheave make, size in inches, and bore.
    - h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
  - 2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    - g. Number, make, and size of belts.
  - 3. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in cfm.
    - b. Total system static pressure in inches wg.
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg.
    - e. Suction static pressure in inches wg.
- F. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
  - 1. Report Data:
    - a. System and air-handling-unit number.

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- b. Location and zone.
- c. Traverse air temperature in deg F.
- d. Duct static pressure in inches wg.
- e. Duct size in inches.
- f. Duct area in sq. ft..
- g. Indicated air flow rate in cfm.
- h. Indicated velocity in fpm.
- i. Actual air flow rate in cfm.
- j. Actual average velocity in fpm.
- k. Barometric pressure in psig.

G. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

- a. Unit identification.
- b. Location.
- c. Service.
- d. Make and size.
- e. Model number and serial number.
- f. Water flow rate in gpm.
- g. Water pressure differential in feet of head or psig.
- h. Required net positive suction head in feet of head or psig.
- i. Pump rpm.
- j. Impeller diameter in inches.
- k. Motor make and frame size.
- l. Motor horsepower and rpm.
- m. Voltage at each connection.
- n. Amperage for each phase.
- o. Full-load amperage and service factor.
- p. Seal type.

2. Test Data (Indicated and Actual Values):

- a. Static head in feet of head or psig.
- b. Pump shutoff pressure in feet of head or psig.
- c. Actual impeller size in inches.
- d. Full-open flow rate in gpm.
- e. Full-open pressure in feet of head or psig.
- f. Final discharge pressure in feet of head or psig.
- g. Final suction pressure in feet of head or psig.
- h. Final total pressure in feet of head or psig.
- i. Final water flow rate in gpm.
- j. Voltage at each connection.
- k. Amperage for each phase.

H. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.

- e. Dates of calibration.

### 3.13 INSPECTIONS

#### A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
  - a. Measure airflow of at least 10 percent of air outlets.
  - b. Measure water flow of at least 5 percent of terminals.
  - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
  - d. Verify that balancing devices are marked with final balance position.
  - e. Note deviations from the Contract Documents in the final report.

#### B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

#### C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

#### D. Prepare test and inspection reports.

### 3.14 ADDITIONAL TESTS

- #### A.
- Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

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- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

## SECTION 23 07 13 - DUCT INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 Information for Bidders, and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes insulating the following duct services:
  - 1. Indoor, exposed supply and outdoor air.
  - 2. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
- B. Related Sections:
  - 1. Division 23 Section "HVAC Equipment Insulation."
  - 2. Division 23 Section "HVAC Piping Insulation."
  - 3. Division 23 Section "Metal Ducts" for duct liners.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

#### 1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

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1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; SoftTouch Duct Wrap.
    - b. Johns Manville; Microlite.
    - c. Knauf Insulation; Friendly Feel Duct Wrap.
    - d. Manson Insulation Inc.; Alley Wrap.
    - e. Owens Corning; SOFTR All-Service Duct Wrap.

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- G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. CertainTeed Corp.; Commercial Board.
- b. Fibrex Insulations Inc.; FBX.
- c. Johns Manville; 800 Series Spin-Glas.
- d. Knauf Insulation; Insulation Board.
- e. Manson Insulation Inc.; AK Board.
- f. Owens Corning; Fiberglas 700 Series.

## 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
- b. Eagle Bridges - Marathon Industries; 225.
- c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
- d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
- b. Eagle Bridges - Marathon Industries; 225.
- c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
- d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
  - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
    - b. Vimasco Corporation; 749.
  - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  - 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
    - b. Eagle Bridges - Marathon Industries; 501.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
    - d. Mon-Eco Industries, Inc.; 55-10.
  - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
  - 3. Service Temperature Range: 0 to 180 deg F.
  - 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
  - 5. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
    - b. Eagle Bridges - Marathon Industries; 570.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
  - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
  - 3. Service Temperature Range: Minus 50 to plus 220 deg F.
  - 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
  - 5. Color: White.

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E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
  - b. Eagle Bridges - Marathon Industries; 550.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
  - d. Mon-Eco Industries, Inc.; 55-50.
  - e. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

## 2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
  - b. Eagle Bridges - Marathon Industries; 405.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
  - d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
  4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
  5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

## 2.6 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 491 AWF FSK.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - c. Compac Corporation; 110 and 111.
    - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
  2. Width: 3 inches.
  3. Thickness: 6.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.

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6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. ABI, Ideal Tape Division; 488 AWF.
  - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
  - c. Compac Corporation; 120.
  - d. Venture Tape; 3520 CW.
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

## 2.7 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. ITW Insulation Systems; Gerrard Strapping and Seals.
  - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; CWP-1.
    - 2) GEMCO; CD.
    - 3) Midwest Fasteners, Inc.; CD.
    - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  - a. Products: Subject to compliance with requirements, provide one of the following:

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- 1) AGM Industries, Inc.; CHP-1.
  - 2) GEMCO; Cupped Head Weld Pin.
  - 3) Midwest Fasteners, Inc.; Cupped Head.
  - 4) Nelson Stud Welding; CHP.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
    - 2) GEMCO; Perforated Base.
    - 3) Midwest Fasteners, Inc.; Spindle.
  - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
  - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) GEMCO; Nylon Hangers.
    - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
  - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
  - c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.
    - 2) GEMCO; Peel & Press.
    - 3) Midwest Fasteners, Inc.; Self Stick.
  - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

- d. Adhesive-backed base with a peel-off protective cover.
- 6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; RC-150.
    - 2) GEMCO; R-150.
    - 3) Midwest Fasteners, Inc.; WA-150.
    - 4) Nelson Stud Welding; Speed Clips.
  - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- 7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
  - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) GEMCO.
    - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. C & F Wire.

## 2.8 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.
- C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  - 4. Seal jacket to wall flashing with flashing sealant.

- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
  - 1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
  - 1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
  - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

### 3.5 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
  - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Impale insulation over pins and attach speed washers.
    - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

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- b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
  5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
  6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
  5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and

- inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.6 FIELD QUALITY CONTROL

#### A. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

#### B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.7 DUCT INSULATION SCHEDULE, GENERAL

#### A. Plenums and Ducts Requiring Insulation:

1. Indoor, exposed supply and outdoor air.
2. Indoor, exposed return located in unconditioned space.
3. Indoor, exposed exhaust between isolation damper and penetration of building exterior.

#### B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

### 3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

#### A. Exposed, round and flat-oval, supply-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

#### B. Exposed, round and flat-oval, return-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

#### C. Exposed, round and flat-oval, outdoor-air duct insulation shall be one of the following:

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1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
  2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
- D. Exposed, round and flat-oval, exhaust-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
  2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
- E. Exposed, rectangular, supply-air duct insulation shall be the following:
1. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
- F. Exposed, rectangular, return-air duct insulation shall be the following:
1. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
- G. Exposed, rectangular, outdoor-air duct insulation shall be the following:
1. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
- H. Exposed, rectangular, exhaust-air duct insulation shall be the following:
1. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

END OF SECTION 23 07 13

## SECTION 23 07 16 - HVAC EQUIPMENT INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 Information for Bidders, and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes insulating the following HVAC equipment that is not factory insulated:
  - 1. Steam Condensate pumps.
  - 2. Steam Condensate tanks.
  - 3. Steam flash tanks, flash separators, and blow-off tanks.
- B. Related Sections:
  - 1. Division 23 Section "Duct Insulation."
  - 2. Division 23 Section "HVAC Piping Insulation."

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

#### 1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

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1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with equipment Installer for equipment insulation application.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Breeching Insulation Schedule" and "Equipment Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; SoftTouch Duct Wrap.
    - b. Johns Manville; Microlite.
    - c. Knauf Insulation; Friendly Feel Duct Wrap.
    - d. Manson Insulation Inc.; Alley Wrap.
    - e. Owens Corning; SOFTR All-Service Duct Wrap.

- G. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Industrial Insulation Group (IIG); MinWool-1200 Flexible Batt.
- b. Johns Manville; HTB 26 Spin-Glas.
- c. Roxul Inc.; Roxul RW.

- H. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Fibrex Insulations Inc.; Coreplus 1200.
- b. Johns Manville; Micro-Lok.
- c. Knauf Insulation; 1000-Degree Pipe Insulation.
- d. Manson Insulation Inc.; Alley-K.
- e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, without factory-applied jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

- I. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. CertainTeed Corp.; CrimpWrap.
- b. Johns Manville; MicroFlex.
- c. Knauf Insulation; Pipe and Tank Insulation.
- d. Manson Insulation Inc.; AK Flex.
- e. Owens Corning; Fiberglas Pipe and Tank Insulation.

## 2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Ramco Insulation, Inc.; Super-Stik.

- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

## 2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    - d. Mon-Eco Industries, Inc.; 22-25.
  - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
    - d. Mon-Eco Industries, Inc.; 22-25.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Corning Corporation; 739, Dow Silicone.
    - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    - c. P.I.C. Plastics, Inc.; Welding Adhesive.
    - d. Speedline Corporation; Polyco VP Adhesive.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
  1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H .B. Fuller Company; 30-80/30-90.
    - b. Vimasco Corporation; 749.
  2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
    - b. Eagle Bridges - Marathon Industries; 501.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
    - d. Mon-Eco Industries, Inc.; 55-10.
  2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
  3. Service Temperature Range: 0 to 180 deg F.
  4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
  5. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
    - b. Eagle Bridges - Marathon Industries; 570.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.

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2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
  - b. Eagle Bridges - Marathon Industries; 550.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
  - d. Mon-Eco Industries, Inc.; 55-50.
  - e. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
  - b. Eagle Bridges - Marathon Industries; 405.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
  - d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
  4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto Corporation; LoSmoke.
    - d. Speedline Corporation; SmokeSafe.

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2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated tank heads and tank side panels.

D. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
  - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
  - c. RPR Products, Inc.; Insul-Mate.
2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
  - a. Sheet and roll stock ready for shop or field sizing.
  - b. Finish and thickness are indicated in field-applied jacket schedules.
  - c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
  - d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
  - e. Factory-Fabricated Fitting Covers:
    - 1) Same material, finish, and thickness as jacket.
    - 2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    - 3) Tee covers.
    - 4) Flange and union covers.
    - 5) End caps.
    - 6) Beveled collars.
    - 7) Valve covers.
    - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

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- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 491 AWF FSK.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - c. Compac Corporation; 110 and 111.
    - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
  2. Width: 3 inches.
  3. Thickness: 6.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 370 White PVC tape.
    - b. Compac Corporation; 130.
    - c. Venture Tape; 1506 CW NS.
  2. Width: 2 inches.
  3. Thickness: 6 mils.
  4. Adhesion: 64 ounces force/inch in width.
  5. Elongation: 500 percent.
  6. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 488 AWF.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    - c. Compac Corporation; 120.
    - d. Venture Tape; 3520 CW.
  2. Width: 2 inches.
  3. Thickness: 3.7 mils.
  4. Adhesion: 100 ounces force/inch in width.
  5. Elongation: 5 percent.
  6. Tensile Strength: 34 lbf/inch in width.

## 2.9 SECUREMENTS

- A. Bands:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

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- a. ITW Insulation Systems; Gerrard Strapping and Seals.
    - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
  2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
  3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
  4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Insulation Pins and Hangers:
1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
    - a. Products: Subject to compliance with requirements, provide one of the following:
      - 1) AGM Industries, Inc.; CWP-1.
      - 2) GEMCO; CD.
      - 3) Midwest Fasteners, Inc.; CD.
      - 4) Nelson Stud Welding; TPA, TPC, and TPS.
  2. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.
    - a. Products: Subject to compliance with requirements, provide one of the following:
      - 1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
      - 2) GEMCO; Perforated Base.
      - 3) Midwest Fasteners, Inc.; Spindle.
    - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
    - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
    - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
  3. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.
    - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) GEMCO; Nylon Hangers.
      - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
    - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
    - c. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.

- d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
  - 4. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.
    - a. Products: Subject to compliance with requirements, provide one of the following:
      - 1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers, Series.
      - 2) GEMCO; Peel & Press.
      - 3) Midwest Fasteners, Inc.; Self Stick.
    - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
    - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
    - d. Adhesive-backed base with a peel-off protective cover.
  - 5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
    - a. Products: Subject to compliance with requirements, provide one of the following:
      - 1) AGM Industries, Inc.; RC-150.
      - 2) GEMCO; R-150.
      - 3) Midwest Fasteners, Inc.; WA-150.
      - 4) Nelson Stud Welding; Speed Clips.
    - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
  - 6. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
    - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) GEMCO.
      - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. C & F Wire.

## 2.10 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.
- C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.

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- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. For above ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Manholes.
  - 5. Handholes.
  - 6. Cleanouts.

### 3.4 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

- A. Mineral-Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.
  - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
  - 2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
  - 3. Protect exposed corners with secured corner angles.
  - 4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
    - a. Do not weld anchor pins to ASME-labeled pressure vessels.
    - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    - d. Do not overcompress insulation during installation.
    - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    - f. Impale insulation over anchor pins and attach speed washers.
    - g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  - 5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
  - 6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
  - 7. Stagger joints between insulation layers at least 3 inches.

8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

### 3.5 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
  1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
  2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
  3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
  1. Draw jacket material smooth and tight.
  2. Install lap or joint strips with same material as jacket.
  3. Secure jacket to insulation with manufacturer's recommended adhesive.
  4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
  1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
- E. Where PVDC jackets are indicated, install as follows:
  1. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. 33-1/2-inch-circumference limit allows for 2-inch-overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
  2. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

### 3.6 FINISHES

- A. Equipment Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
  - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

### 3.7 BREECHING INSULATION SCHEDULE

- A. Round, exposed breeching and connector insulation shall be the following:
  1. High-Temperature Mineral-Fiber Blanket: 3 inches thick and 3-lb/cu. ft. nominal density.
- B. Round, concealed breeching and connector insulation shall be the following:
  1. High-Temperature Mineral-Fiber Blanket: 3 inches thick and 3-lb/cu. ft. nominal density.
- C. Rectangular, exposed breeching and connector insulation shall be the following:
  1. High-Temperature Mineral-Fiber Blanket: 3 inches thick and 3-lb/cu. ft. nominal density.
- D. Rectangular, concealed breeching and connector insulation shall be the following:
  1. High-Temperature Mineral-Fiber Blanket: 3 inches thick and 3-lb/cu. ft. nominal density.

### 3.8 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment that is not factory insulated.
- C. Steam condensate pump and boiler feedwater pump insulation shall be one of the following:
  1. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
  2. Mineral-Fiber Pipe and Tank: 2 inches thick.
- D. Steam condensate tank and receiver insulation shall be one of the following:
  1. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
  2. Mineral-Fiber Pipe and Tank: 2 inches thick.
- E. Steam flash-tank, flash-separator, moisture-separator, and blow-off-tank insulation shall be one of the following:
  1. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
  2. Mineral-Fiber Pipe and Tank: 2 inches thick.

3.9 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Equipment, Concealed:
  - 1. None.
- D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
  - 1. Painted Aluminum, Corrugated with Z-Shaped Locking Seam: 0.016 inch thick.
- E. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
  - 1. Painted Aluminum, Corrugated with Z-Shaped Locking Seam: 0.016 inch thick.

END OF SECTION 23 07 16

## SECTION 23 07 19 - HVAC PIPING INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 Information for Bidders, and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
  - 1. Low Pressure Steam & Steam Condensate piping, indoors
  - 2. Heating hot-water piping, indoors.
- B. Related Sections:
  - 1. Division 23 Section "HVAC Equipment Insulation."
  - 2. Division 23 Section "Duct Insulation."

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

#### 1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

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1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Fibrex Insulations Inc.; Coreplus 1200.
    - b. Johns Manville; Micro-Lok.
    - c. Knauf Insulation; 1000-Degree Pipe Insulation.
    - d. Manson Insulation Inc.; Alley-K.
    - e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  3. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- G. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory-applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Knauf Insulation; Permawick Pipe Insulation.
    - b. Owens Corning; VaporWick Pipe Insulation.
- H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; CrimpWrap.
    - b. Johns Manville; MicroFlex.
    - c. Knauf Insulation; Pipe and Tank Insulation.
    - d. Manson Insulation Inc.; AK Flex.
    - e. Owens Corning; Fiberglas Pipe and Tank Insulation.

## 2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Ramco Insulation, Inc.; Super-Stik.
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    - d. Mon-Eco Industries, Inc.; 22-25.
  - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
    - d. Mon-Eco Industries, Inc.; 22-25.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Corning Corporation; 739, Dow Silicone.
    - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    - c. P.I.C. Plastics, Inc.; Welding Adhesive.
    - d. Speedline Corporation; Polyco VP Adhesive.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
  - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
    - b. Vimasco Corporation; 749.
  - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  - 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
    - b. Eagle Bridges - Marathon Industries; 501.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
    - d. Mon-Eco Industries, Inc.; 55-10.
  - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
  - 3. Service Temperature Range: 0 to 180 deg F.
  - 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
  - 5. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
    - b. Eagle Bridges - Marathon Industries; 570.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
  - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
  - 3. Service Temperature Range: Minus 50 to plus 220 deg F.
  - 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
  - 5. Color: White.

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E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
  - b. Eagle Bridges - Marathon Industries; 550.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
  - d. Mon-Eco Industries, Inc.; 55-50.
  - e. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

## 2.5 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
  - b. Eagle Bridges - Marathon Industries; 405.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
  - d. Mon-Eco Industries, Inc.; 44-05.
  - e. Pittsburgh Corning Corporation; Pittseal 444.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
  - b. Eagle Bridges - Marathon Industries; 405.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
  - d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.

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3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto Corporation; LoSmoke.

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- d. Speedline Corporation; SmokeSafe.
- 2. Adhesive: As recommended by jacket material manufacturer.
- 3. Color: White.
- 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
  - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

## 2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  - 2. Width: 3 inches.
  - 3. Thickness: 11.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 491 AWF FSK.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - c. Compac Corporation; 110 and 111.
    - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
  - 2. Width: 3 inches.
  - 3. Thickness: 6.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 370 White PVC tape.
    - b. Compac Corporation; 130.

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- c. Venture Tape; 1506 CW NS.
    - 2. Width: 2 inches.
    - 3. Thickness: 6 mils.
    - 4. Adhesion: 64 ounces force/inch in width.
    - 5. Elongation: 500 percent.
    - 6. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 488 AWF.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    - c. Compac Corporation; 120.
    - d. Venture Tape; 3520 CW.
  - 2. Width: 2 inches.
  - 3. Thickness: 3.7 mils.
  - 4. Adhesion: 100 ounces force/inch in width.
  - 5. Elongation: 5 percent.
  - 6. Tensile Strength: 34 lbf/inch in width.

## 2.9 SECUREMENTS

- A. Bands:
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ITW Insulation Systems; Gerrard Strapping and Seals.
    - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
  - 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
  - 3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. C & F Wire.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
  2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
  2. Testing agency labels and stamps.
  3. Nameplates and data plates.
  4. Manholes.
  5. Handholes.
  6. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt

- each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

### 3.6 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
  4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 FINISHES

- A. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- B. Do not field paint aluminum or stainless-steel jackets.

3.9 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Underground piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Flexible Elastomeric: 3/4 inch thick.
- B. Heating-Hot-Water Supply and Return, 200 Deg F and Below:
  - 1. NPS 1.5 and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inches thick.
  - 2. NPS 2 and Larger: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe, Type I or Pipe and Tank Insulation: 2 inches thick.
- C. Steam and Steam Condensate, 350 Deg F and Below:
  - 1. NPS 3 and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe, Type I or II: 2-1/2 inches thick.
  - 2. NPS 4 and Larger: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe, Type I or II or Pipe and Tank Insulation: 3 inches thick.

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
  - 1. None.
- D. Piping, Exposed (within 6'-0" from finished floor):
  - 1. PVC: 20 mils thick.

END OF SECTION 23 07 19

## SECTION 23 09 00 - INSTRUMENTATION AND CONTROL FOR HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 Information for Bidders, and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.
- B. Related Sections include the following:
  - 1. Section 23 05 19 "Meters and Gages for HVAC Piping" for measuring equipment that relates to this Section.
  - 2. Section 23 09 93 "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

#### 1.3 SCOPE OF WORK

- A. Expand and modify the existing temperature control system as required to include the new equipment and sequence of operation shown and described in the construction documents.

#### 1.4 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. PC: Personal computer.
- E. PID: Proportional plus integral plus derivative.
- F. RTD: Resistance temperature detector.

#### 1.5 SYSTEM PERFORMANCE

- A. Comply with the following performance requirements:
  - 1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
  - 2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
  - 3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
  - 4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.

5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. 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.
  - 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.
  - e. Ducted Air Temperature: Plus or minus 1 deg F.
  - f. Outside Air Temperature: Plus or minus 2 deg F.
  - g. Dew Point Temperature: Plus or minus 3 deg F.
  - h. Temperature Differential: Plus or minus 0.25 deg F.
  - 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.
  - n. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
  - 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.

#### 1.6 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
  1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
  2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
  3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
  2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
  3. Wiring Diagrams: Power, signal, and control wiring.
  4. Details of control panel faces, including controls, instruments, and labeling.
  5. Written description of sequence of operation.
  6. Schedule of dampers including size, leakage, and flow characteristics.
  7. Schedule of valves including flow characteristics.
  8. DDC System Hardware:
    - a. Wiring diagrams for control units with termination numbers.
    - b. Schematic diagrams and floor plans for field sensors and control hardware.

- c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
- 9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
- 10. Controlled Systems:
  - a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
  - b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
  - c. Written description of sequence of operation including schematic diagram.
  - d. Points list.

#### 1.7 INFORMATIONAL SUBMITTALS

- A. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with LonWorks.
- B. Qualification Data: For Installer and manufacturer.
- C. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.
- D. Field quality-control test reports.

#### 1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
  - 1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
  - 2. Interconnection wiring diagrams with identified and numbered system components and devices.
  - 3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
  - 4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
  - 5. Calibration records and list of set points.
- B. Software and Firmware Operational Documentation: Include the following:
  - 1. Software operating and upgrade manuals.
  - 2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
  - 3. Device address list.
  - 4. Printout of software application and graphic screens.
  - 5. Software license required by and installed for DDC workstations and control systems.

#### 1.9 QUALITY ASSURANCE

- A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

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1.10 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 to latest version of software at Project completion.

1.11 COORDINATION

- A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.
- B. Coordinate supply of conditioned electrical branch circuits for control units.
- C. Coordinate equipment with Section 26 24 16 "Panelboards" to achieve compatibility with starter coils and annunciation devices.
- D. Coordinate equipment with Section 26 24 19 "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.
- E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 CONTROL SYSTEM

- A. Manufacturers:
  - 1. Honeywell - WEBS Jace-AX.
  - 2. Tridium-Niagara-Vykon Jace-AX
  - 3. Siemens – Talon-Jace AX.
  - 4. Distech-EC-NET-Jace-AX.
  - 5. Schneider Electric –I/A Series-Jace AX
  - 6. Circon
  - 7. Approved Equal
- B. The control equipment shall incorporate LonMark technology at the controller level and Niagara Frame AX version technology at the network device level and as network device level and as network management tool.
- C. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers

operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. All graphics associated with the controls work will be created and implemented under a separate contract by the school district's existing service provider.

1. The system installed shall seamless connect devices other than HVAC throughout the building regardless of subsystem type, i.e. HVAC, lighting and security devices should easily coexist on the same network channel without the need for gateways.

## 2.3 DDC EQUIPMENT

- A. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
  1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
  2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
    - a. Global communications.
    - b. Discrete/digital, analog, and pulse I/O.
    - c. Monitoring, controlling, or addressing data points.
    - d. Software applications, scheduling, and alarm processing.
    - e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
  3. Standard Application Programs:
    - a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, antishort cycling, PID control, DDC with fine tuning, and trend logging.
    - b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
    - c. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
    - d. Remote communications.
    - e. Maintenance management.
    - f. Units of Measure: Inch-pound and SI (metric).
  4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
  5. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.
- B. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
  1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
  2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
    - a. Global communications.
    - b. Discrete/digital, analog, and pulse I/O.
    - c. Monitoring, controlling, or addressing data points.
  3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
  4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

5. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.
- C. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
  1. Binary Inputs: Allow monitoring of on-off signals without external power.
  2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
  3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
  4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
  5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
  6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
  7. Universal I/Os: Provide software selectable binary or analog outputs.
- D. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
  1. Output ripple of 5.0 mV maximum peak to peak.
  2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
  3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
- E. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
  1. Minimum dielectric strength of 1000 V.
  2. Maximum response time of 10 nanoseconds.
  3. Minimum transverse-mode noise attenuation of 65 dB.
  4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

## 2.4 UNITARY CONTROLLERS

- A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
  1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
  2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.
  3. LonWorks Compliance: Communicate using EIA/CEA 709.1 datalink/physical layer protocol using LonTalk protocol.
  4. Enclosure: Dustproof rated for operation at 32 to 120 deg F.
  5. Enclosure: Waterproof rated for operation at 40 to 150 deg F.

## 2.5 ANALOG CONTROLLERS

- A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.
- B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F, and single- or double-pole contacts.
- C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
  - 1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.
- D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.
- E. Receiver Controllers: Single- or multiple-input models with control-point adjustment, direct or reverse acting with mechanical set-point adjustment with locking device, proportional band adjustment, authority adjustment, and proportional control mode.
  - 1. Remote-control-point adjustment shall be plus or minus 20 percent of sensor span, input signal of 3 to 13 psig.
  - 2. Proportional band shall extend from 2 to 20 percent for 5 psig.
  - 3. Authority shall be 20 to 200 percent.
  - 4. Air-supply pressure of 18 psig, input signal of 3 to 15 psig, and output signal of zero to supply pressure.
  - 5. Gages: 1-1/2 inches in diameter, 2.5 percent wide-scale accuracy, and range to match transmitter input or output pressure.

## 2.6 TIME CLOCKS

- A. Manufacturers:
  - 1. ATC-Diversified Electronics.
  - 2. Grasslin Controls Corporation.
  - 3. Paragon Electric Co., Inc.
  - 4. Precision Multiple Controls, Inc.
  - 5. SSAC Inc.; ABB USA.
  - 6. TCS/Basys Controls.
  - 7. Theben AG - Lumilite Control Technology, Inc.
  - 8. Time Mark Corporation.
- B. Seven-day, programming-switch timer with synchronous-timing motor and seven-day dial; continuously charged, nickel-cadmium-battery-driven, eight-hour, power-failure carryover; multiple-switch trippers; minimum of two and maximum of eight signals per day with two normally open and two normally closed output contacts.
- C. Solid-state, programmable time control with 4 separate programs each with up to 100 on-off operations; 1-second resolution; lithium battery backup; keyboard interface and manual override; individual on-off-auto switches for each program; 365-day calendar with 20 programmable holidays; choice of fail-safe operation for each program; system fault alarm; and communications package allowing networking of time controls and programming from PC.

## 2.7 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
- B. Thermistor Temperature Sensors and Transmitters:
  - 1. Manufacturers:
    - a. BEC Controls Corporation.
    - b. Ebtron, Inc.
    - c. Heat-Timer Corporation.
    - d. I.T.M. Instruments Inc.
    - e. MAMAC Systems, Inc.
    - f. RDF Corporation.
  - 2. Accuracy: Plus or minus 0.5 deg F at calibration point.
  - 3. Wire: Twisted, shielded-pair cable.
  - 4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
  - 5. Averaging Elements in Ducts: 36 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft..
  - 6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
  - 7. Room Sensor Cover Construction: Plain stainless steel wall plate with 10k Type II thermistor.
    - a. Set-Point Adjustment: Concealed.
    - b. Set-Point Indication: Concealed.
    - c. Thermometer: Concealed.
    - d. Orientation: Vertical.
  - 8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
  - 9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
- C. RTDs and Transmitters:
  - 1. Manufacturers:
    - a. BEC Controls Corporation.
    - b. MAMAC Systems, Inc.
    - c. RDF Corporation.
  - 2. Accuracy: Plus or minus 0.2 percent at calibration point.
  - 3. Wire: Twisted, shielded-pair cable.
  - 4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
  - 5. Averaging Elements in Ducts: 18 inches long, rigid; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
  - 6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
  - 7. Room Sensor Cover Construction: Plain stainless steel wall plate with 10k Type II thermistor.
    - a. Set-Point Adjustment: Concealed.
    - b. Set-Point Indication: Concealed.
    - c. Thermometer: Concealed.
    - d. Orientation: Vertical.
  - 8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
  - 9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
- D. Humidity Sensors: Bulk polymer sensor element.

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1. Manufacturers:
    - a. BEC Controls Corporation.
    - b. General Eastern Instruments.
    - c. MAMAC Systems, Inc.
    - d. ROTRONIC Instrument Corp.
    - e. TCS/Basys Controls.
    - f. Vaisala.
  2. Accuracy: 2 percent full range with linear output.
  3. Room Sensor Range: 20 to 80 percent relative humidity.
  4. Room Sensor Cover Construction: Manufacturer's standard locking covers.
    - a. Set-Point Adjustment: Concealed.
    - b. Set-Point Indication: Concealed.
    - c. Thermometer: Concealed.
    - d. Orientation: Vertical.
  5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
  6. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of 32 to 120 deg F.
  7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.
- E. Pressure Transmitters/Transducers:
1. Manufacturers:
    - a. BEC Controls Corporation.
    - b. General Eastern Instruments.
    - c. MAMAC Systems, Inc.
    - d. ROTRONIC Instrument Corp.
    - e. TCS/Basys Controls.
    - f. Vaisala.
  2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
    - a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
    - b. Output: 4 to 20 mA.
    - c. Building Static-Pressure Range: 0- to 0.25-inch wg.
    - d. Duct Static-Pressure Range: 0- to 5-inch wg.
  3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
  4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.
  5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
  6. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.
- F. Room Sensor Cover Construction: Plain stainless steel wall plate with 10k Type II thermistor.
- a. Set-Point Adjustment: Concealed.
  - b. Set-Point Indication: Concealed.
  - c. Thermometer: Concealed.
  - d. Orientation: Vertical.
- G. Room sensor accessories include the following:
1. Insulating Bases: For sensors located on exterior walls.
  2. Guards: Locking; heavy-duty, transparent plastic; mounted on separate base.
  3. Adjusting Key: As required for calibration and cover screws.

## 2.8 STATUS SENSORS

- A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.
- B. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
- C. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.
- D. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.
- E. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.
- F. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

## 2.9 FLOW MEASURING STATIONS

- A. Duct Airflow Station: Combination of air straightener and multiport, self-averaging pitot tube station.
  - 1. Available Manufacturers:
    - a. Air Monitor Corporation.
    - b. Wetmaster Co., Ltd.
  - 2. Casing: Galvanized-steel frame.
  - 3. Flow Straightener: Aluminum honeycomb, 3/4-inch parallel cell, 3 inches deep.
  - 4. Sensing Manifold: Copper manifold with bullet-nosed static pressure sensors positioned on equal area basis.

## 2.10 THERMOSTATS

- A. Manufacturers:
  - 1. Erie Controls.
  - 2. Danfoss Inc.; Air-Conditioning and Refrigeration Div.
  - 3. Heat-Timer Corporation.
  - 4. Sauter Controls Corporation.
  - 5. tekmar Control Systems, Inc.
  - 6. Theben AG - Lumilite Control Technology, Inc.
- B. Combination Thermostat and Fan Switches: Line-voltage thermostat with push-button or lever-operated fan switch.
  - 1. Label switches "FAN HIGH-MED-LOW-OFF".
  - 2. Mount on single electric switch box.
- C. Electric, solid-state, microcomputer-based room thermostat with remote sensor.
  - 1. Automatic switching from heating to cooling.
  - 2. Preferential rate control to minimize overshoot and deviation from set point.
  - 3. Set up for four separate temperatures per day.
  - 4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
  - 5. Short-cycle protection.

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6. Programming based on every day of week.
  7. Selection features include degree F or degree C display, 12- or 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
  8. Battery replacement without program loss.
  9. Thermostat display features include the following:
    - a. Time of day.
    - b. Actual room temperature.
    - c. Programmed temperature.
    - d. Programmed time.
    - e. Duration of timed override.
    - f. Day of week.
    - g. System mode indications include "heating," "off," "fan auto," and "fan on."
- D. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.
- E. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.
1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
  2. Selector Switch: Integral, manual on-off-auto.
- F. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.
1. Bulbs in water lines with separate wells of same material as bulb.
  2. Bulbs in air ducts with flanges and shields.
  3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
  4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
  5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.
  6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.
- G. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.
- H. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic- reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.
1. Bulb Length: Minimum 20 feet.
  2. Quantity: One thermostat for every 20 sq. ft. of coil surface.
- I. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic- reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above set point.
1. Bulb Length: Minimum 20 feet.
  2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

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- J. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, with molded-rubber diaphragm, remote-bulb liquid-filled element, direct and reverse acting at minimum shutoff pressure of 25 psig, and cast housing with position indicator and adjusting knob.

2.11 HUMIDISTATS

- A. Available Manufacturers:
  - 1. MAMAC Systems, Inc.
  - 2. ROTRONIC Instrument Corp.
- B. Duct-Mounting Humidistats: Electric insertion, 2-position type with adjustable, 2 percent throttling range, 20 to 80 percent operating range, and single- or double-pole contacts.

2.12 ACTUATORS

- A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
  - 1. Comply with requirements in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
  - 2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
  - 3. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
  - 4. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
- B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
  - 1. Available Manufacturers:
    - a. Belimo Aircontrols (USA), Inc.
  - 2. Dampers: Size for running torque calculated as follows:
    - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
    - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
    - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
    - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
    - e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
    - f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
  - 3. Coupling: V-bolt and V-shaped, toothed cradle.
  - 4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
  - 5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
  - 6. Power Requirements (Two-Position Spring Return): 24-V ac.
  - 7. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
  - 8. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
  - 9. Temperature Rating: Minus 22 to plus 122 deg F.
  - 10. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
  - 11. Run Time: 12 seconds open, 5 seconds closed.

## 2.13 DAMPERS

- A. Manufacturers:
  - 1. Air Balance Inc.
  - 2. Don Park Inc.; Autodamp Div.
  - 3. TAMCO (T. A. Morrison & Co. Inc.).
  - 4. United Enertech Corp.
  - 5. Vent Products Company, Inc.
- B. Dampers: AMCA-rated, parallel or opposed-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.
  - 1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
  - 2. Operating Temperature Range: From minus 40 to plus 200 deg F.
  - 3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
  - 4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

## 2.14 CONTROL CABLE

- A. Electronic and fiber-optic cables for control wiring are specified in Section 27 15 00 "Communications Horizontal Cabling."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that conditioned power supply is available to control units and operator workstation.
- B. Verify that pneumatic piping and duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.

### 3.2 INSTALLATION

- A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- B. Connect and configure equipment and software to achieve sequence of operation specified.
- C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 60 inches above the floor.
  - 1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- D. Install guards on thermostats in the following locations:
  - 1. Entrances.
  - 2. Public areas.
  - 3. Where indicated.
- E. Install automatic dampers according to Section 23 33 00 "Air Duct Accessories."

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- F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- G. Install labels and nameplates to identify control components according to Section 23 05 53 "Identification for HVAC Piping and Equipment."
- H. Install electronic and fiber-optic cables according to Section 27 15 00 "Communications Horizontal Cabling."

### 3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Section 26 05 33 "Raceways and Boxes for Electrical Systems."
- B. Install building wire and cable according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- C. Install signal and communication cable according to Section 27 15 00 "Communications Horizontal Cabling."
  - 1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
  - 2. Install exposed cable in raceway.
  - 3. Install concealed cable in raceway.
  - 4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
  - 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
  - 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
  - 7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
- D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. DDC Verification:
  - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
  - 2. Check instruments for proper location and accessibility.
  - 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
  - 4. Check instrument tubing for proper fittings, slope, material, and support.
  - 5. Check installation of air supply for each instrument.
  - 6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
  - 7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.

8. Check temperature instruments and material and length of sensing elements.
9. Check control valves. Verify that they are in correct direction.
10. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
11. Check DDC system as follows:
  - a. Verify that DDC controller power supply is from emergency power supply, if applicable.
  - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
  - c. Verify that spare I/O capacity has been provided.
  - d. Verify that DDC controllers are protected from power supply surges.

C. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

### 3.5 ADJUSTING

#### A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:
  - a. Check analog inputs at 0, 50, and 100 percent of span.
  - b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
  - c. Check digital inputs using jumper wire.
  - d. Check digital outputs using ohmmeter to test for contact making or breaking.
  - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
5. Flow:
  - a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
  - b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
  - a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
  - b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
  - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
  - b. Calibrate temperature switches to make or break contacts.
8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

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- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Section 01 79 00 "Demonstration and Training."

END OF SECTION 23 09 00R

## SECTION 23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 Information for Bidders, and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes control sequences for HVAC systems, subsystems, and equipment.
- B. Related Sections include the following:
  - 1. Section 230900 "Instrumentation and Control for HVAC" for control equipment and devices and for submittal requirements.

#### 1.3 DEFINITIONS

- A. DDC: Direct digital control.
- B. TCC: Temperature control contractor.

#### 1.4 STEAM BOILERS: SB-1,2 & 3

- A. A boiler master control panel shall control the steam boilers. The master panel shall be provided by the boiler manufacturer and shall be installed and wired by the TCC. Each boiler shall be provided with its control panel that is capable of controlling the boiler in standalone mode. The boiler control panel shall be provided by the boiler manufacturer and shall be installed and wired by the TCC.
- B. The BAS system shall enable the boilers, feedwater system, and vacuum pumps when outdoor temperature below 65°F (adjustable). Boiler BS-3 (50 hp) shall be also enabled based on pool heater demand.
- C. Below 65°F (adjustable) the master control panel shall cycle the lead boiler on and Lead/lag fire boilers. The lead-lag and the lead boiler shall be alternated every 15 days (adjustable).
- D. On outside temperature above 65°F lock out boilers BS-1 & 2 except BS-3.

#### 1.5 BOILER FEEDWATER SYSTEM: BFS-1

- A. The boiler feedwater system shall be enabled whenever the boiler is enabled.

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- B. The boiler feedwater system shall operate on its own controls.
- C. The TCC shall wire all loose shipped items furnished by the equipment manufacturer.

1.6 VACUUM CONDENSATE PUMP: CVP-1

- A. The vacuum condensate pump shall be enabled whenever the boiler is enabled.
- B. The vacuum condensate pump shall operate on its own controls.
- C. The TCC shall wire all loose shipped items furnished by the equipment manufacturer

1.7 BOILER ROOM VENTILATION: EF-1

- A. The exhaust fan and associated ventilation intake louvers and motor operated dampers shall be controlled by a room thermostat. If space temperature is above 80°F, start exhaust fan. If space temperature is above 90°F, signal alarm.

1.8 ALT-M1: POOL HEATER: PH-1

- A. The DDC controller shall enable the pool heater system as required by system demands.
- B. Provide new high limit temperature sensor to stop the pool heater and alarm the BAS when water temperature reaches 110°F.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 09 93

## SECTION 23 21 13 - HYDRONIC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 Information for Bidders, and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
  - 1. Hot-water heating piping.
  - 2. Makeup-water piping.
  - 3. Condensate-drain piping.
  - 4. Air-vent piping.
  - 5. Safety-valve-inlet and -outlet piping.
- B. Related Sections include the following:
  - 1. Section 23 21 23 "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
  - 1. Hot-Water Heating Piping: 125 psig at 200 deg F.
  - 2. Makeup-Water Piping: 80 psig at 150 deg F.
  - 3. Condensate-Drain Piping: 150 deg F.
  - 4. Air-Vent Piping: 200 deg F.
  - 5. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
  - 2. Air control devices.
  - 3. Chemical treatment.
  - 4. Hydronic specialties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

1.7 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
- C. DWV Copper Tubing: ASTM B 306, Type DWV.
- D. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.

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- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.
- F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
  - 1. Material Group: 1.1.
  - 2. End Connections: Butt welding.
  - 3. Facings: Raised face.
- H. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

## 2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- E. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

## 2.4 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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- a. Capitol Manufacturing Company.
- b. Central Plastics Company.
- c. Hart Industries International, Inc.
- d. Jomar International Ltd.
- e. Matco-Norca, Inc.
- f. McDonald, A. Y. Mfg. Co.
- g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- h. Wilkins; a Zurn company.

2. Description:

- a. Standard: ASSE 1079.
- b. Pressure Rating: 150 psig.
- c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Capitol Manufacturing Company.
- b. Central Plastics Company.
- c. Matco-Norca, Inc.
- d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- e. Wilkins; a Zurn company.

2. Description:

- a. Standard: ASSE 1079.
- b. Factory-fabricated, bolted, companion-flange assembly.
- c. Pressure Rating: 125 psig minimum at 180 deg F.
- d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Advance Products & Systems, Inc.
- b. Calpico, Inc.
- c. Central Plastics Company.
- d. Pipeline Seal and Insulator, Inc.

2. Description:

- a. Nonconducting materials for field assembly of companion flanges.
- b. Pressure Rating: 150 psig.
- c. Gasket: Neoprene or phenolic.
- d. Bolt Sleeves: Phenolic or polyethylene.
- e. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Elster Perfection.
  - b. Grinnell Mechanical Products.
  - c. Matco-Norca, Inc.
  - d. Precision Plumbing Products, Inc.
  - e. Victaulic Company.
2. Description:
  - a. Standard: IAPMO PS 66
  - b. Electroplated steel nipple. complying with ASTM F 1545.
  - c. Pressure Rating: 300 psig at 225 deg F.
  - d. End Connections: Male threaded or grooved.
  - e. Lining: Inert and noncorrosive, propylene.

## 2.5 VALVES

- A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 23 05 23 "General-Duty Valves for HVAC Piping."
- B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section 23 09 00 "Instrumentation and Control for HVAC."
- C. Bronze, Calibrated-Orifice, Balancing Valves:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Armstrong Pumps, Inc.
    - b. Bell & Gossett Domestic Pump; a division of ITT Industries.
    - c. Flow Design Inc.
    - d. Gerand Engineering Co.
    - e. Griswold Controls.
    - f. Taco.
  2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
  3. Ball: Brass or stainless steel.
  4. Plug: Resin.
  5. Seat: PTFE.
  6. End Connections: Threaded or socket.
  7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
  8. Handle Style: Lever, with memory stop to retain set position.
  9. CWP Rating: Minimum 125 psig.
  10. Maximum Operating Temperature: 250 deg F.
- D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Armstrong Pumps, Inc.
    - b. Bell & Gossett Domestic Pump; a division of ITT Industries.

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- c. Flow Design Inc.
    - d. Gerand Engineering Co.
    - e. Griswold Controls.
    - f. Taco.
    - g. Tour & Andersson; available through Victaulic Company.
  2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
  3. Ball: Brass or stainless steel.
  4. Stem Seals: EPDM O-rings.
  5. Disc: Glass and carbon-filled PTFE.
  6. Seat: PTFE.
  7. End Connections: Flanged or grooved.
  8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
  9. Handle Style: Lever, with memory stop to retain set position.
  10. CWP Rating: Minimum 125 psig.
  11. Maximum Operating Temperature: 250 deg F.
- E. Diaphragm-Operated, Pressure-Reducing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Amtrol, Inc.
    - b. Armstrong Pumps, Inc.
    - c. Bell & Gossett Domestic Pump; a division of ITT Industries.
    - d. Conbraco Industries, Inc.
    - e. Spence Engineering Company, Inc.
    - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  2. Body: Bronze or brass.
  3. Disc: Glass and carbon-filled PTFE.
  4. Seat: Brass.
  5. Stem Seals: EPDM O-rings.
  6. Diaphragm: EPT.
  7. Low inlet-pressure check valve.
  8. Inlet Strainer: removable without system shutdown.
  9. Valve Seat and Stem: Noncorrosive.
  10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.
- F. Diaphragm-Operated Safety Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Amtrol, Inc.
    - b. Armstrong Pumps, Inc.
    - c. Bell & Gossett Domestic Pump; a division of ITT Industries.
    - d. Conbraco Industries, Inc.
    - e. Spence Engineering Company, Inc.
    - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  2. Body: Bronze or brass.
  3. Disc: Glass and carbon-filled PTFE.

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4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

G. Automatic Flow-Control Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Flow Design Inc.
  - b. Griswold Controls.
2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Corrosion resistant, tamper proof, self cleaning, and removable.
4. Combination Assemblies: Include bronze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig.
9. Maximum Operating Temperature: 200 deg F.

2.6 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amtrol, Inc.
2. Armstrong Pumps, Inc.
3. Bell & Gossett Domestic Pump; a division of ITT Industries.
4. Taco.

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

C. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.

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3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 240 deg F.

## 2.7 HYDRONIC PIPING SPECIALTIES

### A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

### B. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

### C. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig.

### D. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

### E. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

- F. Expansion fittings are specified in Section 23 05 16 "Expansion Fittings and Loops for HVAC Piping."

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:
  - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
  - 2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
- B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be the following:
  - 1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
  - 2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
- C. Makeup-water piping installed aboveground shall be the following:
  - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- D. Condensate-Drain Piping: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints or Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.
- E. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
- F. Air-Vent Piping:
  - 1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
  - 2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.
- G. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

### 3.2 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
- B. Install calibrated-orifice, balancing valves at each branch connection to return main.
- C. Install Automatic Flow Control valves in the return pipe of each heating or cooling terminal.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

- E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.
- F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

### 3.3 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, **NPS 3/4** ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install valves according to Section 23 05 23 "General-Duty Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

- R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- T. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Section 23 05 16 "Expansion Fittings and Loops for HVAC Piping."
- U. Identify piping as specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 05 18 "Escutcheons for HVAC Piping."

#### 3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.
- B. Seismic restraints are specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC Piping and Equipment."
- C. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
  - 6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
  - 2. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
  - 3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  - 4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
  - 6. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
  - 7. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.

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8. NPS 6: Maximum span, 17 feet; minimum rod size, 1/2 inch.
  9. NPS 8: Maximum span, 19 feet; minimum rod size, 5/8 inch.
- E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
  2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  5. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  6. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- F. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.
- G. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

### 3.5 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.6 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

- B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

### 3.7 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Section 23 05 19 "Meters and Gages for HVAC Piping."

### 3.8 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
  - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
  - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
  - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
  - 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
  - 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
  - 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
  - 3. Isolate expansion tanks and determine that hydronic system is full of water.
  - 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
  - 5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
  - 6. Prepare written report of testing.
- C. Perform the following before operating the system:
  - 1. Open manual valves fully.

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2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 23 21 13

## SECTION 23 21 23 - HYDRONIC PUMPS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 Information for Bidders, and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Close-coupled, in-line centrifugal pumps.

#### 1.3 DEFINITIONS

- A. Buna-N: Nitrile rubber.
- B. EPT: Ethylene propylene terpolymer.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of pump. Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Mechanical Seals: One mechanical seal(s) for each pump.

## PART 2 - PRODUCTS

### 2.1 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Armstrong Pumps Inc.
  2. Aurora Pump; Division of Pentair Pump Group.
  3. ITT Corporation; Bell & Gossett.
  4. PACO Pumps.
  5. Patterson Pump Co.; a subsidiary of the Gorman-Rupp Co.
  6. Peerless Pump Company.
  7. TACO Incorporated.
- B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically.
- C. Pump Construction:
1. Casing: Radially split, bronze, with threaded gage tapings at inlet and outlet, replaceable bronze wear rings, and threaded companion-flange connections.
  2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance.
  3. Pump Shaft: bronze, with copper-alloy shaft sleeve.
  4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
  5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
  6. Pump Bearings: Permanently lubricated ball bearings.
- D. Motor: Single speed and rigidly mounted to pump casing.
1. 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.
  2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
    - a. Enclosure: Open, dripproof.
    - b. Enclosure Materials: Cast iron.
    - c. Motor Bearings: Permanently lubricated ball bearings.
    - d. Efficiency: Premium efficient.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.
- C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

### 3.3 ALIGNMENT

- A. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.
- B. Comply with pump and coupling manufacturers' written instructions.
- C. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

### 3.4 CONNECTIONS

- A. Comply with requirements for piping specified in Section 23 22 13 "Steam and Condensate Heating Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to pump, allow space for service and maintenance.
- C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.
- D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- E. Install check valve and gate or ball valve on each condensate pump unit discharge.

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- F. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- G. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

### 3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Check piping connections for tightness.
  - 3. Clean strainers on suction piping.
  - 4. Perform the following startup checks for each pump before starting:
    - a. Verify bearing lubrication.
    - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    - c. Verify that pump is rotating in the correct direction.
  - 5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
  - 6. Start motor.
  - 7. Open discharge valve slowly.

### 3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps.

END OF SECTION 23 21 23

## SECTION 232213 - STEAM AND CONDENSATE HEATING PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes pipe and fittings for LP steam and condensate piping:
- B. Related Requirements:
  - 1. Section 232216 "Steam and Condensate Piping Specialties" for strainers, flash tanks, special-duty valves, steam traps, thermostatic air vents and vacuum breakers, and steam and condensate meters.

#### 1.3 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding: Qualify procedures and operators according to the following:
  - 1. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures unless otherwise indicated:
  - 1. LP Steam Piping: 125 psig.
  - 2. Condensate Piping: 125 psig at 250 deg F.
  - 3. Makeup-Water Piping: 80 psig at 150 deg F.
  - 4. Blowdown-Drain Piping: Equal to pressure of the piping system to which it is attached.
  - 5. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.
  - 6. Safety-Valve-Inlet and -Outlet Piping: Equal to pressure of the piping system to which it is attached.

## 2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, plain ends, welded and seamless, Grade B, and Schedule as indicated in piping applications articles.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125, 150, and 300 as indicated in piping applications articles.
- C. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300 as indicated in piping applications articles.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in piping applications articles.
- E. Cast-Iron Threaded Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250 as indicated in piping applications articles; raised ground face, and bolt holes spot faced.
- F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- G. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
  - 1. Material Group: 1.1.
  - 2. End Connections: Butt welding.
  - 3. Facings: Raised face.
- H. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, black steel of same Type, Grade, and Schedule as pipe in which installed.

## 2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- D. Welding Materials: Comply with Section II, Part C, of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

## PART 3 - EXECUTION

### 3.1 LP STEAM PIPING APPLICATIONS

- A. LP Steam Piping, NPS 2 and Smaller: Schedule 40, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.
- B. LP Steam Piping, NPS 2-1/2 through NPS 12: Schedule 40, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
- C. LP Steam Piping, NPS 14 through NPS 18: Schedule 30, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
- D. LP Steam Piping, NPS 20: Schedule 20, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
- E. Condensate piping above grade, NPS 2 and smaller, shall be the following:
  - 1. Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.
- F. Condensate piping above grade, NPS 2-1/2 and larger, shall be the following:
  - 1. Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

### 3.2 ANCILLARY PIPING APPLICATIONS

- A. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
- B. Vacuum-Breaker Piping: Outlet, same as service where installed.
- C. Safety-Valve-Inlet and -Outlet Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

### 3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless otherwise indicated.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

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- E. Install piping to permit valve servicing.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- K. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- L. Install steam supply piping at a minimum uniform grade of 0.2 percent downward in direction of steam flow.
- M. Install condensate return piping at a minimum uniform grade of 0.4 percent downward in direction of condensate flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side down.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to top of main pipe.
- P. Install valves according to Section 230523 "General-Duty Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- S. Install shutoff valve immediately upstream of each dielectric fitting.
- T. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full port ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- U. Comply with requirements in Section 230516 "Expansion Fittings and Loops for HVAC Piping" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides.
- V. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.
- W. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, and control valves.

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1. On straight runs with no natural drainage points, install drip legs at intervals not exceeding 300 feet.
2. Size drip legs same size as main. In steam mains NPS 6 and larger, drip leg size can be reduced, but to no less than NPS 4.

3.4 STEAM AND CONDENSATE PIPING SPECIALTIES INSTALLATION

- A. Comply with requirements in Section 232216 "Steam and Condensate Piping Specialties" for installation requirements for strainers, flash tanks, special-duty valves, steam traps, thermostatic air vents and vacuum breakers, and steam and condensate meters.

3.5 HANGERS AND SUPPORTS

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for installation of hangers and supports. Comply with requirements below for maximum spacing.
- B. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.
- C. Install the following pipe attachments:
  1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet
  - Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
  2. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  3. Spring hangers to support vertical runs.
- D. Install hangers for steel steam supply piping with the following maximum spacing:
  1. NPS 3/4: Maximum span, 9 feet.
  2. NPS 1: Maximum span, 9 feet.
  3. NPS 1-1/2: Maximum span, 12 feet.
  4. NPS 2: Maximum span, 13 feet.
  5. NPS 2-1/2: Maximum span, 14 feet.
  6. NPS 3 and Larger: Maximum span, 15 feet.
- E. Install hangers for steel steam condensate piping with the following maximum spacing:
  1. NPS 3/4: Maximum span, 7 feet.
  2. NPS 1: Maximum span, 7 feet.
  3. NPS 1-1/2: Maximum span, 9 feet.
  4. NPS 2: Maximum span, 10 feet.
  5. NPS 2-1/2: Maximum span, 11 feet.
  6. NPS 3 and Larger: Maximum span, 12 feet.

3.6 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and remove burrs. Bevel plain ends of steel pipe.

- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
- E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.7 TERMINAL EQUIPMENT CONNECTIONS

- A. Size for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install traps and control valves in accessible locations close to connected equipment.
- C. Install vacuum breakers downstream from control valve, close to coil inlet connection.
- D. Install a drip leg at coil outlet.

### 3.8 FIELD QUALITY CONTROL

- A. Prepare steam and condensate piping according to ASME B31.9, "Building Services Piping," and as follows:
  - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
  - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  - 3. Flush system with clean water. Clean strainers.
  - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
- B. Perform the following tests and inspections:
  - 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
  - 2. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure

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at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength.

3. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

- C. Prepare test and inspection reports.

END OF SECTION 232213

## SECTION 232216 - STEAM AND CONDENSATE PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes the following piping specialties for LP steam and condensate piping:
  - 1. Strainers.
  - 2. Flash tanks.
  - 3. Safety valves.
  - 4. Steam traps.
  - 5. Thermostatic air vents and vacuum breakers.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Safety valve.
  - 2. Steam trap.
  - 3. Air vent and vacuum breaker.
  - 4. Flash tank.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For valves, safety valves, steam traps, air vents, and vacuum breakers to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Pipe Welding: Qualify procedures and operators according to the following:
  - 1. ASME Compliance: Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp flash tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures unless otherwise indicated:
1. LP Steam Piping: 125 psig.
  2. Condensate Piping: 125 psig at 250 deg F.
  3. Makeup-Water Piping: 80 psig at 150 deg F.
  4. Blowdown-Drain Piping: Equal to pressure of the piping system to which it is attached.
  5. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.
  6. Safety-Valve-Inlet and -Outlet Piping: Equal to pressure of the piping system to which it is attached.

### 2.2 VALVES

- A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 230523 "General-Duty Valves for HVAC Piping."
- B. Stop-Check Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
    - a. A.Y. McDonald Mfg. Co.
    - b. Cincinnati Valve Company.
    - c. Crane; Crane Energy Flow Solutions.
    - d. Jenkins Valves.
  2. Body and Bonnet: Malleable iron.
  3. End Connections: Flanged.
  4. Disc: Cylindrical with removable liner and machined seat.
  5. Stem: Brass alloy.
  6. Operator: Outside screw and yoke with cast-iron handwheel.
  7. Packing: Polytetrafluoroethylene-impregnated packing with two-piece packing gland assembly.
  8. Pressure Class: 250.

### 2.3 STRAINERS

- A. Y-Pattern Strainers:
1. Body: ASTM A 126, Class B cast iron, with bolted cover and bottom drain connection.
  2. End Connections: Threaded ends for strainers NPS 2 and smaller; flanged ends for strainers NPS 2-1/2 and larger.
  3. Strainer Screen: Stainless-steel, 20-mesh strainer, or perforated stainless-steel basket.
  4. Tapped blowoff plug.
  5. CWP Rating: 250-psig working steam pressure.

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B. Basket Strainers:

1. Body: ASTM A 126, Class B cast iron, with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for strainers NPS 2 and smaller; flanged ends for strainers NPS 2-1/2 and larger.
3. Strainer Screen: Stainless-steel, 20 mesh strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 250-psig working steam pressure.

2.4 FLASH TANKS

- A. Shop or factory fabricated of welded steel according to ASME Boiler and Pressure Vessel Code, for 150-psig rating; and bearing ASME label. Fabricate with tappings for low-pressure steam and condensate outlets, high-pressure condensate inlet, air vent, safety valve, and legs.

2.5 SAFETY VALVES

A. Bronze or Brass Safety Valves: ASME labeled.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. Kunkle Valve.
  - c. Spirax Sarco, Inc.
  - d. Watts Regulator Co.
2. Disc Material: Forged copper alloy.
3. End Connections: Threaded inlet and outlet.
4. Spring: Fully enclosed steel spring with adjustable pressure range and positive shutoff, factory set and sealed.
5. Pressure Class: 250.
6. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.
7. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.

B. Cast-Iron Safety Valves: ASME labeled.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. Kunkle Valve.
  - c. Spirax Sarco, Inc.
  - d. Watts Regulator Co.
2. Disc Material: Forged copper alloy with bronze nozzle.
3. End Connections: Raised-face flanged inlet and threaded or flanged outlet connections.
4. Spring: Fully enclosed cadmium-plated steel spring with adjustable pressure range and positive shutoff, factory set and sealed.

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5. Pressure Class: 250.
6. Drip-Pan Elbow: Cast iron and having threaded inlet, outlet, and drain, with threads complying with ASME B1.20.1.
7. Exhaust Head: Cast iron and having threaded inlet and drain, with threads complying with ASME B1.20.1.
8. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.

## 2.6 STEAM TRAPS

### A. Thermostatic Traps:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. Barnes & Jones, Inc.
  - c. Dunham-Bush, Inc.
  - d. Hoffman Specialty.
  - e. Spirax Sarco, Inc.
  - f. Sterling.
2. Body: Bronze angle-pattern body with integral union tailpiece and screw-in cap.
3. Trap Type: Balanced-pressure.
4. Bellows: Stainless steel or monel.
5. Head and Seat: Replaceable, hardened stainless steel.
6. Pressure Class: 125.

### B. Thermodynamic Traps:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. Barnes & Jones, Inc.
  - c. Dunham-Bush, Inc.
  - d. Hoffman Specialty.
  - e. Spirax Sarco, Inc.
2. Body: Stainless steel with screw-in cap.
3. End Connections: Threaded.
4. Disc and Seat: Stainless steel.
5. Maximum Operating Pressure: 600 psig.

### C. Float and Thermostatic Traps:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. Barnes & Jones, Inc.
  - c. Dunham-Bush, Inc.

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- d. Hoffman Specialty.
  - e. Spirax Sarco, Inc.
  - f. Sterling.
- 2. Body and Bolted Cap: ASTM A 126, cast iron.
  - 3. End Connections: Threaded.
  - 4. Float Mechanism: Replaceable, stainless steel.
  - 5. Head and Seat: Hardened stainless steel.
  - 6. Trap Type: Balanced pressure.
  - 7. Thermostatic Bellows: Stainless steel or monel.
  - 8. Thermostatic air vent capable of withstanding 45 deg F of superheat and resisting water hammer without sustaining damage.
  - 9. Vacuum Breaker: Thermostatic with phosphor bronze bellows, and stainless-steel cage, valve, and seat.
  - 10. Maximum Operating Pressure: 125 psig.

D. Inverted Bucket Traps:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
  - a. Armstrong International, Inc.
  - b. Barnes & Jones, Inc.
  - c. Dunham-Bush, Inc.
  - d. Hoffman Specialty.
  - e. Spirax Sarco, Inc.
  - f. Sterling.
- 2. Body and Cap: Cast iron.
- 3. End Connections: Threaded.
- 4. Head and Seat: Stainless steel.
- 5. Valve Retainer, Lever, and Guide Pin Assembly: Stainless steel.
- 6. Bucket: Brass or stainless steel.
- 7. Strainer: Integral stainless-steel inlet strainer within the trap body.
- 8. Air Vent: Stainless-steel thermostatic vent.
- 9. Pressure Rating: 250 psig.

2.7 THERMOSTATIC AIR VENTS AND VACUUM BREAKERS

A. Thermostatic Air Vents:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
  - a. Armstrong International, Inc.
  - b. Barnes & Jones, Inc.
  - c. Dunham-Bush, Inc.
  - d. Hoffman Specialty.
  - e. Spirax Sarco, Inc.
  - f. Sterling.
- 2. Body: Cast iron, bronze, or stainless steel.

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3. End Connections: Threaded.
4. Float, Valve, and Seat: Stainless steel.
5. Thermostatic Element: Phosphor bronze bellows in a stainless-steel cage.
6. Pressure Rating: 125 psig.
7. Maximum Temperature Rating: 350 deg F.

B. Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
  - a. Armstrong International, Inc.
  - b. Dunham-Bush, Inc.
  - c. Hoffman Specialty.
  - d. Johnson Corporation (The).
  - e. Spirax Sarco, Inc.
2. Body: Cast iron, bronze, or stainless steel.
3. End Connections: Threaded.
4. Sealing Ball, Retainer, Spring, and Screen: Stainless steel.
5. O-Ring Seal: EPR.
6. Pressure Rating: 125 psig.
7. Maximum Temperature Rating: 350 deg F.

## PART 3 - EXECUTION

### 3.1 VALVE APPLICATIONS

- A. Install shutoff duty valves at branch connections to steam supply mains, at steam supply connections to equipment, and at the outlet of steam traps.
- B. Install safety valves as required by ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

### 3.2 PIPING INSTALLATION

- A. Install piping to permit valve servicing.
- B. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- C. Install valves according to Section 230523 "General-Duty Valves for HVAC Piping."
- D. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- E. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full port ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- H. Flash Tank:
  - 1. Pitch condensate piping down toward flash tank.
  - 2. If more than one condensate pipe discharges into flash tank, install a check valve in each line.
  - 3. Install thermostatic air vent at tank top.
  - 4. Install safety valve at tank top.
  - 5. Install full-port ball valve, and swing check valve on condensate outlet.
  - 6. Install inverted bucket or float and thermostatic trap at low-pressure condensate outlet, sized for three times the calculated heat load.
  - 7. Install pressure gage on low-pressure steam outlet according to Section 230519 "Meters and Gages for HVAC Piping."

### 3.3 STEAM-TRAP INSTALLATION

- A. Install steam traps in accessible locations as close as possible to connected equipment.
- B. Install full-port ball valve, strainer, and union upstream from trap; install union, check valve, and full-port ball valve downstream from trap unless otherwise indicated.

### 3.4 SAFETY VALVE INSTALLATION

- A. Install safety valves according to ASME B31.9, "Building Services Piping."
- B. Pipe safety-valve discharge without valves to atmosphere outside the building.
- C. Install drip-pan elbow fitting adjacent to safety valve and pipe drain connection to nearest floor drain.
- D. Install exhaust head with drain to waste, on vents equal to or larger than NPS 2-1/2.

### 3.5 TERMINAL EQUIPMENT CONNECTIONS

- A. Install traps and control valves in accessible locations close to connected equipment.
- B. Install vacuum breakers downstream from control valve, close to coil inlet connection.

END OF SECTION 232216

## SECTION 232223 - STEAM CONDENSATE PUMPS

### 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 vacuum steam condensate pumping unit.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include certified performance curves and rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated. Indicate pump's operating point on curves. Include receiver capacity and material.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 SINGLE-STAGE, CENTRIFUGAL PUMPS WITH FLOOR-MOUNTED RECEIVER

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Alyan Pump Company; Div. of Hannmann Machinery Systems, Inc.
  - 2. Armstrong Fluid Handling; Div. of Armstrong International, Inc.
  - 3. ITT Corporation; Domestic Pump Division.
  - 4. Nicholson Steam Trap; a division of Spence Engineering Company, Inc.
  - 5. Pentair Pump Group.
  - 6. Roth Pump Company.
  - 7. Skidmore Pump.
  - 8. Spence Engineering Company, Inc.; Division of Circor International, Inc.
  - 9. Spirax-Sarco Inc.
  - 10. Sterling.
- B. Description: Factory-fabricated, packaged, electric-driven vacuum pumps; with receiver, pumps, controls, and accessories suitable for operation with steam condensate.

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1. 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.
  2. ASME Compliance: Fabricate and label steam condensate receivers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- C. Configuration: Duplex floor-mounted pump with receiver, multi-jet vacuum producers, discharge valve assemblies, and float switches; rated to pump 200 deg F steam condensate.
- D. Receiver:
1. Floor mounted.
  2. Close-grained cast iron.
  3. Externally adjustable float switches.
  4. Flanges for pump mounting.
  5. Water-level gage and dial thermometer.
  6. Pressure gage at pump discharge.
  7. Vacuum gauge and switches.
  8. Multi-jet vacuum producers.
  9. Vacuum breaker.
  10. Bronze fitting isolation valve between pump and receiver.
  11. Lifting eyebolts.
  12. Inlet vent and an overflow.
  13. Cast-iron inlet strainer with vertical self-cleaning bronze screen and large dirt pocket.
- E. Pumps:
1. Centrifugal, close coupled, vertical design.
  2. Permanently aligned.
  3. Bronze fitted.
  4. Replaceable bronze case ring.
  5. Mechanical seals rated at 250 deg F.
  6. Mounted on receiver flange.
- F. Motor:
1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
  2. Enclosure: Open, dripproof.
  3. Enclosure Materials: Cast iron.
  4. Motor Bearings: Permanently lubricated ball bearings.
  5. Efficiency: Premium efficient.
- G. Control Panel:
1. Factory wired between pumps and float switches, for single external electrical connection.
  2. Provide fused, control-power transformer if voltage exceeds 230 V ac.
  3. NEMA 250, Type 2 enclosure with hinged door and grounding lug, mounted on pump.
  4. Motor controller for each pump.

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5. Electrical pump alternator to operate pumps in lead-lag sequence and allow both pumps to operate on receiver high level.
6. Manual lead-lag control to override electrical pump alternator and manually select the lead pump.
7. Momentary-contact "TEST" push button on cover for each pump.
8. Numbered terminal strip.
9. Disconnect switch.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install pumps according to HI 1.1-1.2, HI 1.3, and HI 1.4.
- B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.
- C. Support pumps and piping separately so piping is not supported by pumps.
- D. Install thermometers and pressure gages.
- E. Equipment Mounting:
  1. Install pumps on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

#### 3.3 CONNECTIONS

- A. Comply with requirements for piping specified in Section 232213 "Steam and Condensate Heating Piping" and Section 232216 "Steam and Condensate Piping Specialties."
- B. Where installing piping adjacent to machine, allow space for service and maintenance.
- C. Install a globe and check valve and pressure gage before inlet of each pump and a gate and check valve at pump outlet.
- D. Pipe drain to nearest floor drain for overflow and drain piping connections.

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- E. Install full-size vent piping to outdoors, terminating in 180-degree elbow at point above highest steam system connection or as indicated.
- F. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- G. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### 3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Clean strainers.
  - 3. Set steam condensate pump controls.
  - 4. Set pump controls for automatic start, stop, and alarm operation.
  - 5. Perform the following preventive maintenance operations and checks before starting:
    - a. Set float switches to operate at proper levels.
    - b. Set throttling valves on pump discharge for specified flow.
    - c. Check motors for proper rotation.
    - d. Test pump controls and demonstrate compliance with requirements.
    - e. Replace damaged or malfunctioning pump controls and equipment.
    - f. Verify that pump controls are correct for required application.
  - 6. Start steam condensate pumps according to manufacturer's written startup instructions.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain steam condensate pumps.

END OF SECTION 232223

## SECTION 232519 - WATER TREATMENT FOR STEAM SYSTEM FEEDWATER

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes the following HVAC water-treatment systems:

1. Automatic chemical-feed equipment.
2. Stainless-steel pipes and fittings.
3. Chemical treatment test equipment.
4. Chemicals.

#### 1.3 DEFINITIONS

- A. TDS: Total dissolved solids.
- B. TSS: Total suspended solids are solid materials, including organic and inorganic, that are suspended in the water. These solids may include silt, plankton, and industrial wastes.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, and furnished specialties and accessories for the following products:
  1. Water meters.
  2. Inhibitor injection timers.
  3. pH controllers.
  4. TDS controllers.
  5. Chemical solution tanks.
  6. Injection pumps.
  7. Chemical test equipment.
  8. Chemical material safety data sheets.
- B. Shop Drawings: Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to steam systems.
  1. Include plans, elevations, sections, and attachment details.
  2. Include diagrams for power, signal, and control wiring.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Water Analysis Provider Qualifications: Verification of experience and capability of HVAC water-treatment service provider.
- C. Field quality-control reports.
- D. Other Informational Submittals:
  - 1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in "Performance Requirements" Article.
  - 2. Water Analysis: Illustrate water quality available at Project site.
  - 3. Passivation Confirmation Report: Verify passivation of galvanized-steel surfaces, and confirm this observation in a letter to Architect.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sensors, injection pumps, and controllers to include in emergency, operation, and maintenance manuals.

## 1.7 QUALITY ASSURANCE

- A. Steam System Water-Treatment Service Provider Qualifications: An experienced steam systems water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Anderson Chemical Company.
  - 2. Aqua-Chem, Inc.
  - 3. Barclay Water Management, Inc.
  - 4. Boland.
  - 5. Cascade Water Services, Inc.
  - 6. Earthwise Environmental Inc.

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7. General Electric Company; GE Water & Process Technologies.
8. H-O-H Water Technology, Inc.
9. Metro Group, Inc. (The); Metropolitan Refining Div.
10. Nalco; an Ecolab company.
11. Watcon, Inc.
12. Water Services Inc.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Water quality for steam systems shall minimize corrosion and scale buildup for optimum efficiency of steam and condensate equipment without creating a hazard to operating personnel or the environment.
- B. Base steam systems feedwater treatment on quality of water available at Project site, steam and condensate system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
- C. Steam Condensate:
  1. pH: Maintain a value within 7.8 to 8.4.
  2. Total Alkalinity: Maintain a value within 5 to 50 ppm.
  3. Chemical Oxygen Demand: Maintain a maximum value of 15 ppm.
  4. Soluble Copper: Maintain a maximum value of 0.20 ppm.
  5. TSS: Maintain a maximum value of 10 ppm.
  6. Ammonia: Maintain a maximum value of 20 ppm.
  7. Total Hardness: Maintain a maximum value of 2 ppm.
- D. Steam boiler operating at 15 psig and less shall have the following water qualities:
  1. "OH" Alkalinity: Maintain a value within 200 to 400 ppm.
  2. TSS: Maintain a value within 600 to 3000 ppm.

## 2.3 AUTOMATIC CHEMICAL-FEED EQUIPMENT

- A. Water Meter:
  1. AWWA C700, oscillating-piston, magnetic-drive, totalization meter.
  2. Body: Bronze.
  3. Minimum Working-Pressure Rating: 150 psig.
  4. Maximum Pressure Loss at Design Flow: 3 psig.
  5. Registration: Gallons or cubic feet.
  6. End Connections: Threaded.
  7. Controls: Flow-control switch with normally open contacts; rated for maximum 10 A, 250-V ac, and that will close at adjustable increments of total flow.
  8. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Water Meter:

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1. AWWA C701, turbine-type, totalization meter.
2. Body: Bronze.
3. Minimum Working-Pressure Rating: 100 psig.
4. Maximum Pressure Loss at Design Flow: 3 psig.
5. Registration: Gallons or cubic feet.
6. End Connections: Threaded.
7. Control: Low-voltage signal capable of transmitting 1000 feet.
8. 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. TSS Controller:

1. Microprocessor-based controller, 1 percent accuracy in a range from zero to 5000 micromhos. Incorporate solid-state integrated circuits and digital display in NEMA 250, Type 12 enclosure with gasketed and lockable door. Interface for start/stop and status indication at central workstation as described in Section 230900 "Instrumentation and Control for HVAC."
2. Digital display and touch pad for input.
3. Sensor probe adaptable to sample stream manifold.
4. High, low, and normal conductance indication.
5. High- or low-conductance-alarm-light trip points, field adjustable; with silence switch.
6. Hand-off-auto switch for solenoid bleed-off valve.
7. Bleed-off valve activated indication.
8. Internal adjustable hysteresis or deadband.
9. Bleed Valves: Motorized ball valve, steel body, and TFE seats and seals.
10. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Chemical Solution Tanks:

1. Chemical-resistant reservoirs fabricated from high-density opaque polyethylene with minimum 110 percent containment vessel.
2. Molded cover with recess for mounting pump.
3. Capacity: 30 gal..

E. Chemical Solution Injection Pumps:

1. Self-priming, positive displacement; rated for intended chemical with minimum 25 percent safety factor for design pressure and temperature.
2. Adjustable flow rate.
3. Metal and thermoplastic construction.
4. Built-in relief valve.
5. Fully enclosed, continuous-duty, single-phase motor. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
6. 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.

F. Chemical Solution Tubing: Polyethylene tubing with compression fittings and joints except ASTM A 269, Type 304, stainless steel for steam boiler injection assemblies.

G. Injection Assembly:

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1. Quill: Minimum NPS 1/2 with insertion length sufficient to discharge into at least 25 percent of pipe diameter.
2. Ball Valve: Three-piece stainless steel as described in "Stainless-Steel Pipes and Fittings" Article; selected to fit quill.
3. Packing Gland: Mechanical seal on quill of sufficient length to allow quill removal during system operation.
4. Assembly Pressure/Temperature Rating: Minimum 600 psig at 200 deg F.

2.4 STAINLESS-STEEL PIPES AND FITTINGS

- A. Stainless-Steel Tubing: Comply with ASTM A 269, Type 316.
- B. Stainless-Steel Fittings: Comply with ASTM A 815/A 815M, Type 316, Grade WP-S.
- C. Two-Piece, Full-Port, Stainless-Steel Ball Valves: ASTM A 351/A 351M, Type 316 stainless-steel body; ASTM A 276, Type 316 stainless-steel stem and vented ball, carbon-filled TFE seats, threaded body design with adjustable stem packing, threaded ends, and 250-psig steam working-pressure rating and 600-psig cold working-pressure rating.
- D. Three-Piece, Full-Port, Stainless-Steel Ball Valves: ASTM A 351/A 351M, Type 316 stainless-steel body; ASTM A 276, Type 316 stainless-steel stem and vented ball, threaded body design with adjustable stem packing, threaded ends, and 150-psig steam working-pressure rating and 600-psig cold working-pressure rating.

2.5 CHEMICAL TREATMENT TEST EQUIPMENT

- A. Test Kit: Manufacturer-recommended equipment and chemicals in a wall-mounting cabinet for testing pH, TDS, inhibitor, chloride, alkalinity, and hardness; sulfite and testable polymer tests for high-pressure boilers, and oxidizing biocide test for open cooling systems.
- B. Sample Cooler:
  1. Tube: Sample.
    - a. Size: NPS 1/4 tubing.
    - b. Material: ASTM A 666, Type 316 stainless steel.
    - c. Pressure Rating: Minimum 2000 psig.
    - d. Temperature Rating: Minimum 850 deg F.
  2. Shell: Cooling water.
    - a. Material: ASTM A 666, Type 304 stainless steel.
    - b. Pressure Rating: Minimum 250 psig.
    - c. Temperature Rating: Minimum 450 deg F.

2.6 CHEMICALS

- A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment and that can attain water quality specified in "Performance Requirements" Article.

### PART 3 - EXECUTION

#### 3.1 WATER ANALYSIS

- A. Perform an analysis of supply water to determine quality of water available at Project site.

#### 3.2 INSTALLATION

- A. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.
- B. Install seismic restraints for equipment and floor-mounting accessories and anchor to building structure. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.
- C. Install water testing equipment on wall near water chemical application equipment.
- D. Install interconnecting control wiring for chemical treatment controls and sensors.
- E. Mount sensors and injectors in piping circuits.
- F. Install automatic chemical-feed equipment for steam boiler and steam condensate systems and include the following:
  - 1. Install water meter in makeup-water supply.
  - 2. Install inhibitor injection pumps and solution tanks with injection timer sensing contacts in water meter.
    - a. Pumps shall operate for timed interval when contacts close at water meter in makeup-water supply connection. Injection pump shall discharge into boiler feedwater tank or feedwater supply connection at boiler.
  - 3. Install test equipment and furnish test-kit to Owner.
  - 4. Install TSS controller with sensor and bleed valves.
    - a. Bleed valves shall cycle to maintain maximum TSS concentration.
  - 5. Install inhibitor injection timer with injection pumps and solution tanks.
    - a. Pumps shall operate for timed interval on contact closure at water meter in makeup-water supply connection. Injection pump shall discharge into main steam supply header.

#### 3.3 CONNECTIONS

- A. Where installing piping adjacent to equipment, allow space for service and maintenance.

- B. Make piping connections between steam systems water-treatment equipment and dissimilar-metal piping with dielectric fittings. Comply with requirements in Section 232113 "Hydronic Piping" for dielectric fittings.
- C. Install shutoff valves on steam systems water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Section 230523 "General-Duty Valves for HVAC Piping."
- D. Comply with requirements in Section 221119 "Domestic Water Piping Specialties" for backflow preventers required in makeup-water connections to potable-water systems.
- E. Confirm applicable electrical requirements in electrical Sections for connecting electrical equipment.
- F. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- G. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

#### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
  - 2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
  - 3. Place steam systems water-treatment system into operation and calibrate controls during the preliminary phase of steam systems' startup procedures.
  - 4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
  - 5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
  - 7. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
  - 8. Repair leaks and defects with new materials and retest piping until no leaks exist.
- C. Equipment will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

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- E. Sample boiler water at one-week intervals after boiler startup for a period of five weeks, and prepare test report advising Owner of changes necessary to adhere to "Performance Requirements" Article for each required characteristic. Sample boiler water at four-week intervals following the testing noted above to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section.
- F. Comply with ASTM D 3370 and with the following standards:
  - 1. Silica: ASTM D 859.
  - 2. Steam System: ASTM D 1066.
  - 3. Acidity and Alkalinity: ASTM D 1067.
  - 4. Iron: ASTM D 1068.
  - 5. Water Hardness: ASTM D 1126.

### 3.5 MAINTENANCE SERVICE

- A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for heating, steam and condensate piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, and shall include the following:
  - 1. Initial water analysis and steam systems water-treatment recommendations.
  - 2. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
  - 3. Periodic field service and consultation.
  - 4. Customer report charts and log sheets.
  - 5. Laboratory technical analysis.
  - 6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain steam systems water-treatment systems and equipment.
- B. Training: Provide a "how-to-use" self-contained breathing apparatus video that details exact operating procedures of equipment.

END OF SECTION 232519

## SECTION 23 31 13 - METAL DUCTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 Information for Bidders, and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Single-wall rectangular ducts and fittings.
  - 2. Sheet metal materials.
  - 3. Sealants and gaskets.
  - 4. Hangers and supports.

- B. Related Sections:

- 1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
  - 2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:

- 1. Liners and adhesives.
  - 2. Sealants and gaskets.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

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1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
  2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
  3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.2 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G60.
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
  - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.3 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
  - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
  - 2. Tape Width: 3 inches.
  - 3. Sealant: Modified styrene acrylic.
  - 4. Water resistant.
  - 5. Mold and mildew resistant.
  - 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  - 7. Service: Indoor and outdoor.
  - 8. Service Temperature: Minus 40 to plus 200 deg F.
  - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
  - 10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Water-Based Joint and Seam Sealant:
  - 1. Application Method: Brush on.
  - 2. Solids Content: Minimum 65 percent.
  - 3. Shore A Hardness: Minimum 20.
  - 4. Water resistant.
  - 5. Mold and mildew resistant.
  - 6. VOC: Maximum 75 g/L (less water).

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7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
11. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
12. Service: Indoor or outdoor.
13. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## 2.4 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

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- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- E. Trapeze and Riser Supports:
  - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

### PART 3 - EXECUTION

#### 3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- J. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

### 3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

### 3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 2. Outdoor, Supply-Air Ducts: Seal Class A.
  - 3. Outdoor, Exhaust Ducts: Seal Class C.
  - 4. Outdoor, Return-Air Ducts: Seal Class C.
  - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
  - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
  - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
  - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
  - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
  - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
  - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
  - 12. Conditioned Space, Return-Air Ducts: Seal Class C.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.

2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
  5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
  2. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
  3. Test for leaks before applying external insulation.
  4. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
  5. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
1. Visually inspect duct system to ensure that no visible contaminants are present.

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2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

- a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

### 3.7 DUCT CLEANING

- A. Clean new duct system before testing, adjusting, and balancing.

### 3.8 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

### 3.9 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

- B. Outdoor-Air Boiler Combustion Air (Not Filtered, Heated, or Cooled) Ducts:

- a. Pressure Class: Positive or negative 2-inch wg.
  - b. Minimum SMACNA Seal Class: A.
  - c. SMACNA Leakage Class for Rectangular: 3.
  - d. SMACNA Leakage Class for Round and Flat Oval: 3.

- C. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

- D. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

- a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

- E. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

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- a. Rectangular Main to Rectangular Branch: 45-degree entry.
- b. Rectangular Main to Round Branch: Spin in.

END OF SECTION 23 31 13

## SECTION 23 33 00 - AIR DUCT ACCESSORIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 Information for Bidders, and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Manual volume dampers.
  - 2. Control dampers.
  - 3. Flange connectors.
  - 4. Turning vanes.
  - 5. Flexible connectors.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

#### 2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G60.
  - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

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- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.3 MANUAL VOLUME DAMPERS

### A. Low-Leakage, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Air Balance Inc.; a division of Mestek, Inc.
  - b. American Warming and Ventilating; a division of Mestek, Inc.
  - c. McGill AirFlow LLC.
  - d. Nailor Industries Inc.
  - e. Pottorff.
  - f. Ruskin Company.
  - g. Trox USA Inc.
  - h. Vent Products Company, Inc.
2. Comply with AMCA 500-D testing for damper rating.
3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
4. Suitable for horizontal or vertical applications.
5. Frames:
  - a. Hat shaped.
  - b. 0.094-inch- thick, galvanized sheet steel.
  - c. Mitered and welded corners.
  - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
6. Blades:
  - a. Multiple or single blade.
  - b. Parallel- or opposed-blade design.
  - c. Stiffen damper blades for stability.
  - d. Galvanized, roll-formed steel, 0.064 inch thick.
7. Blade Axles: Nonferrous metal.
8. Bearings:
  - a. Oil-impregnated bronze.
  - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
9. Blade Seals: Felt.
10. Jamb Seals: Cambered stainless steel.
11. Tie Bars and Brackets: Galvanized steel.
12. Accessories:
  - a. Include locking device to hold single-blade dampers in a fixed position without vibration.

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B. Jackshaft:

1. Size: 0.5-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

## 2.4 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. Lloyd Industries, Inc.
6. McGill AirFlow LLC.
7. Metal Form Manufacturing, Inc.
8. Nailor Industries Inc.
9. NCA Manufacturing, Inc.
10. Pottorff.
11. Ruskin Company.
12. Vent Products Company, Inc.
13. Young Regulator Company.

B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:

1. Hat shaped.
2. 0.094-inch- thick, galvanized sheet steel.
3. Mitered and welded corners.

D. Blades:

1. Multiple blade with maximum blade width of 6 inches.
2. Parallel- and opposed-blade design.
3. Galvanized-steel.
4. 0.064 inch thick single skin or 0.0747-inch- thick dual skin.
5. Blade Edging: Closed-cell neoprene.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

E. Blade Axles: 1/2-inch- diameter; nonferrous metal; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

F. Bearings:

1. Oil-impregnated bronze.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

## 2.5 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
  2. Nexus PDQ; Division of Shilco Holdings Inc.
  3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

## 2.6 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
  2. Duro Dyne Inc.
  3. Elgen Manufacturing.
  4. METALAIRE, Inc.
  5. SEMCO Incorporated.
  6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- E. Vane Construction: Single wall.

- F. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

## 2.7 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
  - 2. Duro Dyne Inc.
  - 3. Elgen Manufacturing.
  - 4. Ventfabrics, Inc.
  - 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  - 1. Minimum Weight: 26 oz./sq. yd..
  - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
  - 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
  - 1. Minimum Weight: 24 oz./sq. yd..
  - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
  - 3. Service Temperature: Minus 50 to plus 250 deg F.
- G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
  - 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
  - 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  - 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
  - 7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
  - 1. Install steel volume dampers in steel ducts.
  - 2. Install aluminum volume dampers in aluminum ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install flexible connectors to connect ducts to equipment.
- G. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- H. Install duct test holes where required for testing and balancing purposes.
- I. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

### 3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Operate dampers to verify full range of movement.
  - 2. Inspect turning vanes for proper and secure installation.

END OF SECTION 23 33 00

## SECTION 23 34 23 - HVAC POWER VENTILATORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 Information for Bidders, and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Propeller fans.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on actual Project site elevations.
- B. Operating Limits: Classify according to AMCA 99.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
  - 1. Certified fan performance curves with system operating conditions indicated.
  - 2. Certified fan sound-power ratings.
  - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 4. Material thickness and finishes, including color charts.
  - 5. Dampers, including housings, linkages, and operators.
  - 6. Fan speed controllers.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Belts: One set(s) for each belt-driven unit.

1.7 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

PART 2 - PRODUCTS

2.1 PROPELLER FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Acme Engineering & Manufacturing Corporation.
  - 2. Broan-NuTone LLC; NuTone Inc.
  - 3. Carnes Company.
  - 4. Hartzell Fan Incorporated.
  - 5. JencoFan.
  - 6. Loren Cook Company.
  - 7. PennBarry.
- B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.
- C. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.
- D. Fan Wheel: Replaceable, extruded-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.
- E. Fan Drive: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- F. Fan Drive:
  - 1. Resiliently mounted to housing.
  - 2. Statically and dynamically balanced.
  - 3. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
  - 4. Extend grease fitting to accessible location outside of unit.
  - 5. Service Factor Based on Fan Motor Size: 1.4.
  - 6. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
  - 7. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
    - a. Ball-Bearing Rating Life: ABMA 9, L<sub>10</sub> of 100,000 hours.
  - 8. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.

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9. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
10. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
11. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

G. Accessories:

1. Gravity Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.
2. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
3. Wall Sleeve: Galvanized steel to match fan and accessory size.
4. Weathershield Hood: Galvanized steel to match fan and accessory size.
5. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
6. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

## 2.2 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Enclosure Type: Totally enclosed, fan cooled.

## 2.3 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Install units with clearances for service and maintenance.
- C. Label units according to requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."

### 3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 23 33 00 "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

### 3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 3. Verify that cleaning and adjusting are complete.
  - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  - 5. Adjust belt tension.
  - 6. Adjust damper linkages for proper damper operation.
  - 7. Verify lubrication for bearings and other moving parts.
  - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  - 10. Shut unit down and reconnect automatic temperature-control operators.
  - 11. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

### 3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

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- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION 23 34 23

SECTION 23 51 00 - BREECHINGS, CHIMNEYS, AND STACKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 00 Information for Bidders, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Listed single-wall vents.
  - 2. Listed double-wall vents.
  - 3. Listed, refractory-lined breechings and stacks.
  - 4. Field-fabricated metal breechings and chimneys.
- B. Related Sections include the following:
  - 1. Section 23 51 13 "Draft Control Devices" for induced-draft and mechanical fans and for motorized and barometric dampers.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Chimney liners.
  - 2. Type B and BW vents.
  - 3. Type L vents.
  - 4. Listed special gas vents.
  - 5. Refractory-lined metal breechings and chimneys.
  - 6. Guy wires and connectors.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain listed system components through one source from a single manufacturer.

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- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," for hangers and supports and AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents, breechings, and stacks.
- C. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

## 1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 07 72 00 "Roof Accessories."

## 1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of venting system that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, structural failures caused by expansion and contraction.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 LISTED TYPE B AND BW VENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Metal Products; MASCO Corporation.
  - 2. Cleaver-Brooks; Div. of Aqua-Chem Inc.
  - 3. FAMCO.
  - 4. Hart & Cooley, Inc.
  - 5. Heat-Fab, Inc.
  - 6. Industrial Chimney Company.
  - 7. LSP Products Group, Inc.
  - 8. Metal-Fab, Inc.
  - 9. Schebler Co. (The).
  - 10. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
  - 11. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
  - 12. Tru-Flex Metal Hose Corp.
  - 13. Van-Packer Company, Inc.
- B. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F continuously for Type B, or 550 deg F continuously for Type BW; with neutral or negative flue pressure complying with NFPA 211.
- C. Construction: Inner shell and outer jacket separated by at least a 1/4-inch airspace.

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- D. Inner Shell: ASTM A 666, Type 430 stainless steel.
- E. Outer Jacket: Galvanized steel.
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
  - 1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.

## 2.2 LISTED TYPE L VENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Metal Products; MASCO Corporation.
  - 2. FAMCO.
  - 3. Heat-Fab, Inc.
  - 4. Industrial Chimney Company.
  - 5. LSP Products Group, Inc.
  - 6. Metal-Fab, Inc.
  - 7. Schebler Co. (The).
  - 8. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
  - 9. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
  - 10. Tru-Flex Metal Hose Corp.
  - 11. Van-Packer Company, Inc.
- B. Description: Double-wall metal vents tested according to UL 641 and rated for 570 deg F continuously, or 1700 deg F for 10 minutes; with neutral or negative flue pressure complying with NFPA 211.
- C. Construction: Inner shell and outer jacket separated by at least a 1/4-inch airspace filled with high-temperature, ceramic-fiber insulation.
- D. Inner Shell: ASTM A 666, Type 304 stainless steel.
- E. Outer Jacket: Galvanized steel.
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
  - 1. Termination: Stack cap designed to exclude 90 percent of rainfall.

## 2.3 LISTED SPECIAL GAS VENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Heat-Fab, Inc.

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2. Metal-Fab, Inc.
  3. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
  4. Z-Flex; Flexmaster Canada Limited.
- B. Description: Double-wall metal vents tested according to UL 1738 and rated for 480 deg F continuously, with positive or negative flue pressure complying with NFPA 211.
- C. Construction: Inner shell and outer jacket separated by at least a 1/2-inch airspace.
- D. Inner Shell: ASTM A 959, Type 29-4C stainless steel.
- E. Outer Jacket: Stainless steel.
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.

2.4 LISTED, REFRACTORY-LINED METAL BREECHINGS AND CHIMNEYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Van-Packer Company, Inc.
  2. Warren Environment, Inc.
- B. Comply with ASME STS-1.
- C. Design Wind Loads: 150 mph.
- D. Design for seismic conditions at Project site.
- E. Chimney Outer Jacket: Aluminized steel with riveted seams.
- F. Refractory Lining: Tested according to UL 959 for temperature and acid resistance, and bearing the testing laboratory label.
1. Temperature Rating: 1800 deg F continuously, and 2000 deg F intermittently.
  2. Acid Extraction: Maximum of 0.2 percent.
  3. Cold Crushing Strength: Minimum of 3200 psig.
  4. Thickness: Minimum of 2 inches.
- G. Finish: Factory-applied, high-heat-resistant paint; color as selected by Architect.
- H. Base Section: Acid-resistant-coated, cast-iron anchor lugs for securing stack to foundation with anchorage designed by manufacturer.
- I. Reinforced Cleanout Section: Smoke-tight connection, with gasketed and bolt-tightened inspection plate; neck shall be welded to stack section.

- J. T or Y Sections: Smoke-tight connection, with welded joints and refractory lining; finished with smooth transition and with no exposed metal on inside.
- K. Spark Screen: ASTM A 666, Type 316 stainless steel, 0.0625 inch thick, maximum 1/2-by-1/2-inch mesh, with ASTM A 666, Type 304 stainless-steel rolled angle and drawband.
- L. Guy Bands: 8-inch- wide bands of same material as jacket, with bolted fasteners.
- M. Roof Penetration: Factory-fabricated thimbles, flashings, and counterflashings.
- N. Fabricate sections, fittings, and accessories as individual pieces or in combination lengths for field handling.
- O. Fabricate components with centrifugally cast refractory lining in lengths suitable for connection with drawbands.
- P. Bond refractory to steel jacket with calcium aluminate cement to prevent separation in finished product during shipping, handling, and installation.
- Q. Fabricate stacks with anchor lugs; cleanout; T sections; flashings and counterflashings; and provisions for support, expansion, and contraction.

## 2.5 FIELD-FABRICATED METAL BREECHINGS AND CHIMNEYS

- A. Fabricate freestanding chimneys according to SMACNA's "Guide for Steel Stack Design and Construction." Design for minimum **<Insert feet>** high and **<Insert inches>** in diameter.
- B. Fabricate breechings and chimneys from ASTM A 1011/A 1011M hot-rolled steel with continuously welded joints, complying with NFPA 211 for minimum metal thickness.
  - 1. Equal to or Less Than 1.069 Sq. Ft. or 14 Inches in Diameter: 0.053 inch.
  - 2. Up to 1.396 Sq. Ft. or 16 Inches in Diameter: 0.067 inch.
  - 3. Up to 1.764 Sq. Ft. or 18 Inches in Diameter: 0.093 inch.
  - 4. Larger Than Above: 0.123 inch.
- C. Fabricate chimneys and vent connectors from galvanized steel, complying with NFPA 211 for minimum metal thickness.
  - 1. Equal to or Less Than 6 Inches in Diameter: 0.019 inch.
  - 2. Up to 10 Inches in Diameter: 0.024 inch.
  - 3. Up to 16 Inches in Diameter: 0.029 inch.
  - 4. Larger Than Above: 0.056 inch.
- D. Fabricate chimneys and vent connectors from ASTM B 209, Type 1100 or 3003, aluminum or stainless steel, complying with NFPA 211 for the following minimum metal thicknesses:
  - 1. Aluminum: 0.027 inch.
  - 2. Stainless Steel: 0.012 inch.
- E. Fabricate cleanout doors from compatible material, same thickness as breeching, bolted and gasketed.

- F. Fabricate engine exhaust from ASTM A 53/A 53M, Type E (electric-resistance welded), Grade B; or ASTM A 106, Type S, Grade B, Schedule 40 pipe; with welded joints and carbon-steel fittings and flanges.
  - 1. Wrought-Steel Fittings: ASME B16.9, wall thickness to match adjoining pipe.
  - 2. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, Class 150, including bolts, nuts, and gaskets.

## 2.6 GUYING AND BRACING MATERIALS

- A. Cable: Three galvanized, stranded wires of the following thickness:
  - 1. Minimum Size: 1/4 inch in diameter.
  - 2. For ID Sizes 4 to 15 Inches: 5/16 inch.
  - 3. For ID Sizes 18 to 24 Inches: 3/8 inch.
  - 4. For ID Sizes 27 to 30 Inches: 7/16 inch.
  - 5. For ID Sizes 33 to 36 Inches: 1/2 inch.
  - 6. For ID Sizes 39 to 48 Inches: 9/16 inch.
  - 7. For ID Sizes 51 to 60 Inches: 5/8 inch.
- B. Pipe: Two galvanized steel, NPS 1-1/4.
- C. Angle Iron: Two galvanized steel, 2 by 2 by 0.25 inch.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLICATION

- A. Listed Chimney Liners: High-efficiency boiler or furnace vents in masonry chimney, dishwasher exhaust, or Type II commercial kitchen hood.
- B. Listed Type B and BW Vents: Vents for certified gas appliances.
- C. Listed Type L Vent: Vents for low-heat appliances.
- D. Listed Special Gas Vent: Condensing gas appliances.
- E. Listed, Refractory-Lined Metal Breechings and Chimneys: Freestanding dual-fuel boiler vents, oven vents, water heaters, exhaust for engines, fireplaces, and other solid-fuel-burning appliances.
- F. Field-Fabricated Metal Breechings and Chimneys: Dual-fuel boilers, oven vents, water heaters, exhaust for engines, fireplaces, and other solid-fuel-burning appliances.

- G. Field-Fabricated Metal Breechings and Chimneys: Steel pipe for use with engine exhaust.

### 3.3 INSTALLATION OF LISTED VENTS AND CHIMNEYS

- A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.
- B. Seal between sections of positive-pressure vents and grease exhaust ducts according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
- C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.
- D. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.
- E. Lap joints in direction of flow.
- F. Connect base section to foundation using anchor lugs of size and number recommended by manufacturer.
- G. Join sections with acid-resistant joint cement to provide continuous joint and smooth interior finish.
- H. Erect stacks plumb to finished tolerance of no more than 1 inch out of plumb from top to bottom.

### 3.4 INSTALLATION OF UNLISTED, FIELD-FABRICATED BREECHINGS AND CHIMNEYS

- A. Suspend breechings and chimneys independent of their appliance connections.
- B. Install, support, and restrain according to seismic requirements.
- C. Align breechings at connections, with smooth internal surface and a maximum 1/8-inch misalignment tolerance.
- D. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.
- E. Lap joints in direction of flow.
- F. Support breechings and chimneys from building structure with bolts, concrete inserts, steel expansion anchors, welded studs, C-clamps, or beam clamps according to manufacturer's written instructions.

### 3.5 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

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- B. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.
- C. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.

END OF SECTION 23 51 00

SECTION 235233 - WATER-TUBE BOILERS-POOL HEATER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes packaged, factory-fabricated and -assembled, gas-fired, finned water-tube boilers, trim, and accessories for generating hot water.
- B. This Section includes packaged, water-tube pool heater, trim, and accessories for generating hot water with the following configurations, burners, and outputs:
  - 1. Factory assembled.
  - 2. Forced-draft gas burner.

1.3 ACTION SUBMITTALS

- A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Source quality-control test reports.
- B. Field quality-control test reports.
- C. Warranty: Special warranty specified in this Section.
- D. Other Informational Submittals:
  - 1. ASME "A" Stamp Certification and Report: Submit "A" stamp certificate of authorization as required by authorities having jurisdiction, and document hydrostatic testing of piping external to boiler.
  - 2. Startup service reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For boilers, components, and accessories to include in emergency, operation, and maintenance manuals.

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1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
- C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
- D. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."
- E. I=B=R Compliance: Boilers shall be tested and rated according to HI's "Rating Procedure for Heating Boilers" and "Testing Standard for Commercial Boilers," with I=B=R emblem on a nameplate affixed to boiler.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace heat exchangers damaged by thermal shock and vent dampers of boilers that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Heat Exchangers: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FINNED WATER-TUBE BOILERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. A. O. Smith Corporation.
  - 2. Ajax Boiler Inc.
  - 3. Allied Engineering Co.
  - 4. Laars Heating Systems.
  - 5. Lochinvar Corporation.
  - 6. Patterson-Kelley.
  - 7. PRECISION Boilers, LLC.

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8. Raypak.
  9. RBI Water Heaters.
  10. RECO USA.
  11. Weben-Jarco, Inc.
- C. Description: Factory-fabricated, -assembled, and -tested boiler with tubes sealed into headers pressure tight, and set on a steel base; including insulated jacket, flue-gas vent, combustion-air intake connections, water supply and return connections, and controls.
- D. Heat Exchanger:
1. Finned copper-nickel tubing with stainless-steel baffles.
  2. Bronze headers.
  3. Single-pass, horizontal configuration.
  4. Tubes shall be sealed in header with silicone O-ring gaskets by mechanically rolling tubes in header.
- E. Combustion Chamber Internal Insulation: Interlocking panels of refractory insulation, high-temperature cements, mineral fiber, and ceramic refractory tile for service temperatures to 2000 deg F.
- F. Casing:
1. Jacket: Sheet metal, with snap-in or interlocking closures.
  2. Control Compartment Enclosure: NEMA 250, Type 1A.
  3. Finish: Baked enamel over primer.
  4. Insulation: Minimum 1-inch- thick, mineral-fiber insulation surrounding the heat exchanger.
  5. Draft Hood: Integral.
  6. Combustion-Air Connection: Inlet duct collar and sheet metal closure over burner compartment.
  7. Mounting base to secure boiler.
- G. Burner:
1. Burner Tubes and Orifices: Stainless steel, for natural gas.
    - a. Sealed Combustion: Factory-mounted centrifugal fan to draw outside air into boiler and discharge into burner compartment.
    - b. Direct Vent: Factory-mounted centrifugal fan to draw flue gas out of boiler and discharge into boiler vent.
  2. Gas Train: Control devices and full-modulation proportional control sequence shall comply with requirements in AGA. In addition to these requirements, include shutoff cock, pressure regulator, and control valve.
  3. Gas Train: Combination gas valve with manual shutoff, pressure regulator, and pilot adjustment.
  4. Pilot: Hot-surface pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
  5. Flue-Gas Recirculation Fans: Centrifugal fans on burner assembly to recirculate flue gas to decrease oxides of nitrogen emissions to less than 30 ppm.

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- a. Motors: Comply with requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

H. Trim:

1. Aquastat Controllers: Operating, firing rate, and high limit.
2. Safety Relief Valve: ASME rated.
3. Pressure and Temperature Gage: Minimum 3-1/2-inch-diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
4. Boiler Air Vent: Automatic.
5. Drain Valve: Minimum NPS 3/4 hose-end gate valve.
6. Circulation Pump: Non-overloading, in-line pump with split-capacitor motor having thermal-overload protection and lubricated bearings; designed to operate at specified boiler pressures and temperatures.

I. Controls:

1. Refer to Section 230900 "Instrumentation and Control for HVAC."
2. Boiler operating controls shall include the following devices and features:
  - a. Control transformer.
  - b. Motorized Vent Damper: Interlocked with burner to open before burner starts. If damper fails to open, stop burner operation.
  - c. Set-Point Adjust: Set points shall be adjustable.
  - d. Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain space temperature in response to thermostat with heat anticipator located in heated space.
3. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
  - a. High Cutoff: Automatic reset stops burner if operating conditions rise above maximum boiler design temperature.
  - b. Water Flow Switch: Automatic-reset paddle-switch shall prevent burner operation on low water flow.
  - c. Blocked Vent Safety Switch: Manual-reset switch factory mounted on draft diverter.
  - d. Rollout Safety Switch: Factory mounted on boiler combustion chamber.
  - e. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.
4. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.
  - a. A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.

## 2.2 ELECTRICAL POWER

- A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in electrical Sections.
- B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
  - 1. House in NEMA 250, Type 1 enclosure.
  - 2. Wiring shall be numbered and color-coded to match wiring diagram.
  - 3. Install factory wiring outside of an enclosure in a metal raceway.
  - 4. Field power interface shall be to non-fused disconnect switch.
  - 5. Provide each motor with overcurrent protection.

## 2.3 VENTING KITS

- A. Vent Damper: Motorized, UL listed for use on atmospheric burner boiler equipped with draft hood; motor to open and close damper; stainless-steel vent coupling and damper blade; keyed wiring harness connector plug; and dual-position switches to permit burner operation.
- B. Kit: Complete system, stainless steel, pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap, and sealant.
- C. Combustion-Air Intake: Stainless steel, pipe, vent terminal with screen, inlet air coupling, and sealant.

## 2.4 SOURCE QUALITY CONTROL

- A. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
- B. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
- C. Allow Owner access to source quality-control testing of boilers. Notify Architect 14 days in advance of testing.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.
  - 1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

- B. Examine mechanical spaces for suitable conditions where boilers will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 BOILER INSTALLATION

- A. Equipment Mounting:
  - 1. Install boilers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033053 "Miscellaneous Cast-in-Place Concrete."
  - 2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
  - 3. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- B. Install gas-fired boilers according to NFPA 54.
- C. Install electrical devices furnished with boiler but not specified to be factory mounted.
- D. Install control wiring to field-mounted electrical devices.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to boiler to allow service and maintenance.
- C. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
- D. Connect hot-water piping to supply- and return-boiler tapings with shutoff valve and union or flange at each connection.
- E. Install piping from safety relief valves to nearest floor drain.
- F. Install piping from safety valves to drip-pan elbow and to nearest floor drain.
- G. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
- H. Boiler Flue Venting:
  - 1. Install venting kit and combustion-air intake.
  - 2. Connect full size to boiler connections.
- I. Install flue-gas recirculation duct from vent to burner. Comply with requirements in Section 235100 "Breechings, Chimneys, and Stacks" for recirculation duct materials.

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- J. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- K. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
  - 1. Perform installation and startup checks according to manufacturer's written instructions.
  - 2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
    - a. Burner Test: Adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency.
    - b. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
    - c. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

### 3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain boilers. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 235233

SECTION 235239 - FIRE-TUBE BOILERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes packaged, factory-fabricated and -assembled boilers, trim, and accessories for generating steam] with the following configurations and burners:
  - 1. Horizontal, Scotch Marine fire-tube boiler.
  - 2. Gas burner.

1.3 ACTION SUBMITTALS

- A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Special warranty specified in this Section.
- B. Other Informational Submittals:
  - 1. ASME Stamp Certification and Report: Submit "A," "S," or "PP" stamp certificate of authorization, as required by authorities having jurisdiction, and document hydrostatic testing of piping external to boiler.
  - 2. Startup service reports provided by the boiler manufacturer.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For boilers, components, and accessories to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

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- B. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
- C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
- D. UL Compliance: Test Boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace front- and rear-door refractories and heat exchangers of boilers that fail in materials or workmanship within specified warranty period.
  - 1. Horizontal, Fire-Tube: Refractory in front and rear doors, 10 years from date of startup by factory-authorized personnel.

PART 2 - PRODUCTS

2.1 HORIZONTAL, FIRE-TUBE BOILERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AESYS Technologies, LLC.
  - 2. Burnham Commercial-Model 4S.
  - 3. Cleaver-Brooks-Model CB.
  - 4. Lattner Boiler Manufacturing.
  - 5. Sellers Engineering Co.
  - 6. Superior Boiler Works, Inc.
- B. Description: Factory-fabricated, -assembled, and -tested, horizontal, Scotch Marine fire-tube boilers with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket, flue-gas vent, steam discharge and water return connections, and controls.
- C. Pressure Vessel Design: Straight, steel tubes welded into steel headers. Four passes with dry-back design. Minimum heat-exchanger surface of 5 sq. ft./bhp. Include the following accessories:
  - 1. Handholes for water-side inspections.
  - 2. Lifting lugs on top of boiler.
  - 3. Minimum NPS 1 hose-end drain valves at shell low point.

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4. Accessible drain and blowdown tappings, piped for both high and low, for surface and mud removal.
5. Tappings for steam supply, makeup, level controls, and chemical treatment.

D. Front and Rear Doors:

1. Hinged or Davited, sealed with heat-resistant gaskets and fastened with lugs and cap screws.
2. Designed so tube sheets and flues are fully accessible for inspection or cleaning when doors are open.
3. Include observation ports in doors at both ends of boiler for inspection of flame conditions.
4. Door refractory and insulation shall be accessible for inspection and maintenance.

E. Casing:

1. Insulation: Minimum 2-inch- thick, mineral-fiber insulation surrounding the boiler shell.
2. Flue Connection: Flange at top of boiler.
3. Jacket: Sheet metal, with screw-fastened closures and baked-enamel protective finish.
4. Mounting base to secure boiler to concrete base.
5. Control Compartment Enclosure: NEMA 250, Type 1.

## 2.2 FORCED-DRAFT GAS BURNERS

- A. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for natural gas. Mount burner on hinged access door to permit access to combustion chamber.
- B. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
  1. Motors: Comply with requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- C. Gas Train: Control devices and modulating control sequence shall comply with requirements in UL.
- D. Pilot: Intermittent-electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.

## 2.3 TRIM

- A. Include devices sized to comply with ANSI B31.9, "Building Services Piping."
- B. Pressure Controllers: Operating, firing rate, and high limit.
- C. Safety Relief Valve:

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1. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.
2. Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.
  - a. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.
- D. Pressure Gage: Minimum 3-1/2-inch diameter. Gage shall have normal operating pressure about 50 percent of full range.
- E. Water Column: Minimum 12-inch glass gage with shutoff cocks.
- F. Drain Valves: Minimum NPS 3/4 or nozzle size with hose-end connection.
- G. Blowdown Valves: Factory-installed bottom and surface, slow-acting blowdown valves same size as boiler blowdown nozzle.
- H. Stop Valves: Boiler inlets and outlets, except safety relief valves or preheater inlet and outlet, shall be equipped with stop valve in an accessible location as near as practical to boiler nozzle and same size or larger than nozzle. Valves larger than NPS 2 shall have rising stem.

## 2.4 CONTROLS

- A. Boiler operating controls and control panel shall include the following devices and features:
  1. Control transformer.
  2. Minimum 4 inch color touch screen HMI.
  3. Set-Point Adjust: Set points shall be adjustable.
  4. Operating Pressure Control: Factory wired and mounted to cycle burner.
  5. Low-Water Cutoff and Pump Control: Cycle feedwater pump(s) for makeup water control.
  6. Sequence of Operation: Electric, factory-fabricated and field-installed PID control panel to control burner firing rate to maintain a constant steam pressure. Maintain pressure set point plus or minus 10 percent.
    - a. Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.
- B. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
  1. High Cutoff: Manual reset stops burner if operating conditions rise above maximum boiler design pressure.
  2. Low-Water Cutoff Switch: Float and electronic probe shall prevent burner operation on low water. Cutoff switch shall be manual-reset type.
  3. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.
- C. Boiler plant master control panel: In addition to the boiler's individual control panels described above, the master control panel shall allow for central control for all boilers, enables remote

monitoring, and modulate boilers in lead-lag or unison modulation. The panel shall have 10" color touch-screen human machine interface.

- D. Building Automation System Interface: Factory-install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.
  - 1. A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.

## 2.5 ELECTRICAL POWER

- A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in electrical Sections.
- B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
  - 1. House in NEMA 250, Type 1 enclosure.
  - 2. Wiring shall be numbered and color-coded to match wiring diagram.
  - 3. Install wiring outside of an enclosure in a metal raceway.
  - 4. Field power interface shall be to nonfused disconnect switch.
  - 5. Provide branch power circuit to each motor and to controls with a disconnect switch or circuit breaker.
  - 6. Provide each motor with overcurrent protection.

## 2.6 SOURCE QUALITY CONTROL

- A. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
- B. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
- C. Allow Owner access to source quality-control testing of boilers. Notify Architect 14 days in advance of testing.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.

1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
- B. Examine mechanical spaces for suitable conditions where boilers will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 BOILER INSTALLATION

- A. Equipment Mounting:
  1. Install boilers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
  2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- B. Install gas-fired boilers according to NFPA 54.
- C. Assemble and install boiler trim.
- D. Install electrical devices furnished with boiler but not specified to be factory mounted.
- E. Install control wiring to field-mounted electrical devices.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to boiler to allow service and maintenance.
- C. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
- D. Connect steam and condensate piping to supply-, return-, and blowdown-boiler tapings with shutoff valve and union or flange at each connection.
- E. Install piping from safety relief valves to nearest floor drain.
- F. Install piping from safety valves to drip-pan elbow and to nearest floor drain.
- G. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
- H. Connect breeching full size to boiler outlet. Comply with requirements in Section 235100 "Breechings, Chimneys, and Stacks" for venting materials.
- I. Install flue-gas recirculation duct from vent to burner. Comply with requirements in Section 235100 "Breechings, Chimneys, and Stacks" for recirculation duct materials.

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- J. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- K. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. The factory-authorized service representative shall perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Perform installation and startup checks according to manufacturer's written instructions.
  - 2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
    - a. Burner Test: Adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency.
    - b. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and steam pressure.
    - c. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.
- E. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers. Video training sessions. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 235239

## SECTION 235313 - BOILER FEEDWATER 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. This Section includes the following:
  - 1. Feedwater pumps and tanks.

#### 1.3 DEFINITION

- A. NPSH: Net-positive suction head.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacity, temperature and NPSH required, pump performance curves with selection points clearly indicated, and furnished specialties and accessories.
- B. Shop Drawings: Include plans, elevations, sections, details, dimensions, weights, loadings, required clearances, method of field assembly, and attachments to other work.
  - 1. Wiring Diagrams: Power, signal, and control wiring.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For feedwater equipment to include in emergency, operation, and maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Fabricate and test unit according to ASME PTC 12.1, "Closed Feedwater Heaters."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

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- C. ASME Compliance: ASME B31.9, "Building Services Piping," for systems equal to or less than 15 psig. Safety valves and pressure vessels shall bear the appropriate ASME label.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Shipping: Clean flanges and exposed-metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.
- B. Store units in dry location.
- C. Retain protective flange covers and machined-surface protective coatings during storage.
- D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.
- E. Comply with manufacturer's written rigging instructions.

1.8 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

PART 2 - PRODUCTS

2.1 FEEDWATER UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AESYS Technologies, LLC; Boiler Div.
  - 2. Alyan Pump.
  - 3. Aurora Pump; Pentair Pump Group.
  - 4. BFS Industries, LLC.
  - 5. Bryan Boilers; Bryan Steam, LLC.
  - 6. Cleaver-Brooks; Div. of Aqua-Chem, Inc.
  - 7. Deaerating Designs; a division of Precision Boilers, Inc.
  - 8. Domestic Pump; a unit of ITT Fluid Technology.
  - 9. Eastern Industrial Products, Inc.; Smith-Koch, Inc. Div.
  - 10. Flotronics, Inc.
  - 11. Gerow Equipment Co.; Pump & Hydraulic Division.
  - 12. Hurst Boiler & Welding Company, Inc.
  - 13. Industrial Steam.
  - 14. Lattner Boiler Manufacturing.
  - 15. Lockwood Products, Inc.; Sub. of John L. Underwood Co., Inc.
  - 16. MEPCO (Marshall Engineered Products Co.).
  - 17. Parker Boiler Co.
  - 18. PVI Industries, LLC.
  - 19. Roth Pump Company; a subsidiary of Roy E. Roth Co.
  - 20. Sellers Engineering Co.

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21. Shippensburg Pump Co., Inc.
22. Skidmore.
23. Stickle Steam Specialties Co., Inc.
24. Superior Boiler Works, Inc.
25. U.S. Deaerator Co.
26. US Filter.

B. Description: Factory-assembled and -tested unit consisting of a receiver, duplex feedwater pumps, controls, and the following features and accessories:

1. Liquid-filled industrial thermometer graduated in Fahrenheit.
2. Level gage glass, reflex flat type, with stops at top and bottom.
3. Lifting eyes.
4. Companion flanges.
5. Pump, suction and discharge isolation valve, inlet strainer, discharge check valve, and liquid-filled pressure gage.
6. Makeup Water Assembly: Float operated with integral valve; with inlet strainer and three-valve bypass.
7. Feedwater Heater: Sparge tube, thermostat, and control valve.
8. Factory-Installed Pipe, NPS 2-1/2 and Smaller: ASTM A 53/A 53M, Type S (seamless), Grade B; or ASTM A 106, Type S, Grade B, Schedule 40; with threaded joints and fittings.
  - a. Cast-Iron Threaded Fittings: ASME B16.4; Class 125.
  - b. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150.
  - c. Forged-Steel Fittings: ASME B16.11, Class 3000.
  - d. Malleable-Iron Unions: ASME B16.39; Class 150.
  - e. Forged-Steel Unions: MSS SP-83, Class 3000.
9. Factory-Installed Pipe, NPS 3 and Larger: ASTM A 53/A 53M, Type E (electric-resistance welded), Grade B; or ASTM A 106, Type S, Grade B, Schedule 40; with welded joints and carbon-steel fittings and flanges.
  - a. Wrought-Steel Fittings: ASME B16.9, wall thickness to match adjoining pipe.
  - b. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, Class 150, including bolts, nuts, and gaskets.

C. Receiver:

1. Material: Welded carbon steel galvanized after fabrication.
2. Additional corrosion protection:
  - a. 0.07-inch thickness allowance.
  - b. Electrolytic corrosion-inhibitor anode.
3. Finish: Primer.
4. Mounting Arrangement: Floor mounted.
5. Mounting Frame: Structural-steel stand to support receiver and pumps.

D. Horizontal Feedwater Pump: Base-mounted, single-stage, radially split-case-design centrifugal pump; rated for 175-psig minimum working pressure and a continuous water temperature of at least 225 deg F; with the following features:

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1. Impeller: Bronze.
  2. Coupling: Close.
  3. Seals: Mechanical.
  4. Motor: Open dripproof enclosure. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
- E. Control panel shall be unit mounted and factory wired and include the following:
1. NEMA 250, Type 1 enclosure.
  2. NEMA-rated motor controller for each motor, and include a hand-off-auto switch and overcurrent protection.
    - a. Alternating controls for duplex units with intermittent operation as indicated by control sequence.
  3. Terminal blocks with numbered and color-coded wiring to match wiring diagram.
  4. Wiring outside of an enclosure in a metal raceway. Make connections to motor with liquidtight conduit.
  5. Removable control mounting plate.
  6. Visual indication of status and alarm with momentary test push button.
  7. Audible alarm and silence switch.
  8. Visual indication of elapsed run time, graduated in hours.
  9. Fused control-circuit transformer.
  10. Microprocessor-based controller.
- F. Feedwater Duplex-Pump Control Sequence:
1. Boiler water-level controller starts and stops lead pump to maintain boiler water-level set point.
  2. Lead and lag pumps alternate after each start to equalize run time.
  3. Lead pump failure, lag pump automatically starts if lead pump cannot maintain set point.
  4. Visual indication of pump on and off status.
  5. Visual indication of pump lead/lag status.
  6. Visual and audible alarm indication of pump failure.
- G. Receiver Makeup Water Control Sequence:
1. Mechanical float operates integral valve to maintain water-level set point.
  2. Visual and audible alarm indication of low and high receiver-water level.
- H. Building Management System Interface: Factory install hardware to enable building management system to monitor and display points.
1. Hardwired Monitoring Points: On/off status for each pump, failure alarm for each pump, receiver low-water-level alarm, receiver high-water-level alarm, feedwater temperature.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Before feedwater unit installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting feedwater unit performance, maintenance, and operations.
  - 1. Final feedwater unit locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Equipment Mounting:
  - 1. Install feedwater units on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033053 "Miscellaneous Cast-in-Place Concrete."
- B. Install unit to permit access for maintenance.
- C. Support piping independent of pumps.
- D. Install base-mounted pumps on concrete bases with grouted base frames.
- E. Install parts and accessories shipped loose.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect makeup water piping and cooling-water piping with reduced-pressure backflow preventers.
- D. Install overflow drain piping to nearest floor drain.
- E. Install vents and extend to outdoors; terminate with elbow turned down and an insect screen.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.

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1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Inspect field-assembled components, equipment installation, and piping and electrical connections for compliance with manufacturer's written instructions.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Check bearing lubrication.
4. Verify proper motor rotation.
5. Start up service.
6. Report results in writing.

D. Remove and replace malfunctioning units and retest as specified above.

3.5 ADJUSTING

- A. Adjust boiler water-level controls to properly stage unit.
- B. Set field-adjustable, makeup water and cooling-water controls.

3.6 CLEANING

- A. Clean equipment internally; remove coatings applied for protection during shipping and storage, foreign material, and oily residue according to manufacturer's written instructions.
- B. Clean strainers.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain feedwater units. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 235313

## SECTION 26 05 00 - BASIC ELECTRICAL REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

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

#### 1.2 DEFINITIONS

- A. Provide all required products and execution for a complete and fully operational Electrical System. Such work includes, but is not limited to, that which is identified on the contract documents. For the purpose of this specification, the following terms are defined:
  - 1. "Contract documents" include the most current project drawings and specification.
  - 2. "Provide" includes furnishing and installation.
  - 3. "Furnish" includes purchasing and transporting new equipment, as specified, to the job site.
  - 4. "Install" includes mounting or setting equipment in place, in specified location, making all required electrical connections for a working product.
  - 5. "Electrical System" includes all distribution of power, lighting, fire protection, life safety, communications, security, special systems, and any other information, electrical in nature, identified on the Contract Documents, from the point(s) of service to utilization device(s).
  - 6. "Connecting" means providing a power source, overcurrent devices, raceways, conductors, terminations, insulation supports, and other materials and equipment required for the operation and control of the relevant operation.
- B. Provide materials, equipment, installation or testing identified on the drawings but not specified herein; or that which is specified herein, but not identified on the drawings shall be provided at no additional cost to the Owner.
- C. Provide materials or equipment including minor items, accessories, or devices reasonably inferable as necessary for the completion and proper operation of any systems or products identified on the Contract Documents.

#### 1.3 QUALITY ASSURANCE

- A. Discovery of any conflicting design information or any design intentions which are not readily interpreted shall be referred to the Architect/Engineer for further description or illustration prior to any product selection or execution of work.
- B. Discovery of any materials or equipment which are damaged, unsuitable, incompatible, or non-compliant with any applicable codes, laws, ordinances, or other regulations shall be brought to the direct attention of the Architect/Engineer.
- C. Generally, the Drawings establish the location, quantity and relationship of the parts of the work, and the specifications define the type and quality of materials and workmanship. Work shown in the drawings and not mentioned in the specifications, or required by the specifications and not shown on the drawings, shall be provided as if fully provided for in both. In the case of conflicts between the drawings and specifications, or within either document, the Architect/Engineer shall determine the intent. In such cases, in general, the more stringent requirement concerning greater quantity, quality, and/or resulting in a higher cost shall govern without further cost to the Owner.

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- D. The equipment list contained in this specification includes only the major equipment requirements. Verify the completeness and suitability of device to meet the intent of the specifications. Any additional equipment required, even if not specifically mentioned herein, shall be provided without claim for additional payment; it being understood that a complete operating system, satisfactory to the Engineer and the Owner, is required in all cases.

1.4 REGULATORY REQUIREMENTS

- A. Where governing codes indicate the Drawings and Specifications do not comply with the minimum requirements of applicable codes, the Contractor shall either notify the Architect/Engineer in writing during the bidding period identifying the revisions required to meet code requirements or provide an installation which will comply with the code requirements.
- B. All material, equipment, installation and testing should be in accordance with all applicable codes, laws, and ordinances of Federal, State and local governing bodies having jurisdiction.
- C. In case of differences between building codes, Federal and State laws, local ordinances and utility company regulations and the Contract Documents, the most stringent shall govern.
- D. Where any materials, equipment or installation is not in compliance with the more stringent of the applicable codes, laws, ordinances, regulations and contract documents, they shall be entirely removed, replaced, modified or otherwise corrected at no additional cost to the Owner.
- E. Materials, equipment, installation and testing shall conform to the latest editions of the applicable following codes:
  - 1. NEC National Electrical Code.
  - 2. State of Illinois Building Code.
  - 3. NFPA 72 National Fire Protection Association.
  - 4. IBC International Building Code.
  - 5. City of Rockford Amendments.
- F. All product materials and work shall comply with all local codes, including but not limited to the following codes and standards as applicable, in addition to any codes and standards referenced within individual specification sections. These codes and standards shall apply to all Division 26 Sections as applicable.
  - 1. ANSI American National Standards Institute.
  - 2. ASTM American Society for Testing Materials.
  - 3. CBM Certified Ballast Manufacturers.
  - 4. ETL Electrical Testing Laboratories.
  - 5. IEEE Institute of Electrical and Electronic Engineers.
  - 6. NBS National Bureau of Standards.
  - 7. NEMA National Electrical Manufacturer's Association.
  - 8. NFPA National Fire Protection Association.
  - 9. OSHA Occupation Safety and Health Act.
  - 10. UL Underwriters Laboratories.
  - 11. ADA Americans with Disabilities Act.
  - 12. NEC National Electrical Code.
  - 13. IBC International Building Code.
  - 14. IEC International Electrical Code.
  - 15. IFC International Fire Code.
- G. Where a UL standard is available, the equipment supplied for the project shall be UL listed and shall bear the UL label.

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- H. Notify the Architect/Engineer of any materials or apparatus believed to be inadequate, unsuitable, in violation of laws, ordinances, rules or regulations of authorities having jurisdiction.

1.5 APPROVALS

- A. Prepare shop drawings and obtain approvals from inspection authorities for emergency and exit lighting, fire alarm and life safety systems, and other electrical installations requiring specific approval..
- B. Prepare shop drawings and obtain approvals from governmental agencies and utility companies for applicable electrical installations requiring approval.
- C. Copies of the final approved drawings shall be delivered to the Architect/Engineer. Approvals shall be obtained before commencement of related work.

1.6 PERMIT AND INSPECTION

- A. Permit: Obtain and pay for all permits, bonds, license, tap-in fees, etc. required by the City, State, or other authority having jurisdiction over the work.
- B. Inspections: Arrange and pay for all inspections required by the above when they become due as part of the work of sections affected. Conceal no work until approved by these governing authorities.
- C. Engineer inspections include one above ceiling review and report before ceiling conceal work, one substantial review report and one final review report.

1.7 FEES

- A. Pay fees and other charges incidental to electrical work and obtain and pay for required insurance, permits, licenses, inspections and taxes. Arrange for required inspections and delivery certificates and approvals for same to the Architect/Engineer.

1.8 SUBMITTALS

- A. Shop Drawings: As soon as practical and before any material or equipment is purchased, the Contractor shall submit shop drawings. A complete list in one category (example: all fixtures) of all shop drawings catalog cuts, material lists, etc. are to be submitted by this Contractor at one time. No consideration will be given to partial shop drawings submitted from time to time.
  - 1. Extended time for submitting special shop drawings may be requested; however, any extension of time approved does not relieve this Contractor of his responsibility of executing his work in accordance with this contract.
  - 2. Any listed materials, fixtures, apparatus, or equipment that are not in accordance with specifications requirements can and will be rejected for use in this installation and construction. Substitutions will not be permitted.
  - 3. Any materials, fixtures, apparatus or equipment installed without stamped or written approval shall be removed by the Contractor and replaced with specified equipment at the direction of the Architect/Engineer and without recourse for additional compensation.
  - 4. Review of shop drawings does not relieve the Contractor from any responsibility for deviation from the Contract Documents unless the deviation is specifically identified on the shop drawings.
  - 5. Contractor shall review and coordinate all shop drawings prior to submitting them for Architects/ Engineer's review. Contractor shall stamp each shop drawing to certify that all

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MEP related contractors have coordinated and reviewed it. Engineer will not check any shop drawings that Contractor has not stamped with his review certification. Shop drawings will be reviewed once.

6. Prior to ordering any switchboard, distribution panels, panelboards, or transformers, the contractor shall submit dimension drawings showing the switchboard will fit in the location shown on the drawings. In the event of conflicts, the contractor shall request a written clarification from the Architect/Engineer.

B. Coordination and Installation Drawings:

1. In addition to the preparation and submittal of Shop Drawings and product data for manufactured electrical equipment and materials, prepare and maintain in current status, a complete set of detailed, completely circuited, and dimensioned electrical coordination and record drawings for electrical work included under the Contract.
2. Coordinate electrical work with the work of all other trades affecting the electrical work and in preparing the coordination drawings; coordinate the work of other trades in order to avoid possible installation conflicts, which includes but is not limited to mechanical equipment and architectural design elements. In the event of conflicts, interferences or discrepancies that are discovered during the coordination phase of the project, the contractor shall request a written clarification from the Architect/Engineer. If conflicts, interferences or discrepancies arise after the coordination phase of the project and no written clarification was requested, then the work shall be removed, replaced, modified or otherwise corrected at no additional cost to the owner.
3. Record drawings shall indicate the electrical installation exactly as constructed and shall be periodically revised to reflect all changes, including those required by the Architect/Engineer, those which are or have been found necessary in the field and those which may be suggested by the Contractor and accepted by the Architect/Engineer. Drawings shall be revised when considered necessary by the Architect/Engineer or the Contractor in order to facilitate proper coordination.
4. If, in the opinion of the Architect/Engineer, the drawings are in acceptable condition after each has been finally revised, they may be submitted as the field record drawings.
5. Electrical contractor shall verify total load prior to the installation of conduit and wiring of any mechanical or plumbing equipment. If any work is installed prior to verifying the load, the contractor shall remove, replace, modify or otherwise correct the work at no additional cost to the Owner. Make any changes to overcurrent devices or feeder size per the local authority having jurisdiction.
6. Coordination and installation drawings shall be made under the direction and supervision of the Contractor and shall show all electrical work including conduit, wiring, electrical equipment and devices, locations and elevations, points where conduit enters or leaves structural slabs and walls, junction boxes, conduit supports and inserts. The complete electrical distribution system from source or sources up to and including each branch circuit panelboard shall be shown and dimensioned with feeders located on plan. Major equipment and apparatus shall be shown to scale and properly located.
7. The Drawings shall include floor plan and reflected ceiling plan electrical layouts. Similar drawings of each trade shall be of the same scale in order to permit respective plans to be superimposed upon all others. Drawing shall be prepared and submitted for coordination and review.
8. Initial copy of all drawings shall be submitted for review. These submittals shall not be considered as shop drawings. Subsequent revised copies need not be issued to the Architect/Engineer unless so requested. It shall be clearly understood that these drawings are for installation coordination purposes only and cannot in any way alter the requirements of the Contract Documents. The Contract Documents, Specifications, and authorized revisions thereto, shall remain the only determinants of contract requirements.

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9. Upon completion of the drawings and any revisions they shall be dated and certified by Contractor as having been fully coordinated. The work shown upon the completed drawings shall then be considered ready for construction.
10. Electrical work shall not begin until the drawings are certified and reviewed by the Architect/Engineer.
11. Drawings shall be made in accordance with a schedule prepared by the Contractor and arranged to coincide with actual construction in a manner to allow the construction to proceed without delay.
12. If, in the opinion of the Architect/Engineer, the drawings are in acceptable condition after all revisions, they may be submitted as the project "As-Built" drawings.
13. Provide "as-built" drawings.

- C. Operation and Maintenance Data: Refer to Division 1 General Requirements and Division 26 Sections. Submit four copies of maintenance manuals in hardbound covers containing approved shop drawings and manufacturer's repair manuals, guarantees, operating instructions, wiring diagram and part lists.

1.9 OPERATION AND MAINTENANCE MANUAL

- A. Provide operation and maintenance instruction for equipment and systems
- B. Allow for 40 man-hours of instruction time for electrical distribution system, emergency system, fire alarm system, communication systems, etc.
- C. Operation and Maintenance Data: Refer to Division 1 General Requirements and Division 26 Sections. Submit four copies of maintenance manuals in hardbound covers containing approved shop drawings and manufacturer's repair manuals, guarantees, operating instructions, wiring diagram and part lists.

1.10 OVERTIME WORK

- A. All construction work shall be done on regular working hours and days, unless otherwise specified. If overtime work, other than specified, is required on the project, it shall be performed as indicated.
- B. System shutdown shall occur during off business hours and shall be done on over-time basis.
- C. The base bid shall include overtime work specified. No compensation shall be made for other work done on overtime basis, unless authorized.

1.11 ALTERNATES

- A. Accepted alternates, if any, may affect portions of the Base Bid Work.
- B. Acceptance of alternates shall include provisions necessary to alter, adjust or otherwise modify work affected by the alteration.
- C. Shop drawings shall include alternate work and shall reflect changes necessitated to other work.

1.12 GUARANTEE

- A. Electrical work shall be guaranteed for both materials and labor for a period of one year.

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- B. On-the-premises maintenance shall be provided at no cost to the purchaser for one year from the date of an operational and accepted installation unless damage is caused by misuse or abuse.
- C. Guarantee all wiring and equipment to be free from inherent and mechanical defects due to workmanship and materials used for the period of one full year from date of operational and accepted installation. Replacement of all or part of the equipment and/or correction of such defects, including labor, shall be rendered without cost to the Owner with the guarantee period.
- D. Manufacturer's equipment guarantees or warranties for periods of more than one year shall be included in the Operation and Maintenance Data

1.13 WARRANTY

- A. Warranty period shall be one year after final acceptance of the system. Repairs or replacements made under the warranty shall bear an additional 1-year warranty dated from final acceptance of the repair or replacement. The Owner shall receive the benefit of all warranties furnished by manufacturers.

1.14 PROJECT/SITE CONDITIONS

- A. Carefully examine the contract documents, visit the site, and thoroughly become familiar with the local conditions relating to the work prior to bidding. Failure to do so will not relieve the contractor of the obligations of the Contract.
- B. Install Work in locations shown on Drawings, unless prevented by Project conditions.
- C. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.

1.15 CONTRACTOR'S RESPONSIBILITY TO VERIFY EQUIPMENT DIMENSIONS

- A. The drawings, schedules and specifications have been prepared using one manufacturer for each piece of equipment as the basis for dimensional design. If the Contractor purchases equipment listed as a specified Acceptable Manufacturer but is not the scheduled manufacturer used for the base design, the Contractor shall be responsible for checking all the dimensions of the equipment to verify that it will fit in the space shown on the Drawings. Minor deviations in dimensions will be permitted, provided the ratings meet what was shown on the drawings and equipment will physically fit into the space allocated with suitable access around equipment for operation and maintenance on the equipment.
- B. Contractor and/or manufacturer shall verify that the capacity and duty specified meets the characteristics of the equipment he submits for review.
- C. If equipment is submitted for review and does not meet the physical size or arrangement of what was scheduled and specified, Contractor shall pay for all alternations required to accommodate such equipment at no additional cost to the Owner. Contractor shall also pay all costs for additional work required by other Contractors, Owner, Architect or Engineer to make changes which would allow the equipment to fit in the space.

PART 2 - PRODUCTS

## 2.1 MATERIALS AND EQUIPMENT

- A. Proposal shall be based upon the furnishing of all materials and equipment as specified, which in every case shall be new and, where not specifically referred to by manufacturer's name, of the best grade and quality available.
- B. Equipment and material shall be without blemish or defect and shall not be used for temporary light or power purposes, including lamps, without the Architect/ Engineer's written authorization.
- C. Items of equipment of one generic type (such as fuses), except conduit, conduit fittings, outlet boxes, wiring and cable, shall be the product of one manufacturer throughout, unless otherwise indicated or accepted by the Architect/Engineer.
- D. Where two or more makes or kinds of materials or equipment are specified, indicate which of these choices will be used. This information shall be included with the list of manufacturers for equipment and materials to be submitted to the Architect/Engineer.
- E. Manufacturers of equipment shall be firms regularly engaged in manufacturing factory-fabricated systems and equipment whose products have been in satisfactory use in similar service for not less than 5 years.

## 2.2 MANUFACTURERS NAMEPLATES

- A. Each major electrical component such as panelboards, circuit breakers, disconnect switches, etc. shall have the manufacturer's name, address, catalog number, model number, rating, and any other required specified markings on a plate or label located inside the cover or otherwise inconspicuously but readily accessible.

## PART 3 - EXECUTION

### 3.1 DELIVERY AND STORAGE

- A. Receive, handle, and store electrical items and materials at the project site. Materials and electrical items shall be so placed that they are protected from damage and deterioration.
- B. Existing equipment which is to be reused shall be cleaned and protected against damage. Equipment which is removed and stored for reuse shall be stacked, boxed or crated in such a manner as to prevent damage. The cost to repair/replace this equipment due to damage incurred during its removal, storage or reinstallation shall be borne by the Contractor.
- C. The Contractor shall bear full responsibility for equipment judged unacceptable due to his failure to comply with these specifications.

### 3.2 INSTALLATION

- A. The Drawings for work under Division 26 are diagrammatic and are intended to convey the scope of work and indicate the general arrangement of conduit, boxes, equipment, fixtures and other work included in the Contract.
- B. Location of items required by the Drawings or specifications not definitely fixed by dimensions are approximate only and exact locations necessary to secure the best conditions and results shall be determined at the site and shall be subject to the approval of the Architect/Engineer.

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- C. Follow Drawings in laying out work, check drawings of other trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points.
  - 1. Where headroom or space conditions appear inadequate, the Architect/Engineer shall be notified before proceeding with installation.
  - 2. Minor conduit rerouting and changes shall be made at no additional cost to the Owner.
- D. Perform all work with skilled mechanics of the particular trade involved in a neat and workmanlike manner.
- E. Perform all work in cooperation with other trades and schedule.
- F. Perform all work in accordance with the manufacturer's recommendations.
- G. Furnish other trades advance information on locations and sizes of frames, boxes, sleeves and openings needed for the work, and also furnish information and shop drawings necessary to permit trades affected to install their work properly and without delay.
- H. Where there is evidence that work of one trade will interfere with the work of other trades, all trades shall assist in working out space allocations to make satisfactory adjustments and shall be prepared to submit and revise coordinated shop drawings.
- I. With the approval of the Architect/Engineer and without additional cost to the Owner, make minor modifications in the work as required by structural interferences, by interferences with work of other trades or for proper execution of the work.
- J. Work installed before coordinating with other trades so as to cause interference with the work of such other trades shall be changed to correct such condition without additional cost to the Owner and as directed by the Architect/Engineer.
- K. Architect/Engineer reserves the right to change location of electrical equipment or device within 10'-0" radius before work is installed without extra charge.
- L. Electrical Contractor shall cooperate with other trades and coordinate work so that conflicts with other work are eliminated.
- M. Equipment shall be installed with adequate space allowed for removal, repair or changes to equipment. Ready accessibility to removable parts of equipment and to wiring shall be provided without moving other equipment which is to be installed or which is in place. Electrical Contractor shall verify measurements. Discrepancies shall be brought to the Architect/Engineer's attention for interpretation.
- N. Determine temporary openings in the buildings that will be required for the admission of apparatus furnished under this Division, and notify the Architect/Engineer accordingly. In the event of failure to give sufficient notice in time to arrange for these openings during construction, assume all costs of providing such openings thereafter.
- O. Location of electrical outlets, fixture, panels, cabinets, equipment, etc. is approximate and exact locations shall be determined at the project.
- P. Electrical Contractor shall refer to contract documents for details, reflected ceiling plans, and large scale drawings.

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- Q. Apparatus, lighting fixtures, material or work not shown on the drawings, but mentioned in the project specifications, or vice versa or any included accessories such as wiring, relays, switches, transformers (line voltage or low voltage), etc., necessary to make the work complete and ready for operating, even though not specified or shown on the electrical drawings shall be furnished and installed without additional expenses to the Owner. It is the Contractor's responsibility prior to bids to review all project documents.
- R. Verify final locations for rough-ins with field measurements of the actual equipment to be connected. Refer to equipment specifications in Division 2 through 26 for rough-in requirements.
- S. Equipment specified under other divisions and requiring electrical supply shall be erected, aligned, leveled and prepared for operation. Provide required controls and accessories along with installation instructions, diagrams, dimensions and supervision of installation and start-up. Provide the required electrical rough-ins and connections and confirm the electrical controls and accessories furnished under the specifications for the other divisions. Install those controls and accessories not located in the mechanical piping and ductwork. Provide additional electrical controls, accessories, fittings and devices not specified under the equipment but required for a finished, operating job. Make all final electrical connections. Participate in the start-up and test procedure.
- T. Electrical Contractor shall weatherproof all openings and penetrations through foundations and exterior walls created by fixtures and conduits to prevent moisture from entering through.
- U. Contractor shall furnish other trades advance information and/or shop drawings on locations and sizes of conduits, raceways, equipment, frames, boxes, sleeves and openings, etc. needed for their work to install their work properly and without delay.
- V. Contractor shall provide sleeves in beams, floors, columns and walls as shown on the drawings, as required by job site conditions, and/or as specified, when installing their work. All beams and columns which are required to be sleeved shall be cut and reinforced as required by field conditions and locations and sizes shall be checked and approved by Architect before contractor cuts any structural building member.
- W. Contractor shall refer to the architectural and structural contract drawings (before submitting their bids) to familiarize themselves with the extent of the general contractors work, ceiling heights and clearance for installing their work.
- X. Contractor shall install all auxiliary supporting steel as required for the supporting of their conduit, fixtures, devices, equipment, etc. All supporting steel for items above a suspended ceiling shall be from new building structure members only. All supports in the existing building shall be from walls. No connection to wood, roof deck or structure is allowed.
- Y. The locations shown for all lighting fixtures and ceiling mounted electrical equipment are diagrammatic. Exact location shall be determined from the reflected ceiling plans and/or on the job site by the construction manager. It shall be the contractor's responsibility to maintain code required spacing for items such as fire alarm devices.
- Z. Contractor shall be required to maintain the fire rated integrity of floors and/or wall partitions. All penetrations through fire rated building elements shall be effectively sealed using approved materials and methods.
- AA. Unless indicated otherwise, the Architect/Engineer makes no representation as to whether or not any hazardous or contaminated materials (including but not limited to asbestos, PCB's, contaminated soils, etc.) are present within the existing building or on the site. Work shown on

the drawings and/or indicated in the specifications shall not be construed to call for contact with any of these materials. If these materials are encountered or suspected, the contractor shall not disturb them and shall contact the architect/engineer immediately.

- BB. Contractor shall store all materials and equipment shipped to the site on a protected area. If material is stored outside the building, it must be stored off the ground a minimum of six inches (6") set on 6 x 6 planks and/or wood pallets. All material and equipment must be completely covered with waterproof tarps or visquin. All conduit will have the ends closed to keep out dirt and other debris. No equipment will be allowed to be stored on the site unless it is sitting on wood planks and completely protected with weatherproof covers.
- CC. This contractor shall be responsible for furnishing all labor and material required to patch all openings in existing floors, walls, ceilings and fire separations created by the removal of this trades material and equipment where these openings are not to be reused.

### 3.3 PROTECTION

- A. Protect conduit and wireway openings against the entrance of foreign matter by means of plugs or caps. Cover fixtures, materials, equipment and devices or otherwise protect against damage from any cause, both before and after installation. Fixtures, materials, equipment, or device damaged prior to final acceptance of the work shall be restored to their original condition or replaced, all at no additional cost to Owner.
- B. Equipment shall be inherently safe and moving parts shall be covered with guards.

### 3.4 COOPERATION

- A. Where jurisdictional rules require the assistance of electrical mechanics in the moving and setting of electrically power equipment, provide such assistance.
- B. Where work covered by this section connects to equipment furnished under other sections, verify electrical work involved in the field and make proper connection to such equipment.

### 3.5 CUTTING AND PATCHING

- A. Do drilling, cutting, fitting and patching necessary for the installation of conduits, wireways, and other electrical equipment, and provide supports necessary for same and for bracing and anchorage of work. No cutting of structural work or of fireproofing shall be done without the written consent of the Architect/Engineer.
- B. Conduits passing through roofs or other surfaces exposed to weather shall be properly flashed as specified in roofing and waterproofing sections. This flashing work shall be paid for as part of the electrical work.

### 3.6 WALL CHASES

- A. Provide templates or details of wall chases, where conduits, pull boxes, cabinets, and other items of equipment are to be concealed or recessed, before the work of other trades is performed in the respective areas. Show exact locations and sizes of such equipment.

### 3.7 SLEEVES AND OPENINGS

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- A. Provide sleeves and openings for exposed wires, cables, and wireways where they pass through walls and floors.
- B. Sleeves for individual cables shall be hot-dip galvanized inside and outside. Sleeve shall be equal in gauge to heavy wall steel conduit and extended 3 inches above finished surface or wall.
- C. Furnish complete dimensioned drawings of openings required through walls and floors, for conduits, or busways, or wireways, before the work of other sections is performed in the respective areas.
- D. Installation of 3 inch high concrete curbs around openings through concrete slabs in electrical closets and other openings shall be provided under Section 03 30 00.
- E. Pack or fill sleeves and openings after the completed work is in place. Filling shall comply with U.L., match rating of original construction and shall provide a waterproof and fireproof packing to prevent leakage of liquid, smoke, or fire through the sleeve or opening.

3.8 EQUIPMENT NOISE LIMITATION

- A. Noise levels of electrical devices and equipment shall be within acceptable limits as established by NEMA or other valid noise rating agencies. Noise levels shall be subject to the Architect/Engineer's acceptance, based on practical and reasonable consideration of occupancy requirements.
- B. Check and tighten the fastenings of sheet metal plates, covers, doors, and trims to prevent vibration isolation and chatter under normal conditions of use.
- C. When located elsewhere than in high-noise-level equipment rooms, the enclosures of solenoid-operated switching devices and other noise-producing device shall have anti-vibration mountings and non-combustible sound-absorbing linings.
- D. Reactors, dimmers, lamp ballasts, and solenoids shall be designed and rated for "quiet" operation.
- E. Remove and replace any individual electrical item or device that is found to produce a sound energy output exceeding that of other identical devices installed at the project.

3.9 TEMPORARY UTILITIES AND HEAT

- A. Contractor's attention is directed to Division 1, which sets forth respective responsibilities of all concerned with furnishings temporary water, electricity and heat for use during construction of all Project.

3.10 EXECUTION, CORRELATION AND INTENT OF DOCUMENTS

- A. In the event that conflicts, if any, cannot be settled promptly and amicably between the affected trades, with work proceeding in a workmanlike manner, then the Architect/Engineer shall decide which work is to be relocated and his judgment shall be final and binding on this Contractor.

3.11 ADJUSTMENTS

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- A. The primary adjustments of the system(s) shall be accomplished by the Contractor to the complete satisfaction of the Owner and Architect/Engineer at the time of completion of the installation.

3.12 TESTING

- A. General: Furnish meters, instruments, cable connections, equipment or apparatus necessary for making all tests.
- B. Insulation Tests:
  - 1. After being pulled in place and before being connected, test all service and feeder cables with 1000 volt, 60 Hz insulation tester for one minute to determine that conductor insulation resistance to ground is not less than that recommended by the manufacturer. Test all branch circuit conductors for lighting, receptacle and miscellaneous loads prior to connection of loads. Tests shall not register less than one megohm to ground during an insulation test as described above for service and feeder cables. Remove, replace and retest all cable failing insulation test.
  - 2. Measure insulation resistance of electrical wiring with a self-contained instrument such as direct-indicating ohmmeter of the generator battery or electronic type.
  - 3. When using any type of d-c voltage source, it is essential that the output voltage is steady to prevent fluctuations in charging current. Where protective resistors are used in test instruments, take into account their effect on the magnitude of the voltage applied to the insulation under test. Properly maintain the instrument used in insulation resistant testing. Make periodic checks to insure that rated voltage is delivered and that the instrument is in calibration.
  - 4. Unless otherwise specified, the insulation resistance shall be approximately one megohm for each 1000 volts of operating voltage with a minimum value of one megohm.
- C. Test all motors under load, with ammeter readings taken in each phase and the RPM of motors recorded at the time. Test all motors for correct direction of rotation.
- D. Documentation: Keep records of all tests, in tabulated, permanent, reproducible form, completely indexed and explained, indicating the specific test performed, environmental conditions such as temperature and humidity, date of performance, results obtained, corrective actions taken (if any), final results, and comments, if required. Copies of all tests shall be delivered to the Architect/Engineer prior to this final project review.

3.13 MOUNTING HEIGHTS

- 1. General Receptacles - 18" to C.L.
- 2. General Tele and Data Outlets - 18" to C.L.
- 3. General Toggle Switches - 44" to C.L.
- 4. Exit Signs - 90" to C.L.
- 5. Individual Disconnects and Starters - 60" to C.L.
- 6. Grouped Disconnects and Starters  $\geq 12"$  to C.L.  $\leq 72"$  to C.L.
- 7. Panelboard Overcurrent Devices  $\geq 12"$  to C.L.  $\leq 72"$  to C.L.

END OF SECTION 26 05 00

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Alcan Products Corporation; Alcan Cable Division.
  - 2. American Insulated Wire Corp.; a Leviton Company.
  - 3. General Cable Corporation.
  - 4. Senator Wire & Cable Company.
  - 5. Southwire Company.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Hubbell Power Systems, Inc.
  - 3. O-Z/Gedney; EGS Electrical Group LLC.
  - 4. 3M; Electrical Products Division.
  - 5. Tyco Electronics Corp.

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- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## 2.3 ADDITIONAL ACCESSORIES

- A. In the event that conduit and wire sizes increase beyond the motor or equipment manufacturer's normal provisions for conduit and wire terminations, due to voltage-drop or other considerations in motor branch-circuit designs, provide necessary auxiliary termination facilities with adequate boxes, lugs, terminals, and other components as may be required. Consult with the suppliers of motors and other items to insure that the equipment is furnished with suitable components to accept the required conduits and wires.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Branch Circuit and Feeder: Type THHN-THWN, single conductors in raceway.
- B. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- C. Class 2 Control Circuits: Power-limited cable, concealed in building finishes.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- C. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- D. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

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- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

### 3.5 INSTALLATION

- A. Completely and thoroughly swab raceway before installing wire.
- B. Install cable in accordance with the NECA "Standard of Installation."
- C. Pull all conductors into raceway at same time.
- D. Feeders shall be installed as continuous conductors without splices whenever possible. Where feeder splices are required, the contractor shall submit a request for approval in writing to the engineer indicating the feeder and splice location. Where splices are installed without written approval, the engineer reserves the right to have the contractor replace the spliced conductors with continuous conductors at no additional cost to the Owner.
- E. Support signal cables above accessible ceiling, using cable ties to support cables from structure. Do not rest cable on ceiling grid.
- F. Use suitable cable fittings, connectors, and supports.
  - 1. Cable supports shall be as required by Code and shall be compatible with the wire and cable type and the associated conduit size.
    - a. Manufacturer: OZ/Gedney or Thomas & Betts.
- G. Increase conductor size as required due to availability. Minimum feeder conductor sizes are shown on Drawings. If increased, be responsible for associated feeder conduit size and increased ground conductor size per NEC.
- H. Provide conductors of the same size from the protective device to the last load.
- I. Make conductor length identical for parallel feeders.
- J. Provide slack wire for all future connections with ends of wires taped and blank box covers installed.
- K. Do not bend cables, either permanently or temporarily during installation, to radii less than that recommended by the manufacturer.
- L. Use conductors with 90°C insulation when wiring is within seven feet of, passing over or attached to the following:
  - 1. Boilers.
  - 2. Hot water heaters.
  - 3. Other heat producing equipment.
- M. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- N. Splices, Taps and Terminations:
  - 1. Make splices and taps in wiring #10 AWG and smaller mechanically and electrically secure with mechanical pressure type splicing devices.
  - 2. Make splices and taps of conductors #8 AWG or larger and all splices in motor terminal boxes using compression connectors requiring the use of compression tools for securing the conductors in the connectors. Termination of conductors at all distribution equipment, except transformers, shall be made using mechanical lugs. Connectors shall be of high

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- conductivity, corrosion-resistant material and have actual contact area that shall provide at least the current carrying capacity of the wire or cable. For conductors #1/0 and larger, connector lugs shall be of the two-hole type. Connector lugs shall be bolted to bussing using Belleville washers in combination with flat washers and nuts.
3. Each conductor lug or bus shall be individually made with separate lug and/or bolt as required for the termination.
  4. Provide insulated connectors for splices and taps with a self-fusing rubber insulating tape that is non-corrosive to the connector and the conductor. Insulation tape shall have a minimum of 350 volts per mil dielectric strength. Friction or vinyl tape shall be applied directly over rubber insulating tape equal to 3M Scotch 88 type.
- O. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connector and terminals to comply with tightening torques specified in UL Standards 486A and B.
- P. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated. Wire color coding shall be as follows or as required by local codes:
- Normal Power
  - 120/208 Volts:
  - Phase A – Black
  - Phase B – Red
  - Phase C – Blue
  - Neutral – White
  - Ground – Green
  - 277/480 Volts:
  - Phase A – Yellow
  - Phase B – Brown
  - Phase C – Orange
  - Neutral – Gray
  - Ground – Green

### 3.6 MAXIMUM BRANCH CIRCUIT LENGTHS

- A. The following indicates maximum installed length a circuit can have and still maintain an adequate voltage level at the last point of use for 20 amp circuit. If the 20 amp circuit length exceeds the length listed, use the next larger wire sized. Multiple circuit runs in the same raceway shall have all conductors sizes the same based on worst case circuit lengths.

#### BRANCH CIRCUIT LENGTH (IN FEET)

Wire Size	2 Wire 120 V	1 Phase 208 V	3 Phase 208 V	2 Wire 277 V	1 Phase 480 V	3 Phase 480 V
12	0 to 61'	0 to 105'	0 to 122'	0 to 141'	0 to 244'	0 to 282'
10	62' to 97'	106' to 168'	123' to 194'	142' to 224'	245' to 388'	283' to 449'
8	98' to 154'	169' to 267'	195' to 309'	225' to 357'	389' to 618'	450' to 714'
6	155' to 246'	268' to 426'	310' to 491'	358' to 567'	619' to 983'	715' to 1135'

### 3.7 PENETRATIONS

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

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- B. Apply joint sealants to cable penetrations of non-fire rated floor and wall penetrations using sealants specified in Section 07 92 00 – Joint Sealants.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Perform tests and inspections and prepare test reports.
- C. Testing: Upon installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
  - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification, Section 7.3.1. Certify compliance with test parameters.
- D. Correct malfunctioning products at site, where possible, and retest to demonstrate compliance; otherwise remove and replace with new units, and retest.
- E. Inspection: Inspect wire and cable for physical damage and proper connection.
- F. Insulation Resistance Test: Prior to energization of circuitry, check installed wires and cables with megohm meter to ensure insulation resistance requirements are fulfilled.
- G. Continuity Test: Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections. Correct if necessary.
- H. Branch Circuits with Receptacles: Branch circuit receptacle wiring shall be tested using a Daniel Woodhead Co. circuit tester Model #1750.
- I. Test Reports: Prepare a written report to record the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- J. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19

## SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

#### 1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70 and all local codes

#### 1.4 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

### PART 2 - PRODUCTS

#### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Tyco International, Ltd.
    - g. Wesanco, Inc.
  - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  - 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  - 5. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

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- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types 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. Materials and Finishes: Provide adequate corrosion resistance.
- G. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products. Design of supports and methods of fastening to building structures shall be acceptable to the Architect/Engineer.
- H. Anchors and Fasteners: For point of attachment weight of 100 pounds or less.
  - 1. Concrete Structural Elements: Use precast insert system, expansion anchors, and preset inserts.
  - 2. Steel Structural Elements: Use beam clamps.
  - 3. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
  - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.
  - 5. Solid Masonry Walls: Use expansion anchors and preset inserts.
  - 6. Sheet Metal: Use sheet metal screws.
  - 7. Wood Elements: Use wood screws.
- I. Anchors and Fasteners: For point of attachment weight of 100 pounds or more, obtain direction and approval from Architect/Engineer.
- J. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Hilti Inc.
      - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 3) MKT Fastening, LLC.
      - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
  - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti Inc.
      - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 5) MKT Fastening, LLC.
  - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

## 2.2 VIBRATION ISOLATION

- A. Suspended vibration producing equipment shall have spring elements in the hanger rods or isolation pads under the equipment.

## 2.3 EQUIPMENT BASES

- A. Provide 4" high concrete pads for floor mounted electrical equipment. The edge of the concrete pads shall have 1/4" chamfer. The pad dimensions shall be at least one inch greater on each side than the floor dimensions of the electrical equipment.
- B. Concrete pads shall include steel reinforcing and necessary bolts, anchors, etc. Where concrete pad is set directly on concrete floor, dowels in floor to tie base to floor shall be provided.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70 and local codes. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to these supports with single-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.
- C. 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.

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- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  - 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
  - 7. To Light Steel: Sheet metal screws.
  - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
- F. Install products in accordance with manufacturer's instructions.
- G. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
- H. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- I. Do not use ceiling system components for support.
- J. Connections to vibration producing equipment shall be made with flexible conduit.
- K. Obtain permission from Architect/Engineer before using spring steel clamps.
- L. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- M. Obtain permission from Architect/Engineer before drilling or cutting structural members.
- N. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- O. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch off wall.
- P. Support surface or pendant lighting fixtures:
  - 1. From an outlet box by means of an interposed metal strap, where weight is less than 5 pounds.
  - 2. From an outlet box by means of a hickey or other direct threaded connection, where weight is from 5 to 50 pounds.
  - 3. Directly from structural slab, deck, or framing member, where weight exceeds 50 pounds.
- Q. Support Recessed Lighting Fixtures:
  - 1. From ceiling suspension members, where weight is less than 60 pounds.

2. Directly from structural slab, deck, or framing member, where weight is 60 pounds or more.

R. Provide weight-distributing facilities, where required, so as not to exceed the load-bearing capabilities of floors or walls that bear the weight of, or support, electrical items.

### 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.

### 3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

### 3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. FMC: Flexible metal conduit.
- E. IMC: Intermediate metal conduit.
- F. LFMC: Liquidtight flexible metal conduit.
- G. LFNC: Liquidtight flexible nonmetallic conduit.
- H. RNC: Rigid nonmetallic conduit.

1.3 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Custom enclosures and cabinets.
- C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Structural members in the paths of conduit groups with common supports.
  - 2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.
- D. Qualification Data: For professional engineer and testing agency.
- E. Source quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70 and all other local codes.

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PART 2 - PRODUCTS

2.1 CONDUIT SCHEDULE

Conduit Location	From 0V up thru 50V	Above 50V up thru 250V	Above 250V up thru 600V
Above an Accessible Ceiling	≤ 2 1/2" EMT ≥ 3" IMC	≤ 2 1/2" EMT ≥ 3" IMC	≤ 2 1/2" EMT ≥ 3" IMC
Concealed in Walls	≤ 2 1/2" EMT ≥ 3" IMC	≤ 2 1/2" EMT ≥ 3" IMC	≤ 2 1/2" EMT ≥ 3" IMC
Exposed Interior	≤ 2 1/2" EMT ≥ 3" IMC	≤ 2 1/2" EMT ≥ 3" IMC	≤ 2 1/2" EMT ≥ 3" IMC
Concealed in Slab	≤ 1" EMT ≥ 1 1/4" IMC	≤ 1" EMT ≥ 1 1/4" IMC	≤ 1" EMT ≥ 1 1/4" IMC
Below Slab	IMC/PVC	IMC/PVC	IMC/PVC
Exposed Exterior	HWG	HWG	HWG
Below Grade	HWG/PVC	HWG/PVC	HWG/PVC

\* All voltages are line-to-line or line-to-neutral.

\*\* Conduit in slab is not allowed for slabs which are not on grade.

2.2 CONDUIT REQUIREMENTS

- A. Minimum Size: 3/4 inch except conduits to switches and receptacles having 5 or less #12 conductors shall be 1/2" C unless noted otherwise.
- B. Flexible conduit connections to recessed lighting fixtures shall be made with UL approved flexible steel conduit, except where UL listed liquid tight flexible conduit is required by code, such as in air plenums, etc.
- C. Final connections to motors shall be made through UL listed liquid tight flexible steel conduits, 1/2 inch minimum size unless otherwise indicated.
- D. Flexible connections, where required, shall be made with flexible metallic tubing 1/2 inch minimum size or sized in accordance with code, except in areas where such connections will be exposed to oil, grease, water, or where installed out of doors. In those areas of adverse exposure, flexible connections shall be made with UL listed liquid tight flexible steel conduit. Grounding conductors with green colored insulation shall be extended through all flexible connections including fixture "whips", and fastened to terminals within the first junction boxes on either side of the flexible length.

2.3 METAL CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.

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2. Alflec Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. EMT: ANSI C80.3.

E. FMC: Zinc-coated steel.

F. LFMC: Flexible steel conduit with PVC jacket.

G. 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.

1. Fittings for EMT: Steel, compression type.

#### 2.4 EXPANSION FITTINGS

A. Provide a suitable expansion fitting in each building expansion joint. Fittings shall be complete with bonding jumper and clamps.

B. Manufacturers: OZ/Gedney, Crouse-Hinds and Appleton.

#### 2.5 BUSHINGS

A. Bushings for conduits 1 inch and smaller shall be self-extinguishing thermoplastic grounding type – 150 degrees C. and insulating type.

B. Bushings for conduits 1 ¼ inch and larger shall be malleable iron body with 150 degree C. insulating ring and shall be grounding type. Insulating material shall be locked in place and non-removable.

#### 2.6 METAL WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Eaton
3. GE
4. Hoffman.
5. Siemens
6. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

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- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type.
- E. Finish: Manufacturer's standard enamel finish.

2.7 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Mono-Systems
    - b. Thomas & Betts Corporation.
    - c. Walker Systems, Inc.; Wiremold Company (The).
    - d. Wiremold Company (The); Electrical Sales Division.

2.8 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
  - 2. EGS/Appleton Electric.
  - 3. Erickson Electrical Equipment Company.
  - 4. Hoffman.
  - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
  - 6. O-Z/Gedney; a unit of General Signal.
  - 7. RACO; a Hubbell Company.
  - 8. Robroy Industries, Inc.; Enclosure Division.
  - 9. Thomas & Betts Corporation.
  - 10. Walker Systems, Inc.; Wiremold Company (The).
  - 11. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
  - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
  - 2. Concrete Ceiling Boxes: Concrete type.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover and threaded hubs.
- D. Metal Floor Boxes: NEMA OS 1 Cast metal, fully adjustable, rectangular, 1-1/2 inch deep.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- G. Outlet boxes shall be minimum of 2 gang and shall be sized to accommodate number of wires inside the box.
- H. Outlet boxes for telephone and data outlets shall be minimum of 2 gang and shall be 2.75" deep.

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- I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- J. Cabinets:
  - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.
  - 6. Exterior cabinets and cabinets exposed to water shall be provided with stainless steel screws.

PART 3 - EXECUTION

3.1 INSTALLATION - CONDUIT

- A. Arrange conduit to maintain headroom and present neat appearance.
- B. Route conduit parallel and perpendicular to walls.
- C. Do not cross conduits in slab.
- D. Maintain adequate clearance, minimum of 12 inches, between conduit and piping.
- E. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
- F. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- G. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate bends in metal conduit larger than 2 inch (50 mm) size, or provide factory elbows.
- H. Provide suitable pull string in each empty conduit except sleeves and nipples.
- I. Ground and bond conduit under provisions of Section 26 05 26.
- J. Identify conduit under provisions of Section 26 05 53.
- K. In general, conduits shall be run concealed. Where exposed conduit runs are shown or required, they shall be run parallel to building construction and shall be suitably supported at required intervals.
- L. In equipment spaces, such as fan rooms, plenums, etc., conduits and outlets may be exposed, but shall avoid interference with ventilating ducts, piping, etc.
- M. Exposed conduit installed on or adjacent to ventilating ducts shall be installed after the ducts are in place, and shall be run from ceiling or wall junction boxes in such manner as to retain accessibility to junction box covers and to permit future removal or replacement of ducts.

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- N. 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.
- O. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- P. 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.
- Q. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- R. 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.
- S. 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 to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where otherwise required by NFPA 70.
- T. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  - 1. Use LFMC in damp or wet locations subject to severe physical damage.
  - 2. Use LFMC in damp or wet locations not subject to severe physical damage.
- U. 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.
- V. Set metal floor boxes level and flush with finished floor surface.

### 3.2 INSTALLATION FITTINGS

- A. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- B. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- C. Provide conduit seals for conduits and ducts entering/exiting hazardous locations.
- D. Provide suitable fittings to accommodate expansion and deflection where conduit crosses expansion joints and in each uninterrupted run of horizontal or vertical conduit in excess of 100 feet. Fittings shall be complete with bonding jumpers and clamps.
- E. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- F. Ends of conduits shall be equipped with insulating bushings for 1 inch and smaller and insulated metallic bushings for 1-1/4 inches and larger. Ends of conduit shall be temporarily capped prior to installation and during construction to exclude foreign material.

- G. Provide wall flanges and gasketing on conduits entering fan housings to minimize air leakage at points of penetration of housing.

### 3.3 INSTALLATION – SUPPORTS

- A. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- B. Fasten conduit supports to building structure and surfaces under provisions of Section 26 05 29.
- C. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
- D. Do not attach conduit to ceiling support wires.
- E. Bring conduit to shoulder of fittings; fasten securely.
- F. Conduit risers shall be rigidly supported on the building structure, using appropriate supports only.
- G. Conduits and other electrical items shall not be fastened to or supported from ventilating ducts, but shall be separately supported. The method of supporting and details of the supporting members shall be reviewed by the Architect/Engineer. In no case shall screws penetrate the sheet metal of the ducts.
- H. Exposed conduits run on surfaces shall be supported according to code and within 3 feet of each outlet, junction box, or cabinet, by galvanized malleable conduit clamps and clamp backs. Suspended conduits shall be supported every 5 feet by conduit hangers and round rods, or where 2 or more conduits are run parallel, by trapeze hangers suitably braced to prevent swaying.
- I. Screws for exposed work shall be stainless steel.
- J. Cadmium plated steel screws may be used for interior unexposed dry locations only.

### 3.4 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 7.
- B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified in Division 7.

### 3.5 INSTALLATION OF BOXES

- A. Box sizes shall not be smaller than that required by Code for the number and size of wires and/or conduits to be installed.
- B. Maintain headroom and present neat mechanical appearance.
- C. Plenum Ceiling Areas: Install boxes in accordance with applicable Code.
- D. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07 Section "Penetration Firestopping".

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- E. Outlet boxes for toggle switches shall be located on the strike side of the door.
- F. Use flush mounting outlet box in finished areas.
- G. Support boxes independently of conduit.
- H. Use cast outlet box in exterior locations and wet locations.
- I. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.
- J. Adjust floor box flush with finish flooring material.
- K. Adjust flush-mounting outlets to make front flush with finished wall material.

3.6 RACEWAY PENETRATIONS

- 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 Section "Penetration Firestopping."
- B. Apply joint sealants to electrical penetrations of non-fire rated floor and wall penetrations using sealants specified in Section 07 92 00 "Joint Sealants".

3.7 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 OF SECTION 26 05 33

## SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

#### 1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70 and all local codes.
- C. Comply with 29 CFR 1910.145.

#### 1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

### PART 2 - PRODUCTS

#### 2.1 CONDUCTOR IDENTIFICATION MATERIALS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

#### 2.2 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Warning label and sign shall include, but are not limited to, the following legends:
  - 1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

## 2.3 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- B. Size: 1 1/4 inch by 3 inch minimum.
- C. Location: Each electrical distribution and control equipment enclosure: panelboards, transformers, motor starters, disconnect switches, circuit breakers, contactors, relay panels, control panels, Cable TV, and associated apparatus. Communications control cabinets.

## 2.4 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength: 50 lb, minimum.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.
  - 1. Interior Zinc-Coated Metal (except Raceways):
    - a. Semi gloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
      - 1) Primer: Interior zinc-coated metal primer.
      - 2) Finish Coats: Interior semi gloss acrylic enamel.
- C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## 2.5 PANELBOARD DIRECTORIES

- A. Description: Type written directory of branch circuit loads.
- B. Location: At branch circuit panelboards.
- C. Legend: circuit number - load location and description.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Power-Circuit Conductor Identification: For conductors No. 1/0 AWG and larger 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.
- B. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use write-on tags. Identify each ungrounded conductor according to source and circuit number.
- C. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. 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.
- D. 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: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
  2. Equipment to Be Labeled:
    - a. Panelboards, electrical cabinets, and enclosures.
    - b. Disconnect switches.
    - c. Enclosed circuit breakers.
    - d. Motor starters.
    - e. Push-button stations.
    - f. Contactors.
    - g. Remote-controlled switches, dimmer modules, and control devices.

### 3.2 INSTALLATION

- A. Secure nameplate to equipment front using screws or rivets.
- B. Verify identity of each item before installing identification products.
- C. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- D. Apply identification devices to surfaces that require finish after completing finish work.
- E. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- 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. 1/0 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.
  3. Colors for 480/277-V Circuits:

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- a. Phase A: Brown.
  - b. Phase B: Orange.
  - c. Phase C: Yellow.
- 4. 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. Locate bands to avoid obscuring factory cable markings.
- G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- H. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION 26 05 53

SECTION 26 08 00 –ELECTRICAL DEMOLITION FOR REMODELING

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 SECTION INCLUDES

- A. Electrical demolition: The work specified in this section includes providing labor, material, equipment, and services necessary for electrical demolition as shown on the drawings and as herein specified to accommodate new construction. The project includes demolition, relocation and replacement of existing electrical equipment, devices, feeders, branch wiring, signal cables, etc. with new work. Contractor shall remove, reinstall or relocate that portion of the existing equipment, system, wiring, fixtures and drawings which are a part of or which applies to the electrical trade.
- B. Selective demolition including:
  - 1. Non-destructive removal of materials and equipment for reuse or salvage as indicated.
  - 2. Dismantling electrical materials and equipment made obsolete by these installations.

1.3 REQUIREMENTS

- A. Contractor shall provide caution and warning signs at all hazardous areas and at all door entries to construction rooms and areas during the entire construction period per IEPA law and regulations.

1.4 SEQUENCING

- A. Sequence the Work in the following order:
  - 1. Complete new or temporary system as specified.
  - 2. Cut-over to new or temporary system.
    - a. Schedule with Owner at least one week in advance.
  - 3. Remove items as shown on drawings.

1.5 SCHEDULING

- A. Schedule work to coincide with other trades and project schedule.
- B. Cease operations immediately when structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

1.6 COORDINATION

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Coordinate demolition work with the construction manager and other related trades.
- C. Coordinate and sequence demolition so as not to cause shutdown of operation of surrounding areas.

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- D. Shut-down periods:
  - 1. Arrange timing of shut-down with Owner. Do not shut down any system, without prior written approval.
  - 2. Keep shut-down period to minimum or use intermittent period as directed by the Owner.
  - 3. Maintain life-safety system in full operation in occupied facilities, or provide notice minimum 15 working days in advance.

1.7 MAINTAIN CONTINUITY OF SERVICE

- A. Any downtime time period shall be at the convenience of the Owner and approved by the General Contractor. Contractor shall give a minimum of 15 working days prior written notice to the General Contractor in advance of any desired shutdown. Prior written notice shall include a schedule for downtime, work to be performed. All downtime period shall be on weekends or off hours with exact time period approved in advance in writing by the General Contractor. Coordinate an overall schedule that is to be submitted and approved by the General Contractor.
- B. An electrician shall be on the premises when any trade is working in close proximity to live equipment or within electric rooms during renovation by any trade.
- C. All premium time, overtime, labor, material and equipment costs required to accomplish the above shall be included in the Contractor's bid proposal.

1.8 PROTECTION

- A. Perform removal of equipment and related components, in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify field measurements and circuiting arrangements.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition Drawings are based on casual field observation and existing record documents. Contractor/Bidder is responsible to verify and confirm all existing conditions that are not in a concealed condition. Report discrepancies to Architect/Engineer before disturbing existing installation. Verify existing conditions before performing any work.
- D. Beginning of demolition means installer accepts existing conditions.

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- E. Where work is concealed above ceiling spaces which are to be removed, cut opening in ceiling and examine condition above the ceiling. If work requires certain devices to remain and the ceiling is supporting the device, contractor shall support device adequately from floor slab above, prior to ceiling demolition or at his option, remove the device and reinstall completely.
- F. Contractor shall verify existing circuit feeding each receptacle in demolition and remodeled area and document in the panelboard directory on record drawings. Contractor shall identify to Architect/ Engineer any wiring in poor condition or overload condition which exists.

### 3.2 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- C. Existing Electrical System: Maintain existing system in service until new system is ready for installation. Obtain permission from Owner at least 15 working days before completely disabling system. If outage lasts more than 24 hours, Contractor shall provide and install a generator for temporary service. Temporary service shall be provided until new service is in operation. Refer to Division 1 for temporary power. Make temporary connections to maintain service in areas adjacent to work area while switchovers are completed.
- D. Protect adjacent materials that are to remain. Install and maintain dust and noise barriers to keep dirt, dust and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
- E. Locate, identify, and protect electrical services passing through demolition areas and serving other areas outside the demolition limits. Maintain services to areas outside demolition lines. When services must be interrupted or relocated, install temporary and/or permanent services for affected areas. Services originating within demolition limits and serving areas outside demolition limits shall be maintained.

### 3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Demolish and extend existing electrical work under provisions of Division 1 General Requirements and this Section.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring to source of supply.
- D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes to source of supply. Cut concealed conduit flush with walls and floors, and patch surfaces. Remove conduit within walls to be removed. Provide cap on abandoned conduits on each end. If the existing concealed conduits are in conflict with new work remove them.
- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

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- F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- G. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
- H. Extend existing installations and provide alterations using acceptable materials and methods compatible with existing electrical installations and in accordance with the equipment manufacturer's recommendations.
- I. Remove, demount, and disconnect existing electrical materials and equipment indicated to be moved and salvaged, and deliver materials and equipment to the location designated for storage. Salvaged material shall be stacked, boxed or crated in such a manner as to prevent damage.
- J. Any existing circuits or equipment not shown on drawings and which are logically expected to be continued in service and which may be interrupted or disturbed during construction shall be reconnected in an approved manner. Check and maintain continuity for all existing devices/equipment to remain. In addition, any existing circuits or equipment which may require relocation or rerouting as a result of the work of this project shall be done by the this Contractor with no additional compensation. Provide blank cover plates on empty outlets which are to remain.
- K. Provide code required disconnects to existing and relocated, equipment when affected by new work.
- L. Where existing equipment, devices and fixtures are to remain but are affected by new work such as replacement of ductwork and piping, reconditioning of walls, ceilings, roofs and floors of relaminating of counters, cabinets and casework, disconnect these items and add extension rings, clean and reinstall same in line with new walls, ceilings and surfaces. Note that certain work (such as replacement of piping, ductwork, etc) may be outside the limit to direct renovation. Electrical contractor shall review drawings of other trades for such work and incorporate that in his scope of work. Provide all necessary materials and labor and rewire in accordance with present code requirements.
- M. Owner shall have the option of selecting any or all of the items, including copper wiring, which are designated to be removed by the contractor as salvage for the Owner. Contractor shall remove such items with extreme care and return such items to the Owner. Any equipment which the Owner does not want will become the property of the contractor and promptly removed from the site.
- N. All cutting and patching, relocating of any equipment, lighting fixtures, conduit, piping, etc., necessary for any work under this contract will be by the respective contractors unless noted otherwise in the architectural sections.
- O. Reference shall be given to Owner to keep any removed device, fixture or equipment. If Owner does not want to keep any of them, dispose them as required.
- P. Ballasts manufactured prior to 1980 containing PCB's and lamps containing mercury shall be disposed of by a federal or state E.P.A. approved method and in accordance with specifications.
- Q. HID and fluorescent lamps containing mercury shall be disposed of by a federal or state approved method and in accordance with specifications.

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- R. Before disconnecting, verify with Owner removal or relocation of all existing devices/equipment. No additional cost will be permitted for lack of such verification.
- S. All existing outlet, junction boxes, conduit and wire which is supported by the existing ceiling system will be resupported to the building construction. New wiring and outlets will be supported from the building construction.
- T. This contractor shall coordinate all his work with the other contractors at the job site before removing existing electrical and installing new items.
- U. Equipment removal in certain locations may require the installation of a junction box to reconnect circuits that remain in operation. Extend conduit and wiring as required to maintain power to remaining equipment.
- V. It is the intent of the electrical demolition drawing(s) to indicate areas in which electrical equipment, conduit, lighting fixtures, devices, etc. are to be removed to allow for the renovation phase of construction. The electrical demolition plan is for reference purposes only and it is not intended to be the sole source of existing conditions.
- W. Electrical Contractor shall be responsible for his own clean-up throughout the course of the demolition work. In the event he fails to provide such clean-up the Architect/Engineer will direct the clean-up to be performed by another contractor and the electrical contractor will be back-charged as deemed appropriate by Architect/Engineer.
- X. The contractor performing the demolition work, shall remove no more than 8" of building material around each device being demolished.
- Y. Disconnect all electrical connections to mechanical, plumbing and architectural equipment for removal by others. Remove all starters, disconnect switches and related conduit and wiring serving such equipment which is indicated to be removed. Refer to mechanical, plumbing and architectural drawings for exact requirements.
- Z. It shall be the contractor's option to reuse existing concealed conduit and flush mounted backboxes where applicable. If existing conduit and/or backboxes are utilized it shall be the electrical contractor's responsibility to provide additional supports and fittings required to conform to the specification.
- AA. Remove all exposed abandoned and exposed non-required conduits together with their associated wires. Remove inaccessible conduits together with all their wires if they are in conflict with renovation work.
- BB. Where wiring devices, telephone, intercom, fixture, motor, starter, disconnect switch, etc. is noted to be removed, install appropriate blank coverplates on junction boxes recessed in walls which are to remain. Provide for wiring continuity for existing circuits which remain.
- CC. All unused conduit and wiring which is existing in the remodeled areas and is abandoned shall be removed along with conduit and wire caused to be abandoned due to this remodeling.
- DD. Contractor shall remove and install ceiling tiles as required for the execution of electrical work that is outside the contract limits of construction. Contractor shall replace ceiling tiles with identical material where damaged by this contractor.

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3.4 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised, existing circuiting arrangement and room numbers served.
- C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, and broken electrical parts.
- D. Cabinets and Cover Plates: Where existing cabinets and cover plates are to be used for installation of new panelboard interiors, contractor shall clean exposed surfaces and paint area near cabinet and cover plates, removed from panelboard, to match existing condition. Contractor shall replace cabinet or coverplate if necessary to accommodate new work.

3.5 FLOOR AND WALL OPENINGS

- A. Opening through floors and walls where piping or equipment has been removed shall be sealed to maintain any fire ratings and to seal off cold, smoke and toxic fumes. Use appropriate sealing materials and methods to maintain existing rating of the floor and wall.

3.6 DAMAGE TO OTHER WORK

- A. The Contractor shall be held responsible for any damage caused to existing installations not pertinent to the Contract. The cost of repairs to such damaged work shall be charged against the Contractor.

3.7 CLEAN-UP

- A. On completion of work of this section and after removal of all debris, site shall be left in clean condition satisfactory to the Construction Manager. Clean-up shall include off the premises disposal of all items and materials not required to remain the property of the Contractor as well as all debris and rubbish resulting from demolition operations.
- B. Debris, including brick, asphalt, concrete, stone and similar materials shall become property of Contractor and shall be disposed of by the Contractor, off the property. Remove concrete foundations, conduits, anchor bolts, and all appurtenances.

3.8 INSTALLATION

- A. Install relocated materials and equipment under the provisions of Division 1 General Requirements.

END OF SECTION 26 08 00

## SECTION 26 09 23 - LIGHTING CONTROL DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following lighting control devices:
  - 1. Indoor occupancy sensors.
  - 2. Lighting relays.

#### 1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
  - 1. Interconnection diagrams showing field-installed wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

#### 1.6 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.

### PART 2 - PRODUCTS

#### 2.1 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Lithonia Lighting; Acuity Lighting Group, Inc.

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- B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
  - 1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
  - 2. Time Delay: 15-second minimum, to prevent false operation.
  - 3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
  - 4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

## 2.2 INDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Lithonia Lighting; Acuity Lighting Group, Inc.
- B. Ceiling-Mounted Photoelectric Switch: Solid-state, light-level sensor unit, with separate relay unit, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.
  - 1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
  - 2. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
  - 3. Light-Level Monitoring Range: 10 to 200 fc, with an adjustment for turn-on and turn-off levels within that range.
  - 4. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
  - 5. Indicator: Two LEDs to indicate the beginning of on-off cycles.

## 2.3 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Lithonia Lighting; Acuity Lighting Group, Inc.
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
  - 1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  - 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
  - 3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
  - 4. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outlet box.
    - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

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5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
  6. Bypass Switch: Override the on function in case of sensor failure.
  7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.
- C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
1. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.
  2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
  3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot-high ceiling.
- D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
  2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch-high ceiling.
  3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
  4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch-high ceiling.
  5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot-high ceiling in a corridor not wider than 14 feet.
- E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
  2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in, and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
  3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

## 2.6 INDOOR VACANCY SENSORS

Provide wall mounted vacancy sensors as indicated on floor plan complying with 2011 IECC (International Energy Conservation Code).

## 2.7 CONTROL UNITS/ADD-A-RELAY (POWER PACK)

- F. Control units shall consist of a DC power supply and a dry contact relay for switching a lighting load. Control units shall be available in versions to accept 120, 230, 277 and 347 VAC line voltages. Output shall be inherently safe, low voltage, limited power output (Class 2). Output shall supply 100mA current, in addition to current consumed internally to operate internal relay. Relay shall utilize normally open, silver alloy dry contacts and shall be rated for a 20A magnetic ballast load at 120V, 230V, 277V and 347V. Control units shall have line voltage wiring,

consisting of input voltage and relay contact connections, exiting from one end, and low voltage DC connections, consisting of ground, power and control wires, exiting from the other end.

- G. Control units shall be equipped with a ½" EMT threaded male fitting on the line voltage. Control units shall be sized and qualified for the following mounting options:
1. To the outside of a junction box with the line voltage wiring internal to the box and the low voltage wiring external.
  2. Inside the ballast cavity of a fluorescent fixture, such that the line voltage wiring is internal to the cavity and the low voltage wiring external. A ½" threaded adapter shall be attached to the low voltage end of control unit in order to secure the control unit to the interior wall of the ballast cavity.
  3. Inside a standard 4" x 4" junction box.
- H. Add-A-Relay shall be available for switching additional circuits. Add-A-Relay has some construction and specifications as control unit except without power supply function.

## 2.8 LIGHTING RELAYS

- I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. GE Industrial Systems; Total Lighting Control.
  2. Hubbell Lighting.
  3. Lithonia Lighting; Acuity Lighting Group, Inc.
  4. Square D; Schneider Electric.
  5. TORK.
  6. Watt Stopper (The).
- J. Description: Electrically operated and mechanically held, complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
  2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
  3. Enclosure: Comply with NEMA 250.
  4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

## 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.
- B. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.
- C. Passive infrared coverage should not extend through doorways. Masking inserts shall be installed for PIR coverage rejection to prevent false tripping.

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3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 3/4 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
  - 1. Identify controlled circuits in lighting contactors.
  - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing time switches and 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.
- 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 to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 26 09 23

## SECTION 26 09 43: NETWORK LIGHTING CONTROLS

### 1.1. SUMMARY

- A. The lighting control system specified in this section shall provide time-based, sensor-based (both occupancy and daylight), and manual lighting control.
- B. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed)
- C. All system devices shall be networked together enabling digital communication and shall be individually addressable.
- D. 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.
- E. The system architecture shall facilitate remote operation via a computer connection.
- F. The system shall not require any centrally hardwired switching equipment.
- G. The system shall be capable of wireless, wired, or hybrid wireless/wired architectures.

### 1.2 SUBMITTALS

- A. Product Datasheets (general device descriptions, dimensions, wiring details, nomenclature)
- B. Riser Diagrams – typical per room type (detailed drawings showing device interconnectivity of devices)
- C. Other Diagrams – as needed for special operation or interaction with other system(s)
- D. Example Contractor Startup/Commissioning Worksheet – must be completed prior to factory start-up
- E. Hardware and Software Operation Manuals
- F. Other operational descriptions as needed

### 1.3 QUALITY ASSURANCE

- A. All steps in sensor manufacturing process shall occur in the USA; including population of all electronic components on circuit boards, soldering, programming, wiring, and housing.
- B. All components and the manufacturing facility where product was manufactured must be ROHS compliant.
- C. In high humidity or cold environments, the sensors shall be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.
- D. All applicable products must be UL / CUL Listed or other acceptable national testing organization.

### 1.4 COORDINATION

- E. Coordinate lighting control components to form an integrated interconnection of compatible components.
- F. Coordinate lighting controls with BAS (if necessary) either through IP based intercommunication of system or hardwired auxiliary relay outputs.
- G. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

### 1.5 WARRANTY

- H. All devices in lighting control system shall have a 5 year warranty.

## PART 2 – PRODUCTS

### 2.1. MANUFACTURERS

- A. Basis of Design, or Owner-Approved Equal: nLight® Network Control System from Sensor Switch, an Acuity Brands Company (800-727-7483, [www.sensorswitch.com](http://www.sensorswitch.com)).

### 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-5 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 possess 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 encryption
- 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.
  - a. Auto-On / Auto-Off (via occupancy sensors)
    - Zones with occupancy sensors automatically turn lights on when occupant is detected.
    - Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
    - 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.
  - b. Manual-On / Auto-Off (also called Semi-Automatic)
    - Pushing a switch will turn lights on.
    - Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
  - c. Manual-On to Auto-On/Auto-Off
    - Pushing a switch will turn lights on.
    - After initial lights on, zones with occupancy and/or photocell sensors turn lights on/off according to occupancy/vacancy and/or daylight conditions.
    - Sequence can be reset via scheduled (ex. daily each morning) events
  - d. Auto-to-Override On
    - Zones with occupancy sensors automatically turn lights on when occupant is detected.
    - 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.
    - Sequence can be reset via scheduled (ex. daily each morning) events
  - e. Manual-to-Override On
    - Pushing a switch will turn lights on.
    - 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.
    - Sequence can be reset via scheduled (ex. daily each morning) events
  - f. Auto On / Predictive Off

- Zones with occupancy sensors automatically turn lights on when occupant is detected.
  - Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
  - 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.
- g. Multi-Level Operation (multiple lighting levels per manual button press)
- Operating mode designed specifically for bi-level applications
  - Enables the user to cycle through the up to four potential on/off lighting states using only a single button.
  - Eliminates user confusion as to which of two buttons controls which load
  - Three different transition sequences are available in order to comply with energy codes or user preference)
  - Mode available as a setting on all nLight devices that have single manual on/off switch (ex. nWSX, nPODM, nPODM-DX).
  - Depending on the sequence selected, every button push steps through relays states according to below table
  - 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-5 cabling supplied with hardware.

## 2.3. INDIVIDUAL DEVICE SPECIFICATIONS

### A. Control Module (Gateway)

- a. Control module shall be a device that facilitates communication and time-based control of downstream network devices and linking into an Ethernet.
- b. Devices shall have a user interface that is capable of wall mounting, powered by low voltage, and have a touch screen.
- c. Control device shall have three RJ-45 ports for connection to other backbone devices (bridges) or directly to lighting control devices.
- d. Device shall automatically detect all devices downstream of it.
- e. Device shall have a standard and astronomical internal time clock.
- f. Device shall have one RJ-45 10/100 BaseT Ethernet connection.
- g. Device shall have a USB port
- h. Each control gateway device shall be capable of linking 1500 devices to the management software.
- i. Device shall be capable of using a dedicated or DHCP assigned IP address.
- j. Network Control Gateway device shall be the following Sensor Switch model Series:

nGWY2

### B. Networked System Occupancy Sensors

- a. Occupancy sensors system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
- b. 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.
- c. 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.
- d. 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.
- e. 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.
- f. 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.
- g. Sensors shall be available with one or two occupancy "poles", each of which provides a programmable time delay.
- h. Sensors shall be available in multiple lens options which are customized for specific applications.
- i. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
- j. All sensors shall have two RJ-45 ports or capable of utilizing a splitter.

- k. 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
- l. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.
- m. 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.
- n. 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.
- o. Wall switch sensors shall recess into single-gang switch box and fit a standard GFI opening.
- p. 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.
- q. Wall switch sensors shall have optional features for photocell/daylight override, vandal resistant lens, and low temperature/high humidity operation.
- r. Wall switch sensors shall be available in four standard colors (Ivory, White, Light Almond, Gray)
- s. Wall switch sensors shall be available with optional raise/lower dimming adjustment controls
- t. 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)
- u. Network system shall have sensors that can be embedded into luminaire such that only the lens shows on luminaire face.
- v. Embedded sensors shall be capable of both PIR and Dual Technology occupancy detection
- w. Embedded sensors shall have an optional photocell
- x. 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)
- y. Network system shall also have ceiling, fixture, recessed, & corner mounted sensors available.
- z. Fixture mount sensors shall be capable of powering themselves via a line power feed.
- aa. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.

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- bb. 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).
- cc. 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

Note: Recessed mount versions of the above ceiling(fixture) mount versions also shall be available (e.g. nCMR(B) 9 => nRMR 9)

- bb. System shall have WiFi enabled fixture mountable sensors available.
- cc. Embedded sensors shall have an optional photocell and 0-10 VDC dimming output
- dd. 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

- a. 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.

- b. 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.
- c. 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).
- d. 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).
- e. 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.)
- f. Combination units that have all features of on/off photocell and dimming sensors shall also be available.
- g. 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.
- h. 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.
- i. 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)

- j. Network system shall have dimming photocells that can be embedded into luminaire such that only the lens shows on luminaire face.
- k. Embedded sensors shall be the following Sensor Switch model number:

nES ADCX (Dimming Photocell)

D. Networked System Power (Relay) Packs

- a. 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 2<sup>nd</sup> 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.
- b. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC), be plenum rated, and provide Class 2 power to the system.
- c. All devices shall have two RJ-45 ports.

- d. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
- e. 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.
- f. 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.
- g. Power Packs and Power Supplies shall be available that are WiFi enabled.
- h. Power (Secondary) Packs shall be available that provide up to 16 Amp switching of all lighting load types.
- i. 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.
- j. 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.
- k. 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).
- l. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120/277 VAC magnetic low voltage transformers.
- m. Specific Secondary Packs shall be available that provide up to 4 Amps of switching and can dim 120 VAC electronic low voltage transformers.
- n. Specific Secondary Packs shall be available that provide up to 5 Amps of switching of dual phase (208/240/480 VAC) lighting loads.
- o. Specific Secondary Packs shall be available that require a manual switch signal (via a networked Wall Station) in order to close its relay.
- p. Specific Power/Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits.
- q. Specific Secondary Packs shall be available that control louver/damper motors for skylights.
- r. Specific Secondary Packs shall be available that provide a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.
- s. 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

- a. 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.
- b. Relays shall be rated to switch up to a 30A ballast load at 277 VAC.
- c. Panel shall provide one 0-10VDC dimming output paired with each relay.
- d. Panel shall power itself from an integrated 120/277 VAC supply.
- e. Panel shall be capable of operating as either two networked devices or as one.
- f. Panel shall supply current limited low voltage power to other networked devices connected via CAT-5.
- g. Panel shall provide auxiliary low voltage device power connected wired directly to a dedicated terminal connection
- h. 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

- a. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½" knockout.
- b. Devices shall have two RJ-45 ports
- c. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
- d. 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).
- e. Specific I/O devices shall have an input that read a 0-10 VDC signal from an external device.
- f. 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
- g. Specific I/O devices shall sense state of low voltage outdoor photocells

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- h. Specific I/O devices shall enable RS-232 communication between lighting control system and Touch Screen based A/V control systems.
- i. Specific I/O devices shall sense .

- j. 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

- a. Networked LED luminaire shall have a mechanically integrated control device
- b. Networked LED luminaire shall have two RJ-45 ports
- c. Networked LED luminaire shall be able to digitally network directly to other network control devices (sensors, photocells, switches, dimmers)
- d. Networked LED luminaire shall provide low voltage power to other networked control devices
- e. System shall be able to turn on/off LED luminaire without using a relay
- f. System shall be able to maintain constant lumen output over the specified life of the LED luminaire (also called lumen compensation) by varying the input control power (and thus saving up to 20% power usage).
- g. System shall indicate (via a blink warning) when the LED luminaire has reached its expected life (in hrs).
- k. LED Luminaires shall be the following Lithonia model families:

RTLED

TLED

VLED

ACLED

AL LED

WLED

STLED

MINO

H. Networked System Wall Switches & Dimmers

- a. Devices shall recess into single-gang switch box and fit a standard GFI opening.
- b. Devices shall be available with zero or one integrated Class 1 switching relay.
- c. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
- d. All sensors shall have two RJ-45 ports.
- e. All devices shall provide toggle switch control. Dimming control and low temperature/high humidity operation are available options.
- f. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).

- g. 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).
- h. Devices with capacitive touch buttons shall provide audible user feedback with different sounds for on/off, raise/lower, start-up, and communication offline.
- i. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
- j. Devices with mechanical push-buttons shall be made available with custom button labeling
- k. 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.
- l. 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

- a. 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.
- b. Device shall enable configuration of lighting presets, switched, and dimmers via password protected setup screens.
- c. Device shall enable user supplied .jpg screen saver image to be uploaded.
- d. Device shall surface mount to single-gang switch box
- e. Device shall have a micro-USB style connector for local computer connectivity.
- f. Device shall have two RJ-45 ports for communication
- g. Device shall be the following Sensor Switch model number:

nPOD GFX

J. Networked System Scene Controllers

- a. Device shall have two to four buttons for selecting programmable lighting control profiles or acting as on/off switches.
- b. Device shall recess into single-gang switch box and fit a standard GFI opening.
- c. Devices shall provide LED user feedback.
- d. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
- e. All sensors shall have two RJ-45 ports.
- f. Device shall be capable of reprogramming other devices in its zone so as to implement user selected lighting scene.

- g. 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).
- h. Device shall have LEDs indicating current selection.
- i. 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

- a. Device shall surface mount to a standard 4" x 4" square junction box.
- b. Device shall have 8 RJ-45 ports.
- c. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway.
- d. 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.
- e. 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.
- f. 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<sub>2</sub>.
- 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

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- 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.

**3. PART 3 – EXECUTION**

3.1 Install and test entire system as recommended by manufacturer. If system fails, repair and re-test until system is completely operational.

3.2 Provide training to Owner, so Owner is fully capable of operating and maintaining the system.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

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 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. RFI: Radio-frequency interference.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.

1.3 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Bus configuration, current, and voltage ratings.
    - c. Short-circuit current rating of panelboards and overcurrent protective devices.
    - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Field quality-control test reports including the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
  - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

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2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

#### 1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with NEMA PB 1.
- F. Comply with NFPA 70.

#### 1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
  1. Ambient Temperature: Not exceeding 104 deg F.
  2. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
  1. Ambient temperatures within limits specified.
  2. Altitude not exceeding 6600 feet.

#### 1.6 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, and encumbrances to workspace clearance requirements.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

#### 1.7 FIELD MEASUREMENTS

- A. Make all necessary field measurements to verify that equipment shall fit in allocated space in full compliance with minimum required clearances specified in National Electrical Code

#### 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

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1. Keys: Six spares for each type of panelboard cabinet lock.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Eaton Corporation; Cutler-Hammer Products.
  2. General Electrical Company; GE Industrial Systems.
  3. Siemens/Furnas Controls.
  4. Square D.

### 2.2 MANUFACTURED UNITS

- A. Phase sequence and balance:
  1. Phase sequence: A-B-C, left to right.
  2. Load balance: Distribute loads for maximum 10 percent difference.
- B. Each panelboard and associated fused switches and circuit breakers shall be of the same manufacturer.
- C. Each panelboard lock shall be operable by the same key.
- D. Enclosures: Flush Surface-mounted cabinets. NEMA PB 1, Type 1.
  1. Rated for environmental conditions at installed location.
    - a. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
    - b. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
  3. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
  4. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
  5. Fronts shall be reinforced steel with concealed hinges and concealed trim adjusting screws. Trim clamps are unacceptable.
- E. Phase and Ground Buses:
  1. Panelboard Bus: 1000 amp per sq.in. Copper, ampere and voltage ratings as indicated on drawings. Provide copper ground bus in each panelboard. Provide insulated ground bus and 200% rated neutral bus as indicated on drawings.
- F. Conductor Connectors: Suitable for use with conductor material.
  1. Main and Neutral Lugs: Mechanical type.
  2. Ground Lugs and Bus Configured Terminators: Mechanical type.
  3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
  4. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- G. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

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- H. Circuit Breakers: Circuit breakers shall be bolt-on type.
- I. Main breakers shall be UL listed for use with: Shunt, Under Voltage, and Ground Fault Shunt Trips; Auxiliary and Alarm Switches; and Mechanical Lug Kits. Provide these accessories as indicated on drawings.
- J. Contactors: Contactors shall be mechanically held GE type CR160MC, or ASCO Type 920 or approved equal.

2.3 PANELBOARD SHORT-CIRCUIT RATING

- A. Minimum Short Circuit Rating: Fully rated, 42,000 amperes rms symmetrical for 240 volt panelboards; 65,000 amperes rms symmetrical for 480 volt panelboards, or as indicated, or as required to be greater than the available short circuit current..

2.4 DISTRIBUTION PANELBOARDS

- A. Interlocks: Disconnects shall have ON and OFF indication. Disconnect door or cover shall be interlocked mechanically with the disconnect device to prevent opening door with the disconnect device in ON position and application of power while the door is open. Means shall be provided for releasing the interlock for intentional access to the interior, and intentional application of power, if desired, while the door is open. Padlocking arrangements shall permit locking the disconnect device OFF with a maximum of 3 padlocks with door closed or open.
- B. Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits. Quantity and ratings as indicated. Circuit breakers shall bolt directly onto bus, modular devices utilizing spring reinforcement jaws with pressure locked connections are not acceptable.
- C. Controllers: NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower, with bimetal overload relay. Size and ratings as indicated. Provide unit mounted control power transformer and HAND-OFF-AUTO selector switch and GREEN indicating light in front cover.
- D. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.
- E. Enclosure: NEMA PB 1, Galvanized steel finished inside and outside with manufactures standard gray enamel, fully flanged, fastened with quarter-turn trim clamps. Type 1 or 12 or 3R as suitable for the location, 12 inches deep, 35 inches wide, minimum, or as required to accommodate the number of outgoing conduits.
- F. Cabinet Front: Surface type, finished in manufacturer's standard gray enamel. Fasten doors 48 inches in height or less with concealed hinged door with flush catch lock. Fasten doors over 48 inches in height with three point catch lock and vault type handle.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

- C. Where indicated on drawings, the branch circuit breakers shall be SWD type, type HACR for air-conditioning equipment, ground fault circuit interrupter type, arc fault circuit interrupter type and shall have shunt trip accessories.

## 2.6 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: 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-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and with 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.
  - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  - 5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
  - 6. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
  - 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
  - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
  - 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  - 4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
  - 5. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
  - 6. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.
- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

## 2.7 CONTROLLERS

- A. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held general-purpose controller.
  - 1. Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
  - 2. Control-Power Source: 120-V branch circuit.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Provide concrete equipment base for floor mounted equipment installation.

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- B. Verify field measurements.
- C. Verify that required utilities are available, in proper location and ready for use.
- D. Beginning of installation means installer accepts conditions.

### 3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- C. Install overcurrent protective devices and controllers.
  - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- D. Install filler plates in unused spaces.
- E. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- F. Install panelboards in accordance with NEMA and NECA standards and as instructed by manufacturer.
- G. Support free-standing panelboards with structural channel framework.
- H. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with lowest operating handle not lower than 18" above finished floor per NEC.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

### 3.4 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

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2. Test continuity of each circuit.
- B. Perform the following field tests and inspections and prepare test reports:
1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. 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. 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 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. SPD: Surge protection devices.
- F. UTP: Unshielded twisted pair.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.5 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 1. Cord and Plug Sets: Match equipment requirements.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  2. Leviton Mfg. Company Inc. (Leviton).
  3. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

### 2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell; HBL5351 (single), CR5352 (duplex).
    - b. Leviton; 5361 (single), 5362 (duplex).
    - c. Pass & Seymour; 5381 (single), 5352 (duplex).
- B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell; CR 5253IG.
    - b. Leviton; 5362-IG.
    - c. Pass & Seymour; IG6300.
  2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

### 2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Pass & Seymour; 2095.
    - b. Hubbell; GFR5352.
    - c. Leviton; 7899.

### 2.4 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
    - b. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
    - c. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

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- C. Pilot Light Switches, 20 A:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell; HPL1221PL for 120 V and 277 V.
    - b. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
    - c. Pass & Seymour; PS20AC1-PLR for 120 V.
  - 2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."
- D. Keyed Switches, 120/277 V, 20 A:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
    - b. Leviton; 1221-2L (single pole), 1223-2L (three way),
    - c. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

## 2.5 OCCUPANCY SENSORS

- A. Wall-Switch Sensors:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell; AT1277
    - b. Leviton; ODS 15-ID.
    - c. Watt Stopper.
  - 3. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft.
- B. Long-Range Wall-Switch Sensors:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell; ATD1600WRP.
    - b. Leviton; ODW12-MRW.
    - c. Watt Stopper (The); DT-200.
  - 3. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1600 sq. ft..
- C. Wide-Range Wall-Switch Sensors:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell; ATP120HBRP.
    - b. Leviton; ODWHB-IRW.
    - c. Watt Stopper (The); CX-100-3.
  - 3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 120 linear feet.
- D. Exterior Occupancy Sensors:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell
    - b. Leviton; PS200-10.

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- c. Watt Stopper (The); EW-100-120.
- 3. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.

## 2.6 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
  - 1. Plate-Securing Screws: Metal with head color to match plate finish.
  - 2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
  - 3. Material for Unfinished Spaces: Galvanized steel.
  - 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

## 2.7 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular, solid brass with satin finish.
- D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for UTP cable.

## 2.8 POKE-THROUGH ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hubbell Incorporated; Wiring Device-Kellems.
  - 2. Pass & Seymour/Legrand; Wiring Devices & Accessories.
  - 3. Wiremold Company.
- B. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.
  - 1. Service Outlet Assembly: Flush type with two simplex receptacles and space for two RJ-45 jacks.
  - 2. Size: Matched to floor thickness.
  - 3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
  - 4. Closure Plug: Arranged to close unused cored openings and reestablish fire rating of floor.
  - 5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of two, 4-pair, voice and data communication cables.

## 2.9 FINISHES AND COLOR

- A. Color: Wiring device catalog numbers indicated above do not designate device color. Color for devices and for cover plates shall be as indicated below. The final color shall be as selected by the architect.
  - 1. Wiring Devices Connected to Normal Power System: Match to existing devices in the given area, unless otherwise indicated.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
  - 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
  - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
  - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
  - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
- D. Device Installation:
  - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
  - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
  - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
  - 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
  - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
  - 8. Tighten unused terminal screws on the device.
  - 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

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- E. Receptacle Orientation:
  - 1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical. Group adjacent switches under single, multigang wall plates.
- H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 FIELD QUALITY CONTROL

- A. Clean debris from outlet boxes.
- B. Perform tests and inspections and prepare test reports.
  - 1. Test Instruments: Use instruments that comply with UL 1436.
  - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
  - 3. Operate each wall switch with circuit energized and verify proper operation.
  - 4. Verify that each receptacle device is energized.
  - 5. Test each receptacle device.

END OF SECTION 26 27 26

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Molded-case circuit breakers.
  - 4. Enclosures.

1.3 DEFINITIONS

- A. GD: General duty.
- B. GFCI: Ground-fault circuit interrupter.
- C. HD: Heavy duty.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current rating.
  - 4. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
  - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
  - 2. Time-current curves, including selectable ranges for each type of circuit breaker.

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1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.6 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

1.7 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Manufacturers:
  - 1. Eaton Corporation; Cutler-Hammer Products.
  - 2. General Electric Co.; Electrical Distribution & Control Division.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D/Group Schneider.
- B. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Nonfusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2.2 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

- A. Manufacturers:
  - 1. Eaton Corporation; Cutler-Hammer Products.
  - 2. General Electric Co.; Electrical Distribution & Control Division.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D/Group Schneider.
- B. Molded-Case Circuit Breaker: NEMA AB 1, 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-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with 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.
4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.

## 2.3 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
  1. Outdoor Locations: NEMA 250, Type 3R.
  2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
  3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

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

### 3.2 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Prepare for acceptance testing as follows:
  - 1. Inspect mechanical and electrical connections.
  - 2. Verify switch and relay type and labeling verification.
  - 3. Verify rating of installed fuses.
  - 4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.

3.5 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.6 CLEANING

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 26 28 16

## SECTION 26 29 13 - ENCLOSED CONTROLLERS

### 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 SUBMITTALS

- A. Product Data: For each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each enclosed controller.
  - 1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Each installed unit's type and details.
    - b. Nameplate legends.
    - c. Short-circuit current rating of integrated unit.
    - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices in combination controllers.
  - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
  - 1. Routine maintenance requirements for enclosed controllers and all installed components.
  - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
- E. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

#### 1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. Source Limitations: Obtain enclosed controllers of a single type through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 70 and all local codes.

#### 1.4 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. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install electric heating of sufficient wattage to prevent condensation.

#### 1.5 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 size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."
- D. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.
- E. 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.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Corporation; Cutler-Hammer Products.
  - 2. General Electrical Company; GE Industrial Systems.
  - 3. Siemens/Furnas Controls.
  - 4. Square D.
- B. Size: The starter shall be large enough to serve the motor being served.
- C. Minimum Starter Size: NEMA 1.

#### 2.2 ACROSS-THE-LINE ENCLOSED CONTROLLERS

- A. Manual Controller: NEMA ICS 2, general purpose, Class A, with "quick-make, quick-break" toggle or pushbutton action, and marked to show whether unit is "OFF," "ON," or "TRIPPED."
  - 1. Overload Relay: Ambient-compensated type with inverse-time-current characteristics and NEMA ICS 2, Class 10 tripping characteristics. Relays shall have heaters and sensors in

each phase, matched to nameplate, full-load current of specific motor to which they connect and shall have appropriate adjustment for duty cycle.

- B. Magnetic Controller: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated.
- C. Combination Magnetic Controller: Factory-assembled combination controller and disconnect switch.
  - 1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by an NRTL. Fuses shall be Class RK-1, dual element, time delay.

## 2.3 REDUCED-VOLTAGE ENCLOSED CONTROLLERS

- A. Star-Delta Controller: NEMA ICS 2, closed transition with adjustable time delay. Match controller to motor type and application.

## 2.4 MULTISPEED ENCLOSED CONTROLLERS

- A. Multispeed Enclosed Controller: Match controller to motor type, application, and number of speeds; include the following accessories:
  - 1. Compelling relay to ensure that motor will start only at low speed.
  - 2. Accelerating relay to ensure properly timed acceleration through speeds lower than that selected.
  - 3. Decelerating relay to ensure automatically timed deceleration through each speed.

## 2.5 ENCLOSURES

- A. Description: Flush- or surface-mounting cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.
  - 1. Outdoor Locations: NEMA 250, Type 3R.
  - 2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

## 2.6 ACCESSORIES

- A. Devices shall be heavy duty type and shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Push-Button Stations, Green Running "On", Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
- C. HOA switch: Rotary, heavy duty type.
- D. Elapsed Time Meters: Heavy duty with digital readout in hours.
- E. Phase-Failure and Undervoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable undervoltage setting.
- F. 120-volt control transformer with fused protection in primary and in secondary. Bond unfused legs of secondary to enclosure.
- G. Overload relay in each phase.

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- H. One N.O. and one N.C. auxiliary contact.
- I. Cover mounted recessed overload reset button.

## 2.7 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.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLICATIONS

- A. Verify the actual manufacture, size and location of each motor provided to determine final connection, control, and overcurrent protection selection.
- B. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, controller, and load; and configuration of pilot device and control circuit affecting controller functions.
- C. Select horsepower rating of controllers to suit motor controlled.

### 3.3 INSTALLATION

- A. Perform work in accordance with NECA standards.
- B. 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 Division 26 Section "Hangers and Supports for Electrical Systems."
- C. Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 26 Section "Fuses."

### 3.4 IDENTIFICATION

- A. Identify enclosed controller, components, and control wiring according to Division 26 Section "Identification for Electrical Systems."

### 3.5 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect hand-off-automatic switch and other automatic-control devices where applicable.

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1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.

3.6 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 Division 26 Section "Grounding and Bonding for Electrical Systems."

3.7 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  1. Test insulation resistance for each enclosed controller element, bus, component, connecting supply, feeder, and control circuit.
  2. Test continuity of each circuit.
- B. Perform the following field tests and inspections and prepare test reports:
  1. Perform each electrical test and visual and mechanical inspection, except optional tests, stated in NETA ATS, "Motor Control - Motor Starters." 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.

3.8 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 26 29 13

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

- A. BF: Ballast factor.
- B. CRI: Color-rendering index.
- C. CU: Coefficient of utilization.
- D. HID: High-intensity discharge.
- E. LED: Light emitting diode.
- F. LER: Luminaire efficacy rating.
- G. Luminaire: Complete lighting fixture, including ballast and driver housing.
- H. RCR: Room cavity ratio.

1.3 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of lighting fixture including dimensions.
  - 2. Energy-efficiency data.
  - 3. Life, output, and energy-efficiency data for lamps.
  - 4. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
  - 1. Wiring Diagrams: Power and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
- E. Warranties: Special warranties specified in this Section.

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1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.5 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
- B. In Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. LED fixtures: The LED fixtures shall comply with applicable latest standards. They meet the standards established by nationally recognized testing laboratories.
- C. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit access 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.
- E. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
  - 1. White Surfaces: 85 percent.
  - 2. Specular Surfaces: 83 percent.
  - 3. Diffusing Specular Surfaces: 75 percent.
  - 4. Laminated Silver Metallized Film: 90 percent.
- F. Plastic Diffusers, Covers, and Globes:
  - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
    - a. Lens Thickness: At least 0.125 inch minimum unless different thickness is indicated.
    - b. UV stabilized.

2. Glass: Annealed crystal glass, unless otherwise indicated.

- G. Plaster frames, angles, and channels for recessed luminaires shall be furnished under this section where required. Plaster frames shall be specifically constructed for the application by the manufacturer of the related luminaire.
- H. CRI of minimum 80.
- I. Rated lamp life of LED shall be 50000 hours.
- J. All LED fixtures shall be dimmable from 100 percent to 0 percent of maximum light output.
- K. Unless otherwise indicated in lighting fixture schedule, all LED fixtures shall have integral driver.

## 2.3 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, 70,000 hours minimum rated lamp life.
- C. Furnish products as scheduled and in compliance with applicable codes.
- D. Description: Exit sign fixture.
- E. Housing: Sheet steel.
- F. Face: Translucent glass face with red letters on white background.
- G. Letters: 6" high with  $\frac{3}{4}$ " stroke, minimum or as required by local codes.
- H. Directional Arrows: As indicated with letters 4-1/2" high,  $\frac{3}{4}$ " stroke, minimum or as required by local codes.
- I. Lamps, Light emitting diodes.

## 2.4 FLUORESCENT LAMPS

## 2.5 LIGHTING FIXTURE 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. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

- E. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

## 2.6 REQUIREMENTS FOR INDIVIDUAL LIGHTING FIXTURES

- A. Refer to light fixture schedule for requirements.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.
  - 1. Install a minimum of two ceiling support system rods or wires for each fixture. Locate not more than 6 inches from lighting fixture corners.
  - 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
- C. Suspended Lighting Fixture Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
  - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- D. Install suspended luminaires and exit signs directly from building structure using rigid stem pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- E. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- F. Grid Ceilings: Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips.
- G. Install recessed luminaires to permit removal from below.
- H. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- I. Install wall mounted luminaires and exit signs at height as shown.
- J. Install accessories furnished with each luminaire.
- K. Bond products and metal accessories to branch circuit separate green equipment grounding conductor.
- L. Install specified lamps in each luminaire and exit sign in accordance with manufactures instructions for handling and burning position.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate installation of recessed luminaire frames and trims with ceiling construction.
- B. Coordinate the installation of suspended luminaires with building components, verify exact locations and mounting heights.

3.3 FIELD QUALITY CONTROL

- A. The use of permanent luminaires for temporary lighting shall only be as permitted by the Architect/Engineer.
- B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 ADJUSTING

- A. Adjust installed work under provisions of Division 1 General Requirements.
- B. Aim and adjust luminaires as indicated and as directed.
- C. Position exit sign directional arrows as indicated.

3.5 CLEANING

- A. Clean installed work under provisions of Division 1 General Requirements.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosures.
- D. Clean photometric control surfaces to remove all dust and smudges with cleaning solution as recommended by manufacturer.
- E. Clean finishes and touch up damage.

3.6 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate installed work under provisions of Division 1 General Requirements.
- B. Demonstrate luminaire operation for minimum of two hours.

3.7 PROTECTION OF FINISHED WORK

- A. Protect installed work under provisions of Division 1 General Requirements.
- B. Relamp luminaires used for temporary lighting and luminaires that have failed lamps at the time of project turn-over.

END OF SECTION 26 51 00



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# FEBRUARY 29, 2016

<b>DATE:</b> 02-29-2016	<b>ISSUED FOR:</b>	<b>DATE:</b> 02-29-16	<b>APPROVED</b>
<b>PROJECT NUMBER</b>			
<b>25107</b>			
<b>SHEET NUMBER</b>			
<b>CS</b>			

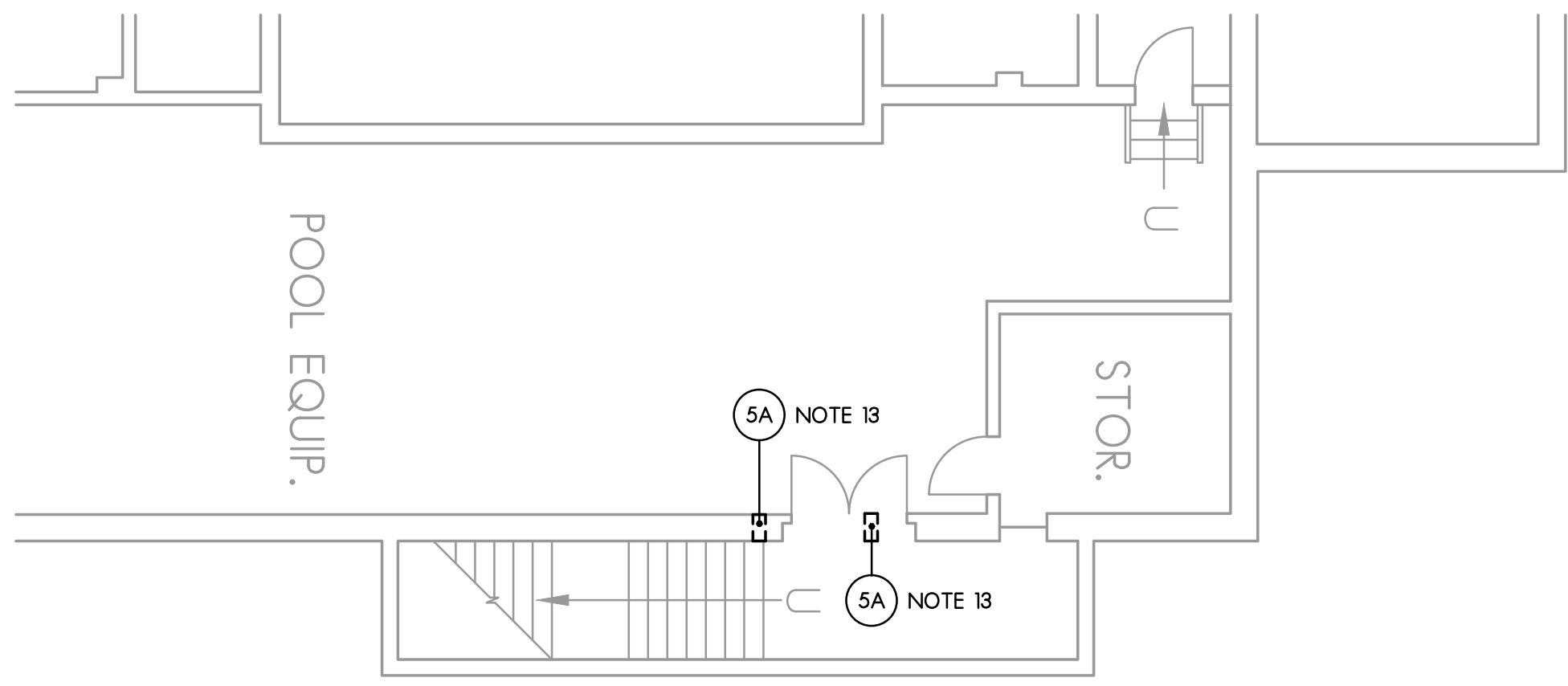
**WEST MIDDLE SCHOOL**

**HVAC AND ELECTRICAL RENOVATIONS - ROCKFORD IL**

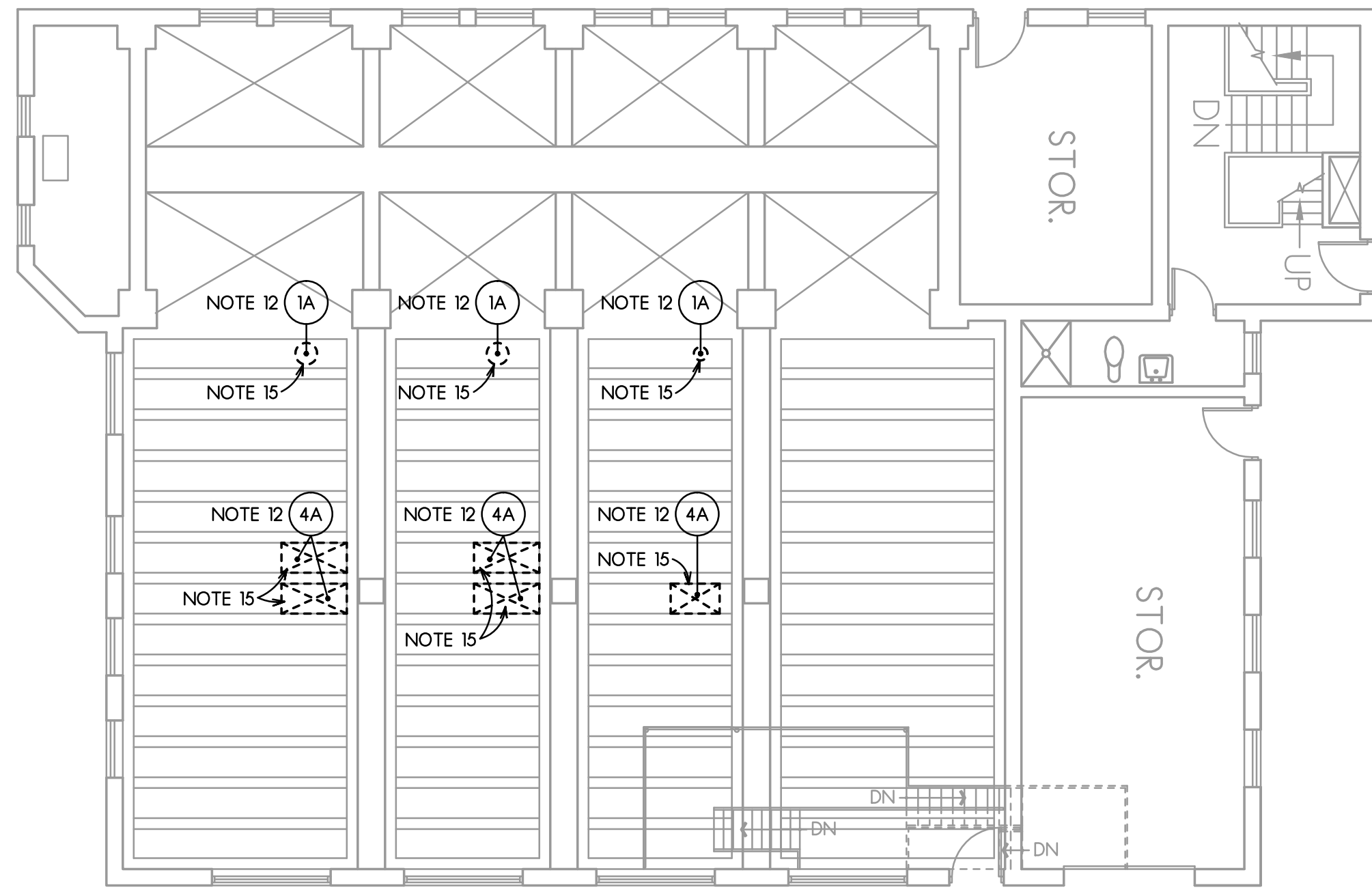
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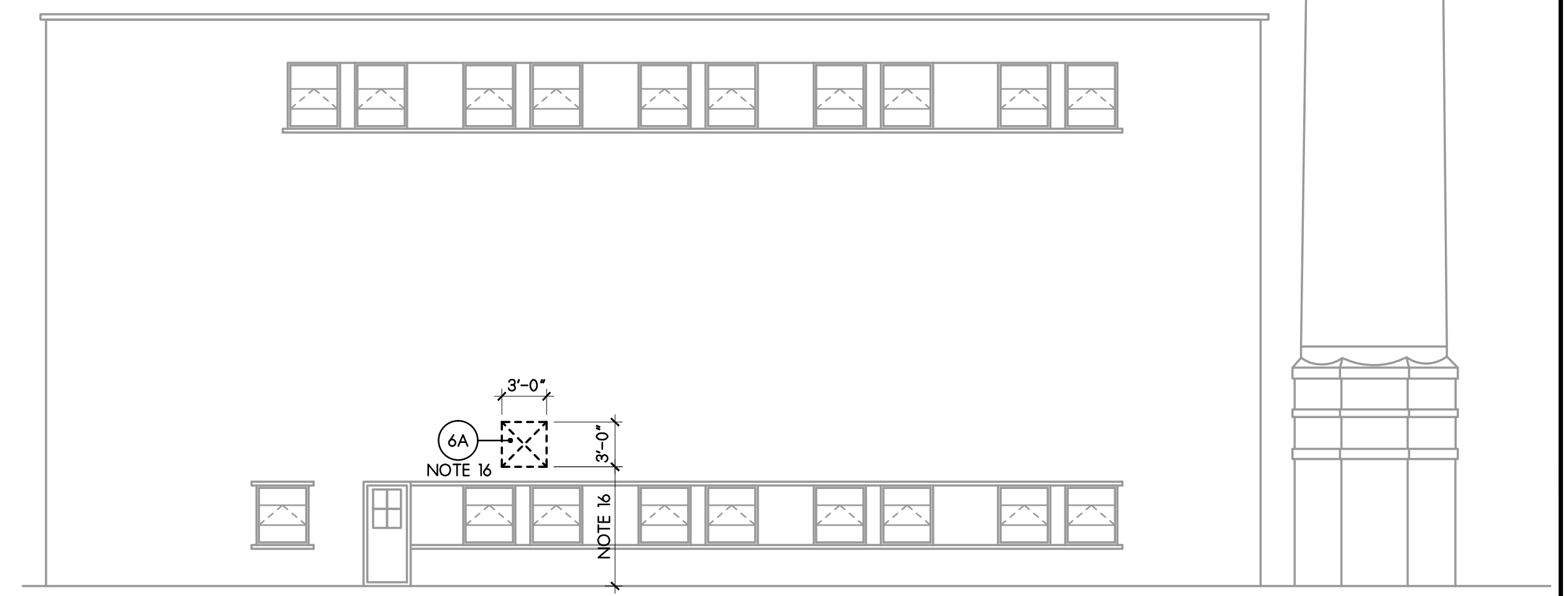
**Larson & Darby Group**  
 Architects Engineers Interiors  
 Rockford Office - 4045 Harrison Ave., Suite 100, P.O.Box 2207 Rockford, IL 61105 Tel (815) 844-0739 Fax (815) 229-9667



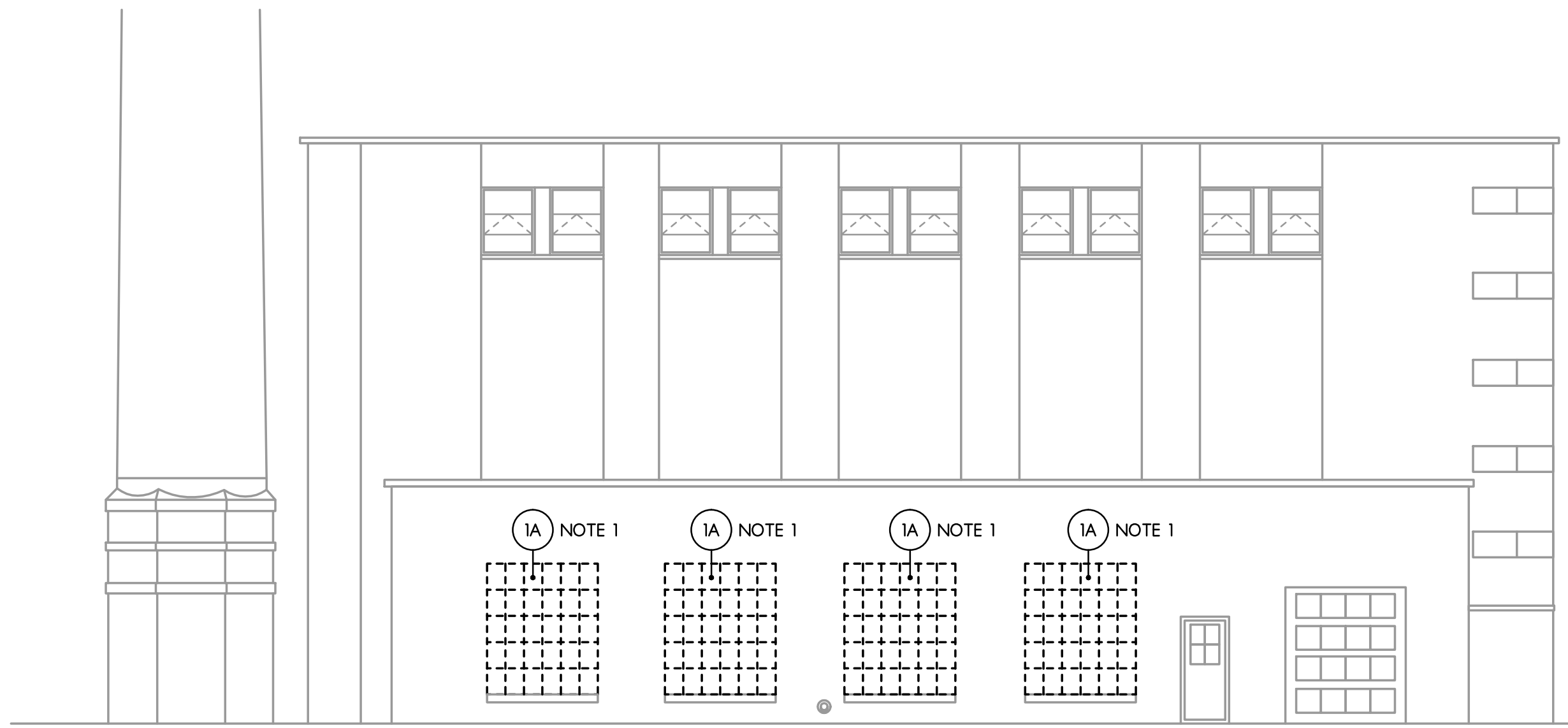
6 ALT. M1 DEMOLITION  
EXISTING PARTIAL POOL EQUIPMENT PLAN  
SCALE: 1/8" = 1'-0"



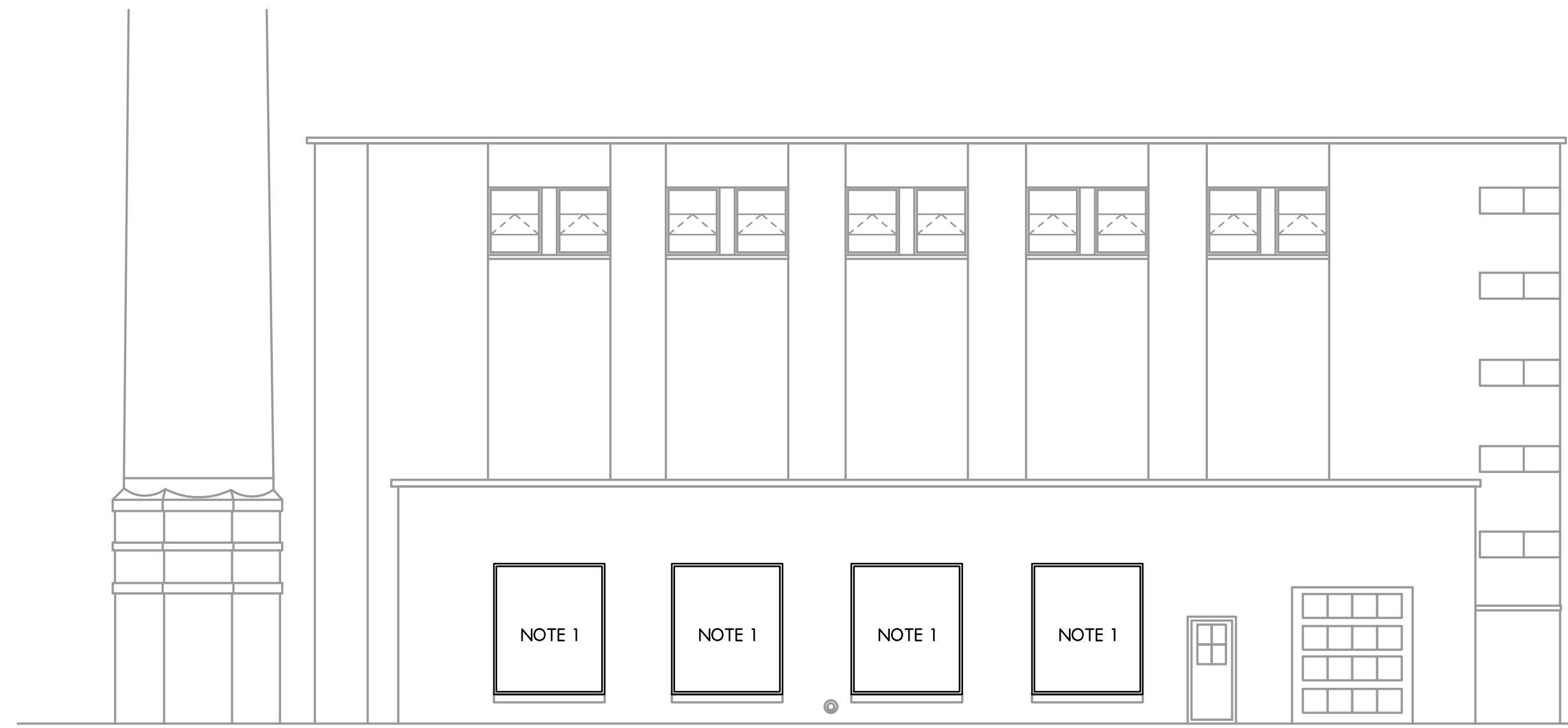
5 EXISTING C.I.P. CONCRETE CEILING PLAN  
SCALE: 1/8" = 1'-0"



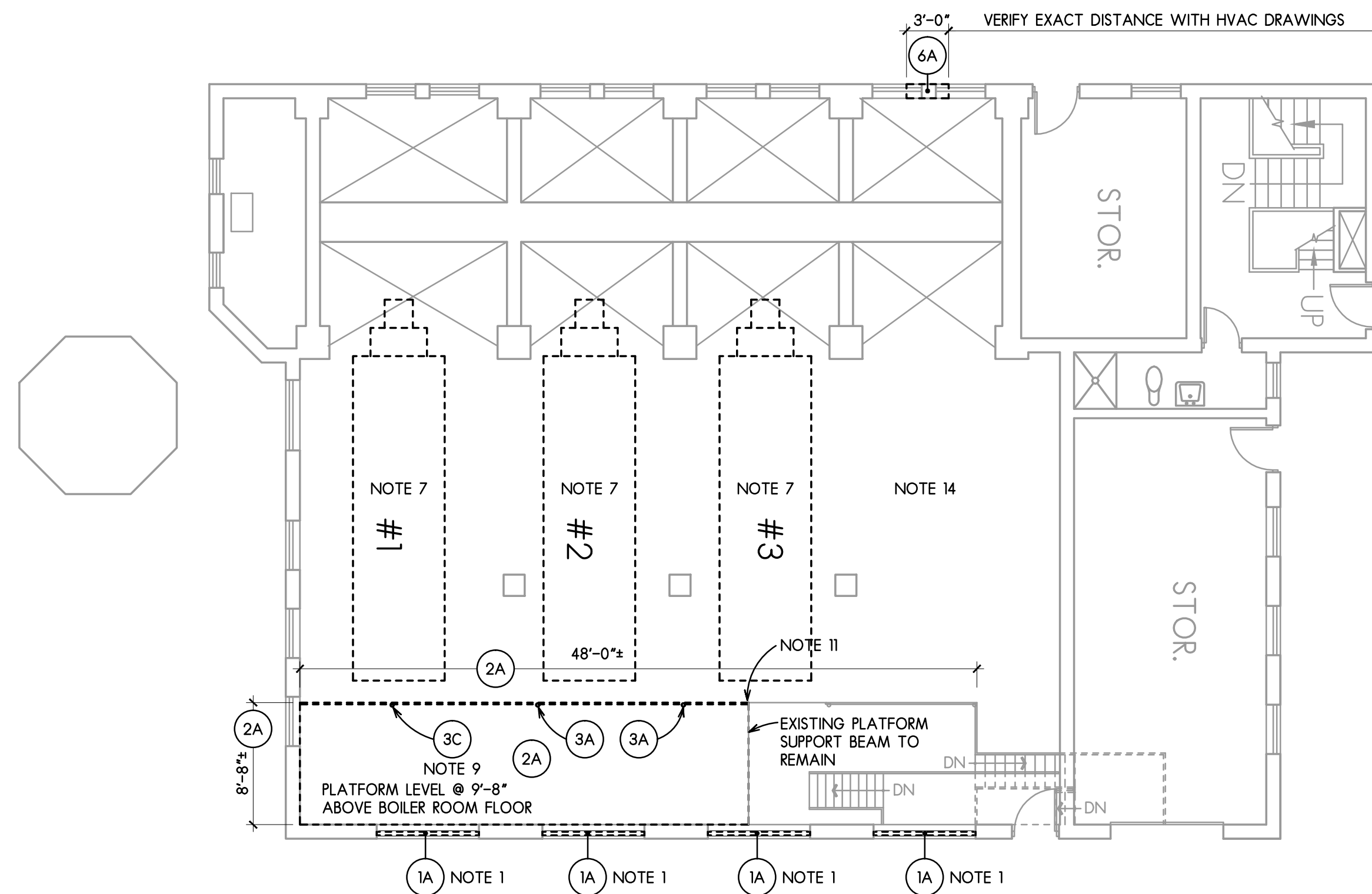
7 DEMOLITION NORTH ELEVATION  
SCALE: 1/8" = 1'-0"



3 DEMOLITION SOUTH ELEVATION  
SCALE: 1/8" = 1'-0"

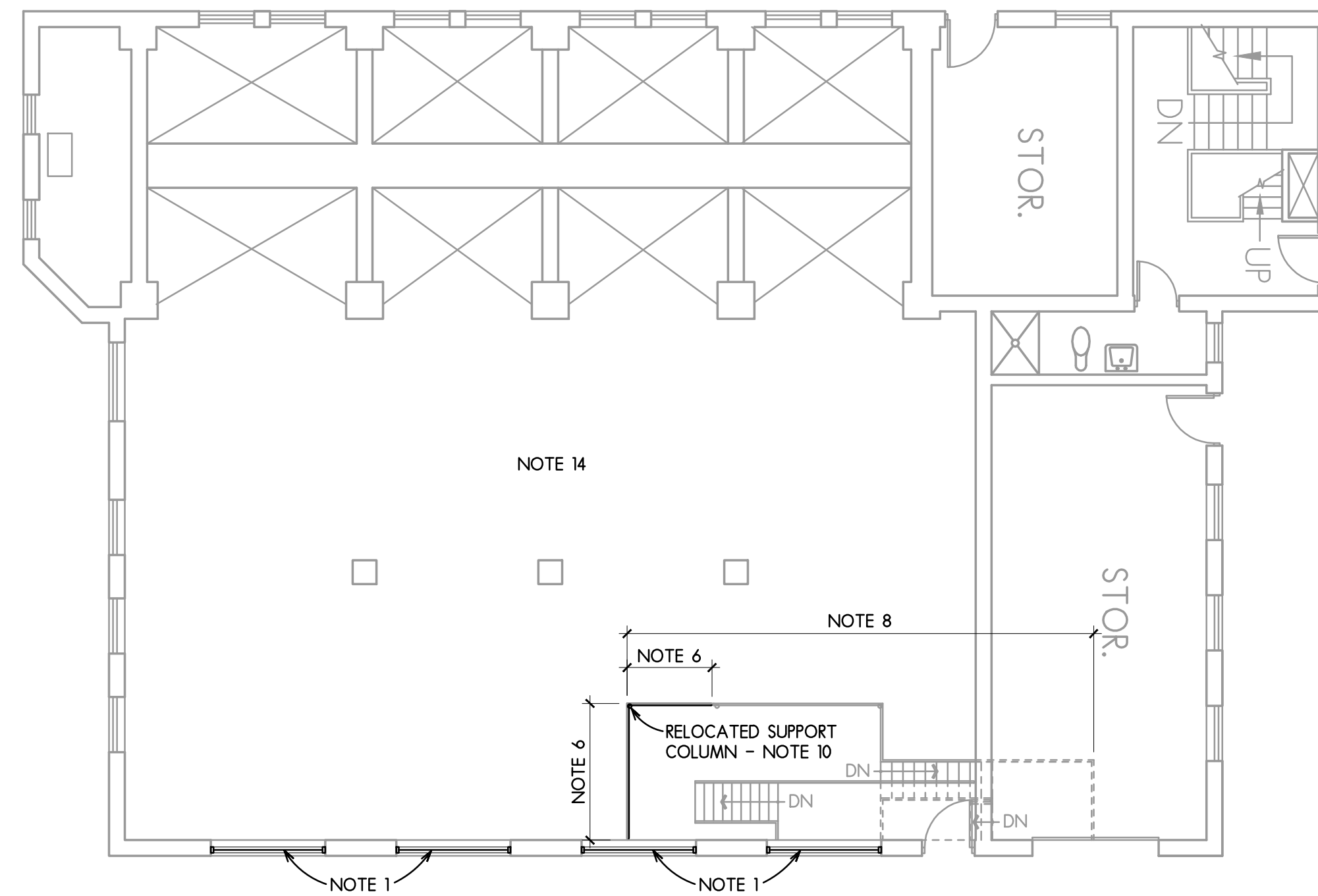


4 REVISED SOUTH ELEVATION  
SCALE: 1/8" = 1'-0"



1 DEMOLITION FIRST FLOOR PLAN  
SCALE: 1/8" = 1'-0"

NOTE:  
ALL DEMOLITION OF EXISTING SOUTH METAL GRATE PLATFORMS  
TO BE BID AS ALTERNATE #3 - BASE BID IS NO DEMO. OF ANY  
PORTION OF SOUTH PLATFORMS.

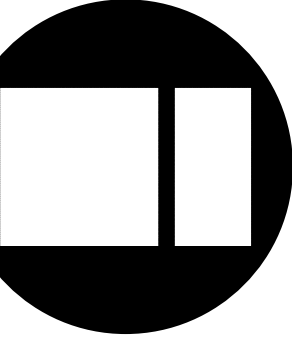


2 REVISED FIRST FLOOR PLAN  
SCALE: 1/8" = 1'-0"

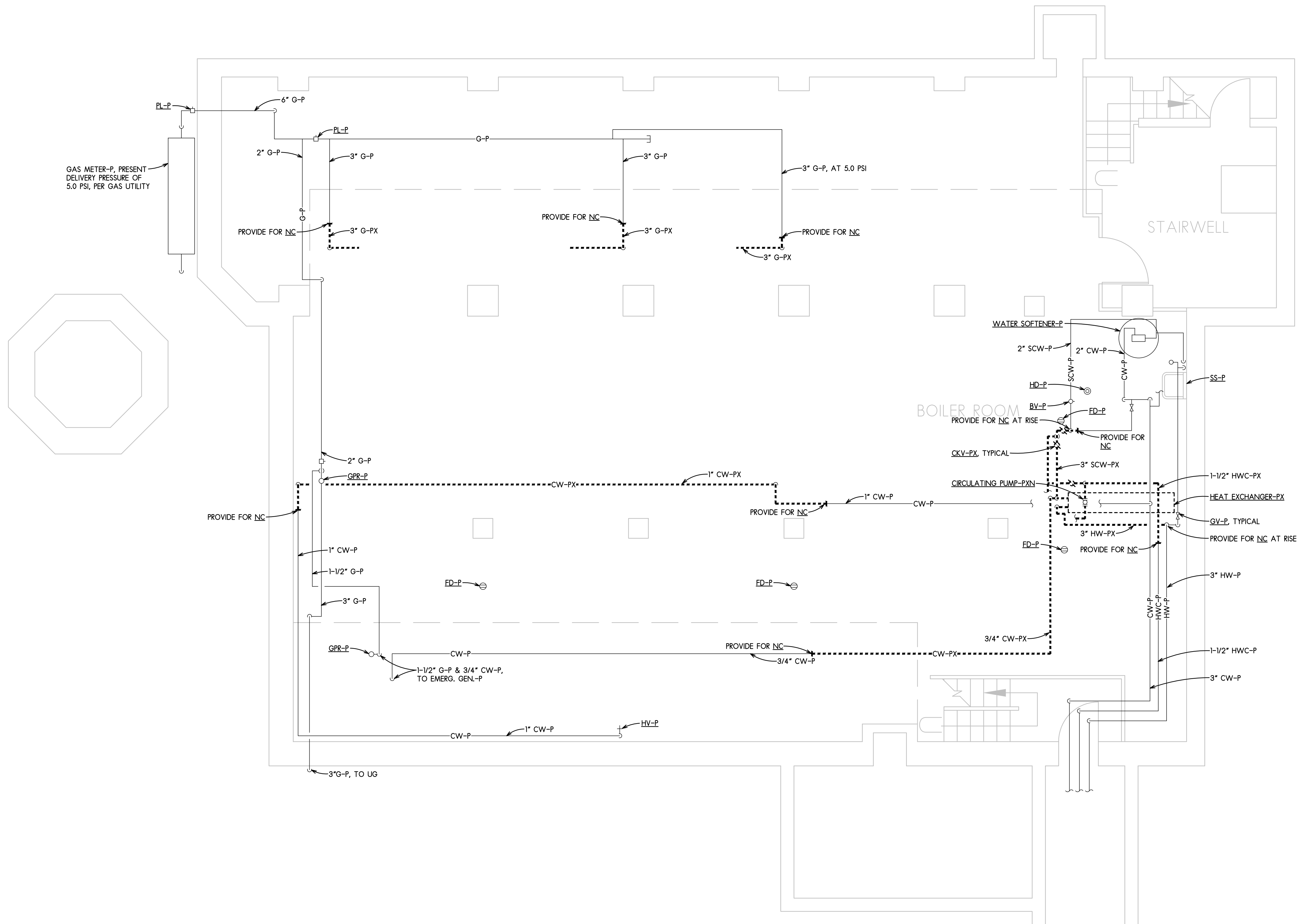
DEMOLITION KEYNOTES	
ITEM:	
1	WINDOW UNIT
2	METAL GRATE PLATFORM CONSTRUCTION
3	PLATFORM COLUMNS
4	CAST IN PLACE CONCRETE PAN
5	CAST IN PLACE CONCRETE WALL CONSTRUCTION
6	MASONRY WALL CONSTRUCTION
ACTION:	
A	REMOVE AND DISCARD
B	REMOVE AND TURN OVER TO OWNER
C	REMOVE AND STORE FOR REUSE
GENERAL NOTES: FOR DEMOLITION	
1. ABATEMENT CONTRACTOR HIRED SEPARATELY BY OWNER WILL REMOVE EXISTING WINDOWS AND INSTALL PLYWOOD AND FRAMING TO FILL IN THE OPENINGS - G.C. WILL REMOVE PLYWOOD AND RETURN TO ABATEMENT CONTRACTOR - UPON COMPLETION OF BOILER REPLACEMENT NEW WINDOWS TO BE INSTALLED UNDER SEPARATE CONTRACT.	
2. ITEMS REMOVED AND TURNED OVER TO OWNER SHALL BE TRANSPORTED TO A ROOM OR AREA ONSITE DESIGNATED BY THE OWNER/PROJECT ARCHITECT.	
3. WHERE ITEMS ARE REMOVED, THE SUBSTRATE SHALL BE REPAIRED, PATCHED, CLEANED, ETC. TO A CONDITION SUITABLE TO RECEIVE NEW WORK AND OR FINISHES.	
4. ITEMS TO BE DISPOSED, SHALL BE REMOVED FROM THE SITE ON A TIMELY BASIS.	
5. VERIFY EXACT LIMITS OF STAIR DEMOLITION WITH OWNER PRIOR TO REMOVING ANY LANDINGS.	
6. INSTALL NEW PIPE RAILING TO MATCH HEIGHT AND PROFILE OF EXISTING ADJACENT RAILING TO REMAIN - THIS RAILING TO BE INSTALLED AT THE EXISTING PLATFORM LEVEL - ATTACH TO TOP OF EXISTING PLATFORM BEAM IN SIMILAR FASHION AS EXISTING RAILINGS.	
7. SEE MECHANICAL PLANS FOR LIMITS OF BOILER DEMOLITION.	
8. ACCESS FROM EXTERIOR GRADE LEVEL TO BOILER ROOM FLOOR LEVEL TO BE MAINTAINED WITH EXISTING METAL GRATE STAIR.	
9. RELOCATE EXISTING COLUMN INCLUDING BASE AND CAP PLATE TO THE END OF REMAINING PLATFORM - SEE REVISED PLAN FOR LOCATION.	
10. RELOCATED EXISTING COLUMN TO BE THRU-BOLTED TO REMAINING PLATFORM SUPPORT BEAM AT TOP AND EXPANSION BOLTED INTO EXISTING FLOOR SLAB AT BOTTOM - SHIM TO LEVEL AS NECESSARY.	
11. SHORE END OF EXISTING PLATFORM TO REMAIN WHILE EXISTING BEAM IS CUT AND EXISTING COLUMN IS RELOCATED - REST REMAINING END ON RELOCATED COLUMN CAP PLATE.	
12. REMOVE PORTION OF CAST IN PLACE CONCRETE PAN STRUCTURE TO ACCOMMODATE NEW MECH. INTAKE, EXHAUST AND FLUE PENETRATIONS - SEE MECH. PLAN M12 FOR EXACT LOCATION AND SQUARE FOOTAGE NECESSARY - NO DEMOLITION TO OCCUR IN ANY CONCRETE BEAMS OR JOISTS.	
13. REMOVE PORTION OF CAST IN PLACE CONCRETE WALL CONSTRUCTION TO ACCOMMODATE NEW MECH. INTAKE AND FLUE PENETRATIONS - SEE MECH. PLAN M11 FOR EXACT LOCATION AND SIZE NECESSARY.	
14. UPON COMPLETION OF DEMOLITION WORK IN THE BOILER ROOM, G.C. TO PATCH EXISTING CONCRETE FLOOR TO A LEVEL AND SMOOTH FINISH IN ALL AREAS DAMAGED DURING DEMO. WORK.	
15. AFTER INSTALLATION OF HVAC COMBUSTION AIR INTAKE HOOD, POWER ROOF EXHAUST AND FLUE THROUGH ROOF IS COMPLETE, G.C. TO REPAIR ADJACENT ROOF TO A WEATHER-TIGHT SEAL IN A MANNER APPROPRIATE FOR THE TYPE OF ROOF CONSTRUCTION THAT EXISTS - VERIFY PRIOR TO DEMOLITION.	
16. G.C. TO REMOVE PORTION OF MASONRY WALL TO ACCOMMODATE NEW EXHAUST FAN - SEE HVAC SHEETS AND VERIFY EXACT LOCATION AND SIZE PRIOR TO CUTTING OPENINGS.	

## DEMOLITION AND REVISED FLOOR PLAN AND ELEVATION

SCALE: AS NOTED



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**PLUMBING DEMOLITION PLAN**

SCALE: 1/4" = 1'-0"

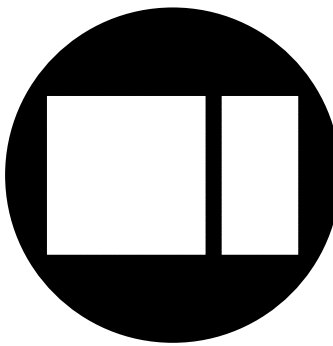


DATE: 02-29-2016	PROJECT NUMBER	SHEET NUMBER
	<b>25107</b>	<b>PD1.1</b>

ISSUED FOR:	DATE
100	02-29-16
DRAWN	APPROVED
TW	RAS

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**WEST MIDDLE SCHOOL  
HVAC AND ELECTRICAL RENOVATIONS - ROCKFORD IL  
ROCKFORD PUBLIC SCHOOLS 205**



**Larson & Darby Group**  
Architects Engineers Interiors  
Rockford Office - 4445 Harrison Ave., Suite 100, Rockford, IL 61105 Tel (815) 494-0739 Fax (815) 225-9607

MARK	DESCRIPTION	MARK	DESCRIPTION
AFF	ABOVE FINISHED FLOOR	HW	HOT WATER
BFP	BACKFLOW PREVENTER	HWC	HOT WATER CIRCULATING
BV	BALL VALVE	HV	HOSE VALVE
CKV	CHECK VALVE	NC	NEW CONNECTION
CW	COLD WATER	P	PRESENT
D	DROP	PL	PLUG VALVE
FBF	FROM BELOW FLOOR	R	RISE
FBHVACC	FURNISHED BY HVAC CONTRACTOR	SA	SANITARY SEWER
FBO	FURNISHED BY OTHERS	SCW	SOFT COLD WATER
FD	FLOOR DRAIN	SS	SERVICE SINK
G	GAS PIPING	TAF	TO ABOVE FLOOR
GPR	GAS PRESSURE REGULATOR	UG	UNDER GROUND
GWH	GAS WATER HEATER	VL	VERIFY LOCATION
HD	HUB DRAIN	WT	WATER THERMOMETER

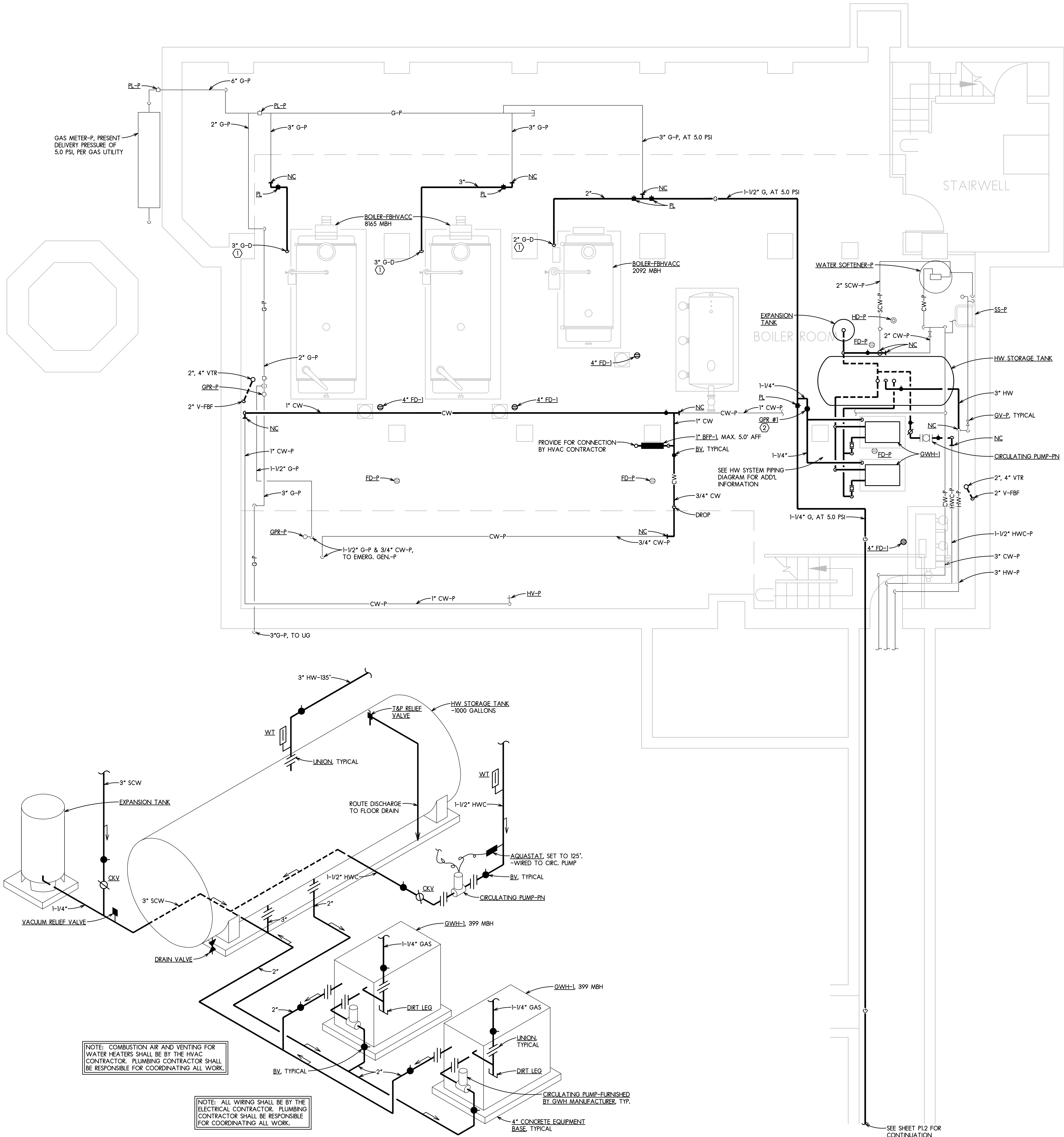
MARK	SYMBOL	DESCRIPTION
CW		COLD WATER
SCW		SOFT COLD WATER
HW		HOT WATER
HWC		HOT WATER CIRCULATING
G		GAS
SA		SANITARY SEWER (UNDERGROUND OR UNDER FLOOR)
R		RISE
D		DROP
NC		NEW CONNECTION
FD		FLOOR DRAIN
HD		HUB DRAIN (FOR SANITARY SEWER SYSTEM)
BV		BALL VALVE
BV-P		BALL VALVE PRESENT
PL		PLUG VALVE
PL-P		PLUG VALVE PRESENT
CKV		CHECK VALVE
GPR		GAS PRESSURE REGULATOR
UN		UNION
		DIRECTION OF SYSTEM FLOW

PLUMBING PIPING LEGEND	
	NEW PIPING
	PRESENT PIPING TO REMAIN ("P")
	PRESENT PIPING TO BE REMOVED ("PX")

### PLUMBING GENERAL NOTES:

- DRAWINGS ARE GENERALLY DIAGRAMMATIC. EACH CONTRACTOR SHALL MAKE REQUIRED CHANGES FROM THE GENERAL ROUTING SHOWN ON THESE DRAWINGS SUCH AS OFFSETS, BENDS OR CHANGES IN ELEVATION DUE TO COORDINATION WITH THE WORK OF OTHER TRADES AND THE BUILDING CONSTRUCTION. ALL CHANGES SHALL BE MADE WITHOUT ADDITIONAL COST TO THE OWNER.
- EACH CONTRACTOR SHALL CHECK DRAWINGS OF THE OTHER CONTRACTORS TO VERIFY SPACES IN WHICH THEIR WORK WILL BE INSTALLED IS CLEAR OF OBSTRUCTIONS. MAINTAIN MAXIMUM HEADROOM AND SPACE CONDITIONS AT ALL POINTS IN THE BUILDING. WHERE HEADROOM OR SPACE CONDITIONS APPEAR INADEQUATE, NOTIFY ARCHITECT/ENGINEER BEFORE PROCEEDING WITH THE INSTALLATION.
- WHERE THERE IS EVIDENCE THAT THE WORK OF ONE CONTRACTOR WILL INTERFERE WITH THE WORK OF OTHER CONTRACTORS, EACH CONTRACTOR SHALL ASSIST IN WORKING OUT SPACE CONDITIONS TO MAKE SATISFACTORY ADJUSTMENTS.
- UNUSED OPENINGS IN PIPING SHALL BE CAPPED OR PLUGGED; THOSE IN CONDUITS, BOXES, CABINETS AND PANELS SHALL BE FIELDED. STRUCTURAL MEMBERS AND SUPPORTS SHALL NOT BE CUT UNLESS AUTHORIZED BY ARCHITECT, IN WRITING.
- PRESENT PAINTED CONSTRUCTION WHICH IS MARKED SHALL BE REPAINTED SAME AS NEW CONSTRUCTION.
- THESE DRAWINGS ARE BASED UPON INFORMATION FURNISHED TO THE ENGINEER BY THE OWNER, BY THE ORIGINAL DRAWINGS AND BY VISUAL SURVEY WHERE POSSIBLE. THE CONTRACTOR SHALL CAREFULLY CONSIDER ALL INFORMATION PRESENTED ON THESE DRAWINGS AND SHALL BE RESPONSIBLE FOR REPORTING ANY DISCREPANCIES DISCOVERED.
- CONTRACTOR IS ALLOWED TO MAKE MINOR CHANGES TO PIPING, ETC., FROM THAT SHOWN ON DRAWINGS AS REQUIRED TO AVOID FIELD CONFLICTS AT NO ADDITIONAL COST TO THE OWNER AND AS LONG AS THE RELOCATION DOES NOT AFFECT THE PERFORMANCE OF THE SYSTEM.
- THE PRESENT PLUMBING SYSTEMS OF ANY TYPE, INCLUDING UTILITY SERVICES, SHALL NOT BE INTERRUPTED EXCEPT AS DIRECTED BY THE OWNER. WHEN SUCH INTERRUPTIONS ARE ALLOWED, THE SYSTEM SHALL BE PUT BACK INTO OPERATION AS SOON AS POSSIBLE, BUT NO LATER THAN AT THE END OF THE NORMAL WORKING DAY, UNLESS SPECIFIC DIRECTION IS OTHERWISE GIVEN.
- CONTRACTOR SHALL VERIFY ALL PRESENT CONDITIONS INCLUDING, BUT NOT LIMITED TO, PIPE SIZES, LOCATIONS, INVERTS, TEMPERATURES, ELEVATIONS, PRESSURES, ETC., AND MAKE MODIFICATIONS FOR WORK SHOWN AS REQUIRED TO ACCOMMODATE PRESENT OR NEW CONSTRUCTION. ALL AT NO INCREASE IN CONTRACT PRICE.
- EQUIPMENT REQUIRING ELECTRICITY SHALL HAVE EQUIPMENT FURNISHED BY THE PLUMBING CONTRACTOR, BUT SHALL BE WIRED BY THE ELECTRICAL CONTRACTOR. THE PLUMBING CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING REQUIRED ELECTRICAL INFORMATION WITH THE ELECTRICAL CONTRACTOR. SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION.
- THE INSTALLATION OF ALL PIPING SHALL MEET THE REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE (NEC) AS IT PERTAINS WITH CLEARANCE OF PIPING IN RELATIONSHIP TO ELECTRICAL SWITCHGEAR, ELECTRICAL EQUIPMENT, ELECTRICAL PANELS, ETC. PIPING SHALL NOT CROSS OVER THE TOP OF OR IMPINGE UPON ELECTRICAL EQUIPMENT.
- CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CUTTING AND PATCHING, INCLUDING CORE DRILLING, SAW CUTTING, ETC., AS REQUIRED TO ACCOMMODATE HIS WORK.
- CONTRACTOR TO PROVIDE RECORD DRAWINGS INDICATING THE LOCATION OF ALL PLUMBING SYSTEMS NOTED HEREIN.
- CONTRACTOR SHALL INSTALL HIS WORK IN ACCORDANCE WITH ALL LAWS, RULES, REGULATIONS, CODES, ETC. PER ALL FEDERAL, STATE AND LOCAL REQUIREMENTS.
- CONTRACTOR SHALL WARRANTY HIS SYSTEMS FOR A PERIOD OF ONE (1) YEAR.
- CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR ALL MATERIALS AND EQUIPMENT ITEMS.
- CONTRACTOR SHALL SECURE AND PAY FOR ALL PERMITS, FEES, INSPECTIONS, ETC. AS REQUIRED FOR HIS WORK.
- ALL SYSTEMS SHALL BE TESTED PER APPLICABLE CODE.
- CERTAIN PREFIXES OR LINE SYMBOLS, WHEN APPLIED TO PRESENT LINE, DEVICE OR EQUIPMENT, SHALL HAVE THE FOLLOWING MEANINGS.

NC:	NEW CONNECTION TO EXISTING EQUIPMENT OR MATERIAL.
P:	PRESENT, TO REMAIN UNCHANGED.
PX:	PRESENT, TO BE COMPLETELY REMOVED INCLUDING UNNEEDED CONNECTIONS, PIPING, DUCTWORK, CONTROL WIRING, THERMOSTATS, BASES, ETC. OF EVERY KIND, UNUSED OPENINGS PLUGGED OR CAPPED, TESTED, COVERED, PAINTED SAME AS NEW WORK. OTHER DISTURBED WORK OF EVERY KIND RESTORED, PATCHED, TESTED, COVERED, PAINTED, ETC. TO EQUAL ORIGINAL CONDITION. REMOVED MATERIALS SHALL NOT BE REUSED UNLESS OTHERWISE SPECIFIED OR DIRECTED BY ARCHITECT/ENGINEER.
PXR:	SAME AS "PX", EXCEPT REMOVED, CLEANED AND RESTORED TO GOOD OPERATING CONDITION, AND REINSTALLED, SAME AS NEW WORK IN ORIGINAL POSITION. IF RECONDITIONING IS IMPRACTICAL, PROVIDE NEW DEVICE, AS APPROVED BY ARCHITECT/ENGINEER, AT NO INCREASE IN CONTRACT PRICE.
PXN:	SAME AS "PXR" EXCEPT REMOVED, CLEANED AND RESTORED TO GOOD OPERATING CONDITION AND REINSTALLED SAME AS NEW WORK, IN NEW POSITION MARKED "PN, ETC.". IF RECONDITIONING IS IMPRACTICAL, PROVIDE NEW DEVICE, AS APPROVED BY ARCHITECT/ENGINEER, AT NO INCREASE IN CONTRACT PRICE.
PN:	COMPLETELY REINSTALL DEVICE, LINE OR EQUIPMENT REMOVED AT "PXN, ETC." IN INDICATED NEW LOCATION, SAME AS NEW WORK.
VL:	VERIFY EXACT LOCATION IN FIELD, THIS NOTE APPLIES TO ALL PRESENT OR EXISTING UTILITIES AND CONSTRUCTION WHETHER CALLED FOR OR NOT.

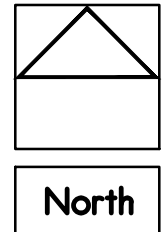


1 HOT WATER SYSTEM PIPING DIAGRAM  
NO SCALE

### NOTES:

- CONNECT TO GAS FIRED EQUIPMENT WITH GAS COCK, UNION AND DIRT LEG. COORDINATE EXACT LOCATION IN FIELD.
- ROUTE VENT FROM GAS PRESSURE REGULATOR (GPR) TO EXTERIOR. COORDINATE EXACT TERMINATION POINT AND ROUTING IN FIELD.

**NEW WORK  
PLUMBING BOILER ROOM PLAN**  
SCALE: 1/4" = 1'-0"



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### WATER HEATER SCHEDULE

#### ACCEPTABLE MANUFACTURERS:

WATER HEATER: A. O. SMITH, OR OWNER APPROVED EQUIVALENT.  
EXPANSION TANKS: AMTROL, WATTS, WESSELS, OR OWNER APPROVED EQUIVALENT.  
VACUUM RELIEF VALVE: WATTS, OR OWNER APPROVED EQUIVALENT.

#### ITEMS:

GW-H-1:  
399,000 BTU/HR INPUT, 412 GPH RECOVERY AT 100 DEGREE F. RISE, 5-YEAR LIMITED WARRANTY. FIN-TUBE 2-PASS DESIGN, WITH STRAIGHT SOLID COPPER TUBES HAVING EXTRUDED INTEGRAL FINIS. TUBES SHALL TERMINATE INTO A ONE-PIECE, LINED, CAST-IRON HEADER. HEATER SHALL BE EQUIPPED WITH A FACTORY INSTALLED AND WIRED LOW-LEAD CIRCULATING PUMP OF SUFFICIENT CAPACITY TO INSURE SCALE-FREE HEATER PERFORMANCE. COMBUSTION CHAMBER SHALL BE ENCLOSED BY HIGH TEMPERATURE RESISTANT, 1" CERAMIC FIBERBOARD INSULATION. UNIT SHALL BE CONSTRUCTED WITH A HEAVY GAUGE JACKET, GALVANIZED INSIDE AND OUTSIDE, AND PROTECTED WITH A 3-COAT ACRYLIC FINISH. UNIT SHALL HAVE BUILT-IN DRAFT DIVERTER CONTAINED ENTIRELY WITHIN THE JACKET. CONTROLS SHALL INCLUDE ON/OFF SWITCH, FLOW SWITCH, LOW AIR PRESSURE SWITCH, INLET/OUTLET TEMPERATURE SENSORS, TEST COCKS, 100% SAFETY PILOT SHUTDOWN, DUAL ADJUSTABLE HI-LIMIT CONTROLS, REDUNDANT GAS VALVES, MAIN AND PILOT GAS PRESSURE REGULATORS, AND ASME TEMPERATURE AND PRESSURE RELIEF VALVE. UNIT SHALL HAVE LCD DISPLAY, BUILT-IN CASCADING SEQUENCER FOR UP TO 8-HEATERS, BMS SYSTEM INTEGRATION, LOW WATER FLOW CONTROL AND INDICATION, INLET AND OUTLET TEMPERATURE READOUT, PUMP CONTROL FOR WATER HEATER PUMP AND RECIRCULATION PUMP AND CONTACTS FOR CONNECTION OF DEVICES.WATER HEATER SHALL MEET THE MINIMUM REQUIREMENTS OF ASHRAE 90A AND SHALL BE ASME AND AGA CERTIFIED AND UL LISTED. A. O. SMITH MODEL NO. GW-H-400.

EXPANSION TANK:  
ASME WELDED STEEL TANK WITH HEAVY DUTY BUTYL DIAPHRAGM SEPARATING AIR AND WATER RESERVOIRS. RIGID POLYPROPYLENE-LINED WATER RESERVOIR. AIR CHARGING VALVE, RED OXIDE PRIMER FINISH. 1-1/4" WATER INLET, 55 GALLON CAPACITY. PRE-CHARGED TO 55 PSIG. AMTROL MODEL NO. ST-80VC.

VACUUM RELIEF VALVE:  
BRASS BODY, HIGH HEAT-RESISTING DISC, VALVE TO CLOSE QUICKLY AND TIGHTLY UNDER PRESSURE AND OPEN ON VACUUM OF NOT OVER 1/2" MERCURY COLUMN. WATTS NO. N36.

### BACKFLOW PREVENTER SCHEDULE

#### ACCEPTABLE MANUFACTURERS:

AMES, CONBRACO, FEBCO, WATTS, WILKINS, OR OWNER APPROVED EQUIVALENT.

#### ITEMS:

BFP-1:  
REDUCED PRESSURE ZONE BACKFLOW PREVENTER, MAIN BODY AND ACCESS COVERS SHALL BE LOW LEAD BRONZE, SEAT RING AND INTERNAL POLYMERS SHALL BE NSF LISTED NORYL AND SEAT ELASTOMERS SHALL BE SILICONE. DEVICE SHALL BE NSF/ANSI 372 CERTIFIED AND ASSE 103 LISTED, WITH FULL PORT UNION BALL VALVES, TEST COCKS, LEAD FREE BRONZE Y-TYPE STRAINER AND AIR GAP ASSEMBLY. WILKINS NO. 975XL2U-S-AG.

### CLEANOUT SCHEDULE

#### ACCEPTABLE MANUFACTURERS:

JOSAM, MIFAB, WADE, ZURN.

#### ITEMS:

FLOOR CLEANOUT-UNFINISHED FLOOR AREAS: CAST IRON, THREADED OR INSIDE CAULK AT GRADE ADJUSTABLE HOUSING, FERRULE WITH PLUG, MEDIUM DUTY CAST IRON SECURED SCORIATED COVER. ZURN NO. ZN1400-HD.

### FLOOR DRAIN SCHEDULE

#### ACCEPTABLE MANUFACTURERS:

JOSAM, MIFAB, WADE, ZURN.

#### ITEMS:

FD-1:  
CAST IRON FLANGE, SEDIMENT BUCKET, HEAVY DUTY GRATE SUPPORTED BY BUCKET, ROUND STRAINER, BOTTOM OUTLET, SEPARATE P-TRAP, NOT FLASHED. ZURN NO. Z-550-Y.

### HOT WATER STORAGE TANK SCHEDULE

#### ACCEPTABLE MANUFACTURERS:

LOCHINVAR, SMITH, OR OWNER APPROVED EQUIVALENT.

#### ITEMS:

HORIZONTAL CONFIGURATION, ASME CONSTRUCTED WITH TAPPINGS FOR INSTALLATION OF ACCESSORIES, RATED AND STAMPED FOR WORKING PRESSURE OF 125 PSI. GLASS LINED WITH MAGNESIUM ANODES, MANWAY, LIFTING LUGS AND TANK SADDLES. TANK SHALL HAVE MINIMUM ONE PRIME COAT OF PAINT ON EXTERNAL SURFACE. FIELD INSULATED. MINIMUM 1000 GALLON CAPACITY, 48" DIAMETER.

GAS PRESSURE REGULATOR (GPR) SCHEDULE				
TAG	INPUT (MBH)	INLET PRESSURE	OUTLET PRESSURE	SIZE (INLET/OUTLET)
GPR #1	798	5.0 PSI	10" W.C.	1-1/4" x 1-1/2"
GPR #2	650	5.0 PSI	10" W.C.	1-1/4" x 1-1/4"

#### NOTES:

NOTE-1:  
GAS PRESSURE REGULATORS: SELF CONTAINED, SELF OPERATED, SPRING LOADED OR PRESSURE LOADED REGULATOR. UNIT TO HAVE AN INTERNAL RELIEF TO MINIMIZE OVER-PRESSURE AND SHALL ALLOW EXCESS PRESSURE TO BLEED OUT THROUGH THE SCREENED SPRING CASE VENT.  
REGULATOR SHALL HAVE VALVES BEFORE AND AFTER AND WITH UNION ON INLET SIDE. REGULATOR SHALL BE SUITABLE FOR NATURAL GAS AT 0.60 SPECIFIC GRAVITY.  
ACCEPTABLE MANUFACTURERS: DRESSER, EQUIMETER, FISHER OR ROCKWELL-NORDSTROM.

### GAS PRESSURE REGULATOR (GPR) SCHEDULE

NO SCALE

## 1 PLUMBING TUNNEL PLAN

SCALE: 1/8" = 1'-0"

## 2 UNDERFLOOR PLUMBING PLAN

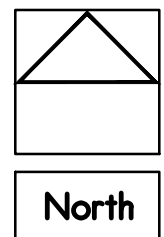
SCALE: 1/4" = 1'-0"

### NOTES:

- CONNECT TO GAS FIRED EQUIPMENT WITH GAS COCK, UNION AND DIRT LEG. COORDINATE EXACT LOCATION IN FIELD.
- ROUTE VENT FROM GAS PRESSURE REGULATOR (GPR) TO EXTERIOR. COORDINATE EXACT TERMINATION POINT AND ROUTING IN FIELD.
- WHEN SAW CUTTING FLOOR, CONTRACTOR SHALL USE CAUTION TO PREVENT CUTTING OF ANY EXISTING UNDERFLOOR UTILITIES. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING UNDERFLOOR UTILITIES PRIOR TO CUTTING FLOOR VIA X-RAY EQUIPMENT. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO REPAIR ANY DAMAGES TO THE EXISTING UTILITIES IF DAMAGES OCCURRED DURING CONSTRUCTION, AT NO ADDITIONAL COST TO OWNER.
- TO PATCH FLOORS, DRILL & DOWEL EXISTING CONCRETE WITH #4 ROD AT 16" OC. ROD SHALL BE 12" LONG AND EXTEND 6" INTO EXISTING CONCRETE. REPLACE SLAB WITH CONCRETE AND ONE LAYER OF 6x6-8/8 WWF. 1" CLEAR TO TOP, ON TOP OF 15 MIL VAPOR BARRIER OVER COMPACTED GRANULAR FILL, FIELD VERIFY AND MATCH EXISTING SLAB THICKNESS. DO NOT UNDERMINE OR DISTURB BUILDING FOUNDATION.

## PARTIAL PLUMBING PLANS AND PLUMBING SCHEDULES

SCALE: AS NOTED



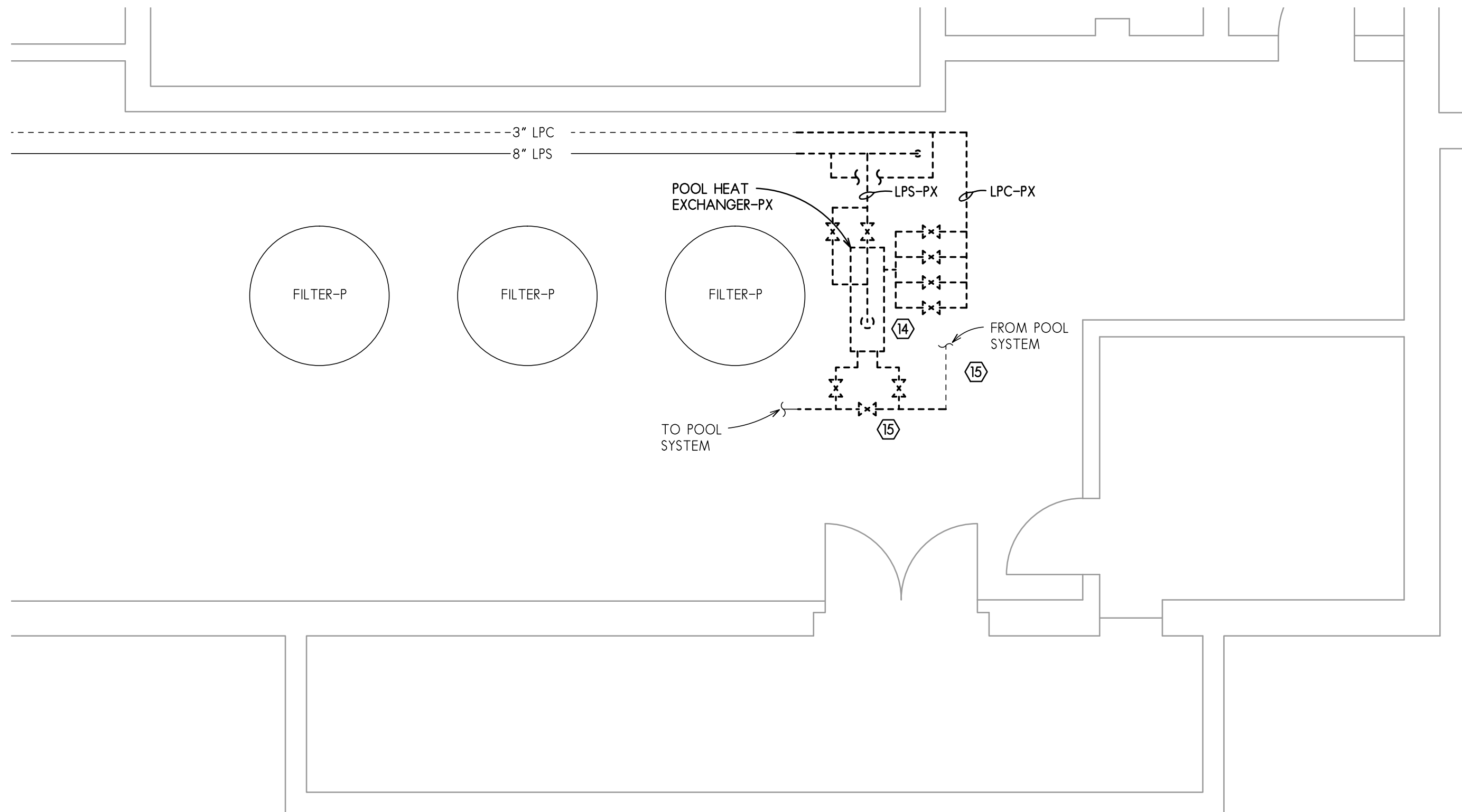
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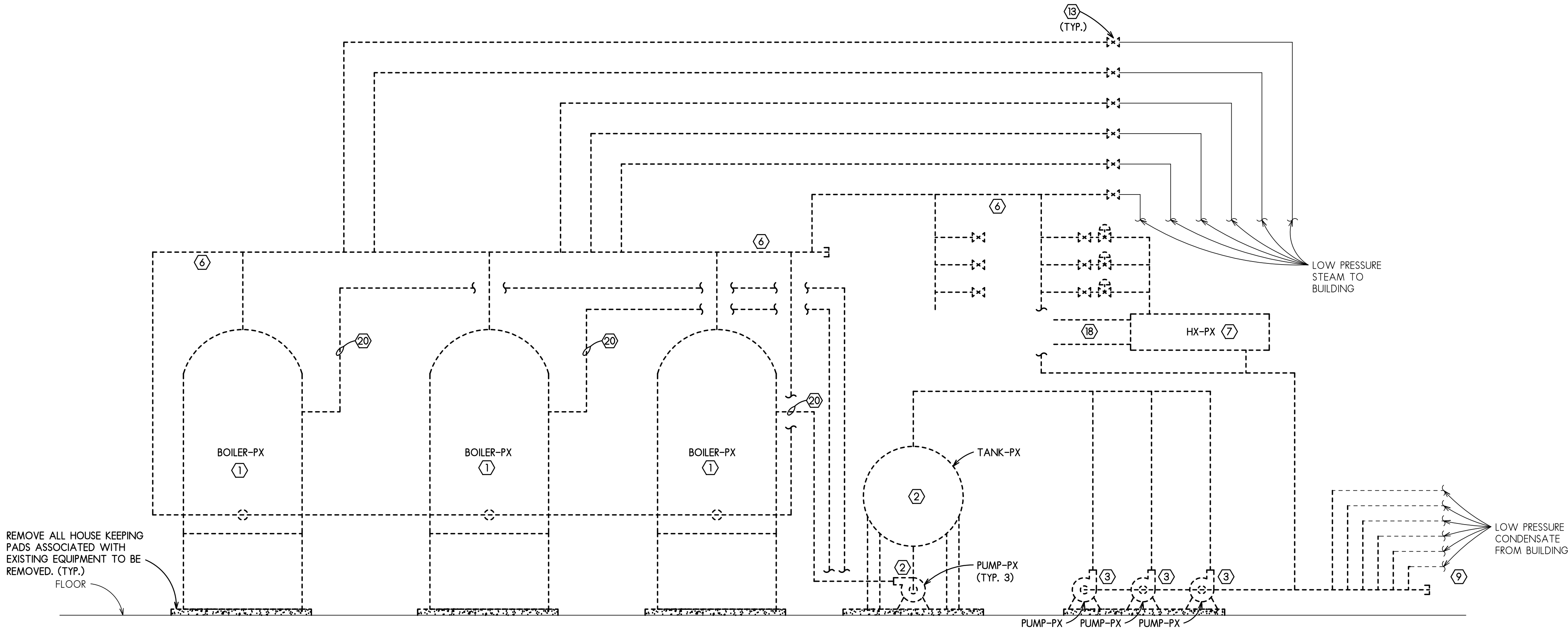
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	P1.2



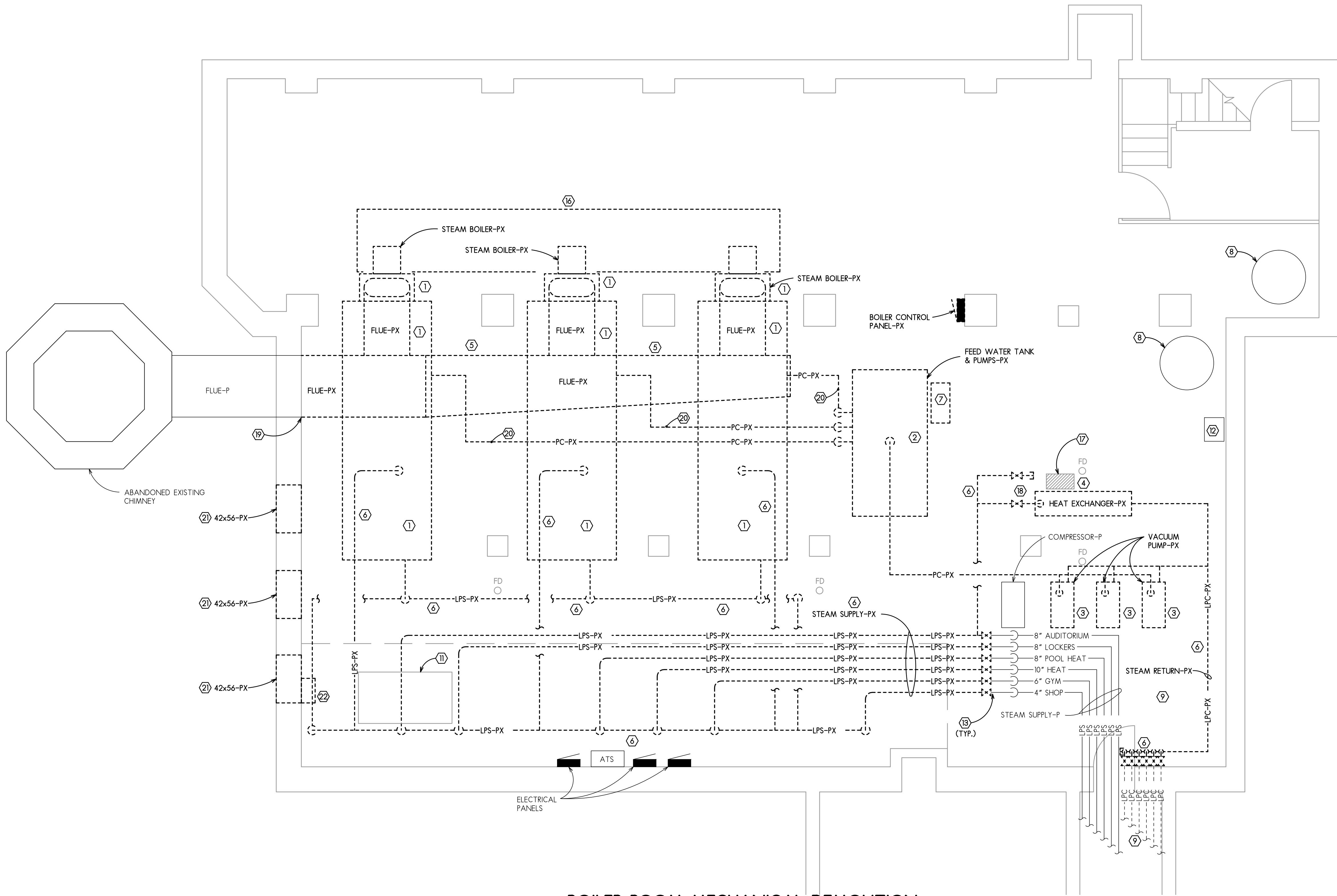
**3 ALT-M1: POOL HEATER DEMOLITION PLAN**  
SCALE: 1/4" = 1'-0"



**2 BOILER ROOM PIPING DIAGRAM**  
SCALE: N/A

**DEMOLITION KEYED NOTES**

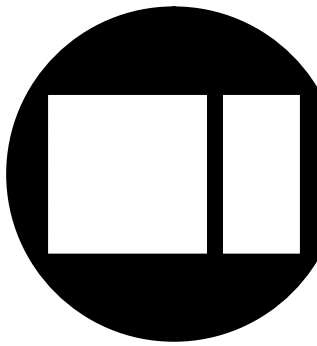
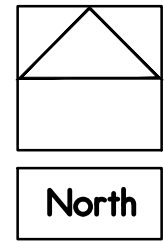
- 1 REMOVE EXISTING STEAM BOILER, MASONRY, REFRACTORY, STRUCTURAL SUPPORT, NATURAL GAS ATMOSPHERIC BURNER, BURNER CONTROL PANEL, CONTROLS, TRIM, RELIEF VALVES, ASSOCIATED VALVES AND PIPING, INSULATION, ETC. AS REQUIRED FOR THE INSTALLATION OF NEW BOILERS AS SHOWN ON NEW WORK PLANS
- 2 REMOVE EXISTING BOILER FEED SYSTEM, TANK, PUMPS, SUPPORTS, CONTROLS, ASSOCIATED PIPING, VALVES, CONTROLS, INSULATION, ETC...
- 3 REMOVE EXISTING VACUUM CONDENSATE PUMP AND ASSOCIATED PIPING, VALVES, CONTROLS, CONCRETE PAD, ETC...
- 4 REMOVE EXISTING DOMESTIC WATER SHELL & TUBE HEAT EXCHANGER AND ASSOCIATED SUPPORTS, PIPING, VALVES, CONTROLS, INSULATION, ETC...
- 5 REMOVE EXISTING BREECHING, SUPPORT, INSULATION, ETC...
- 6 REMOVE EXISTING STEAM/CONDENSATE/PUMPED CONDENSATE/MAKE-UP/DRAIN PIPING, VALVES, SUPPORTS, INSULATION, ETC...
- 7 REMOVE EXISTING CHEMICAL FEEDER SYSTEM.
- 8 EXISTING WATER SOFTENER EQUIPMENT TO REMAIN.
- 9 EXISTING STEAM/CONDENSATE/PIPING TO REMAIN.
- 10 EXISTING CONTROL PANEL & EQUIPMENT, AIR COMPRESSOR, CONCRETE PAD, AIR DRYER, AND ALL ASSOCIATED PNEUMATIC PIPING, VALVES & CONTROLS PART OF EXISTING ACTIVE SYSTEMS IN THE BUILDING SHALL REMAIN.
- 11 EXISTING EMERGENCY GENERATOR.
- 12 EXISTING SERVICE SINK.
- 13 REMOVE EXISTING STEAM SUPPLY BACK TO THIS POINT (APPROXIMATELY). PREPARE TO CONNECT WITH NEW STEAM SUPPLY AS SHOWN ON NEW WORK PLAN.
- 14 REMOVE EXISTING POOL INSTANTANEOUS HEATER AND ASSOCIATED STEAM SUPPLY, CONDENSATE RETURN, VALVES, TRAPS, ETC...
- 15 REMOVE EXISTING POOL HEATING SUPPLY PIPING AS SHOWN BACK TO THIS POINT (APPROXIMATELY). PREPARE TO CONNECT WITH NEW PIPING AS SHOWN ON NEW WORK PLAN.
- 16 REMOVE EXISTING SERVICE PLATFORM IN FRONT OF STEAM BOILERS. PATCH ANY FLOORS/WALLS AS A RESULT OF THIS DEMOLITION.
- 17 REMOVE EXISTING CONCRETE PAD.
- 18 REFER TO PLUMBING PLANS FOR DOMESTIC WATER PIPING REMOVAL.
- 19 CAP EXISTING WALL OPENING.
- 20 REMOVE EXISTING BOILER CONDENSATE RETURN AS SHOWN.
- 21 REMOVE EXISTING LOUVERS AS SHOWN. PREPARE TO REPLACE WITH NEW LOUVER OF SAME SIZE.
- 22 REMOVE EXISTING ABANDONED WALL MOUNTED FAN.

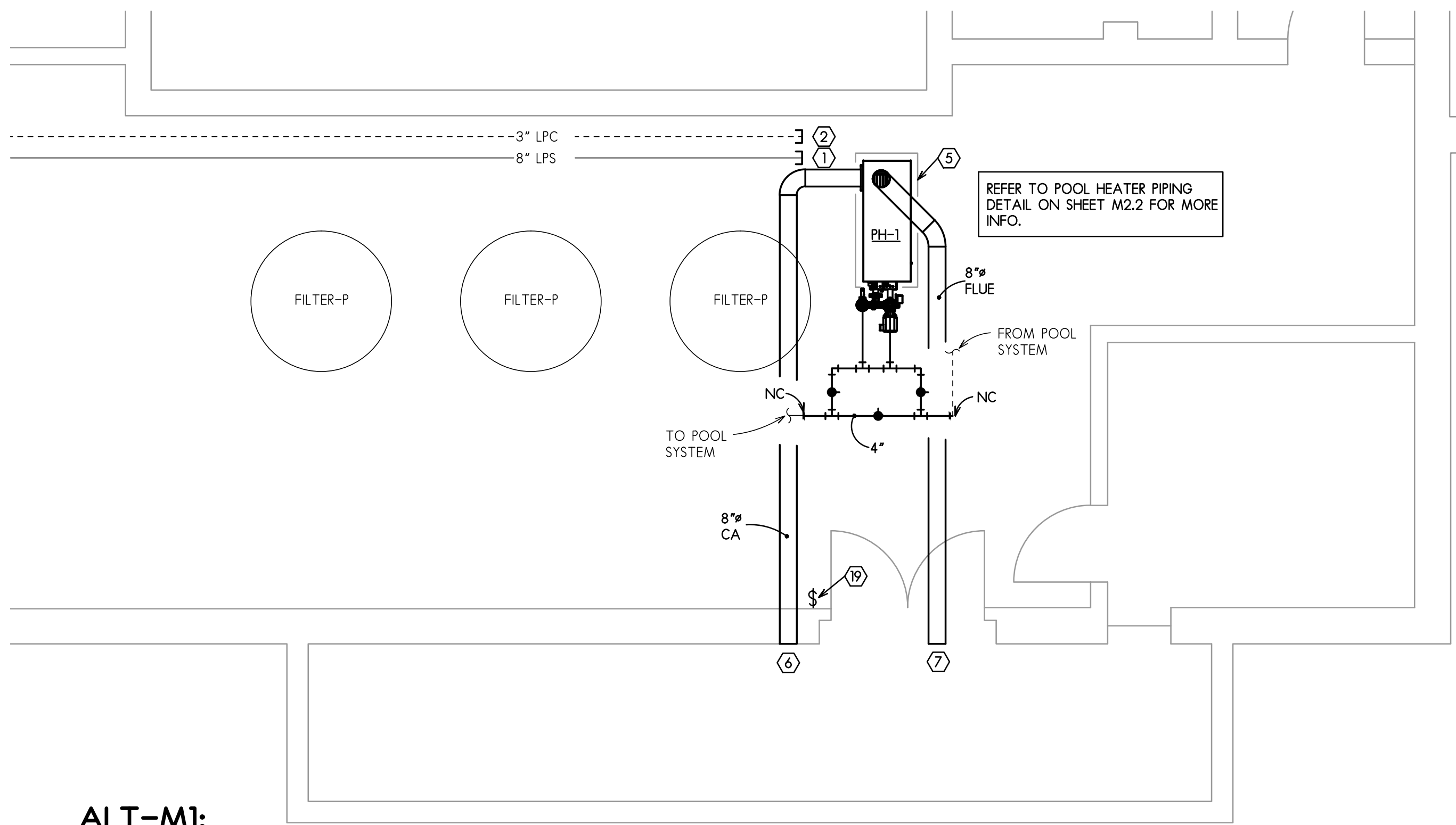


**1 BOILER ROOM MECHANICAL DEMOLITION**  
SCALE: 1/4" = 1'-0"

**MECHANICAL DEMOLITION PLANS**

SCALE: AS NOTED

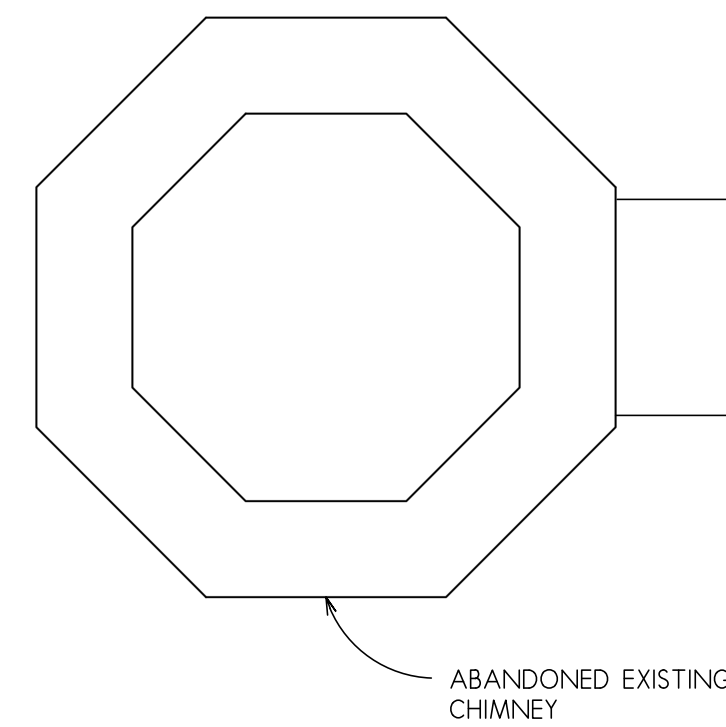




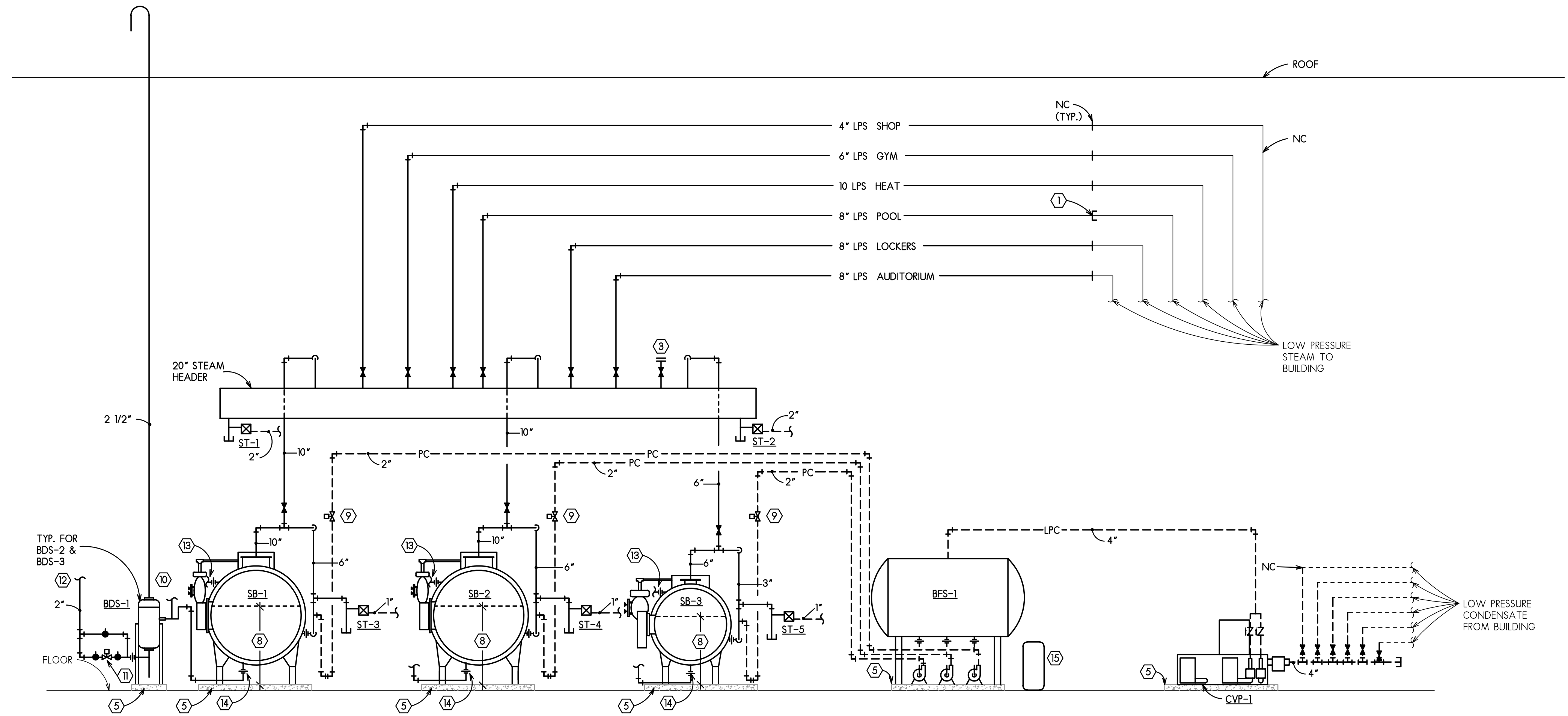
**3 ALT-M1:  
POOL HEATER NEW WORK PLAN**  
SCALE: 1/4" = 1'-0"

#### KEYED NOTES

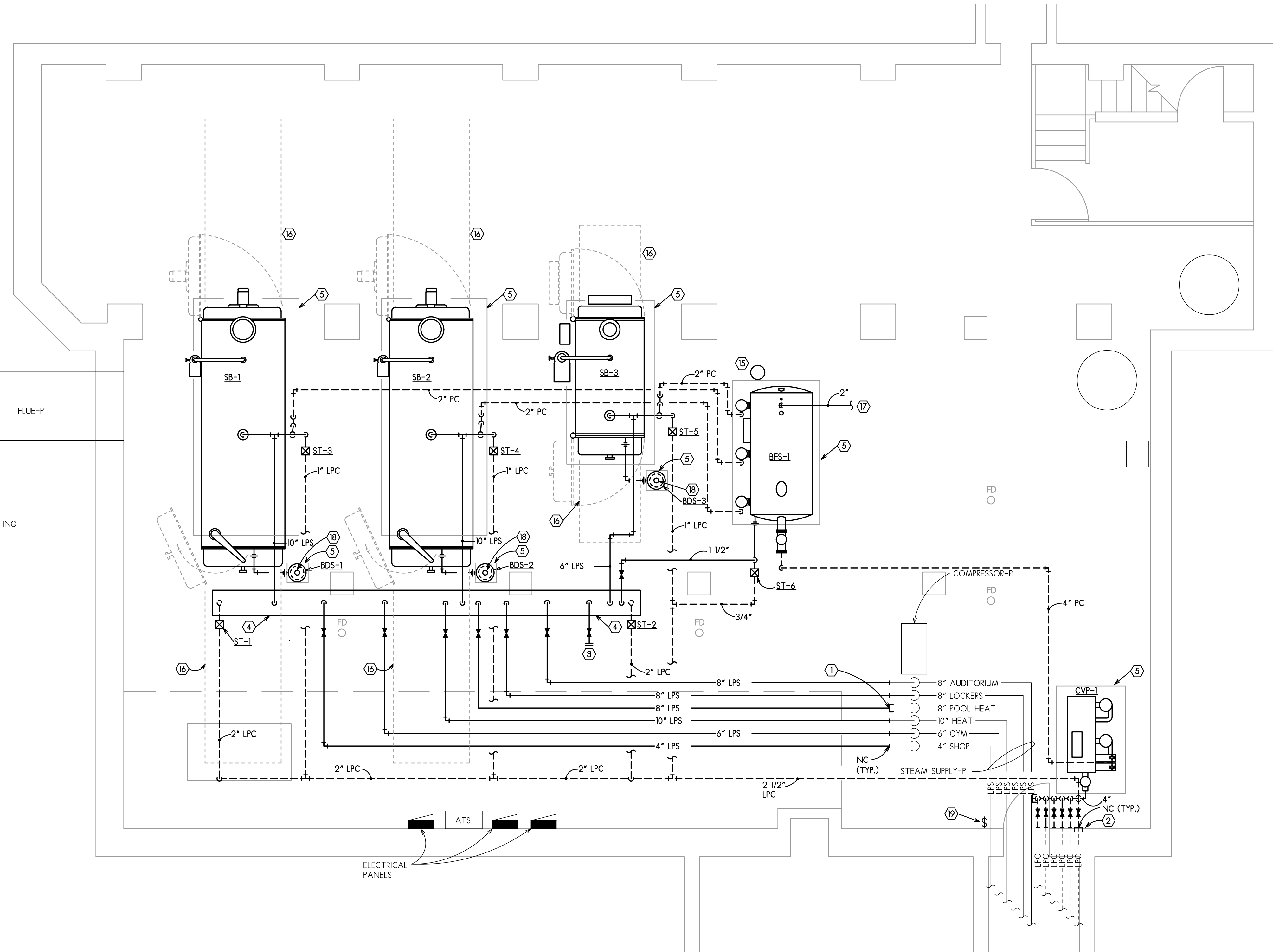
- ① BASE BID: CONNECT NEW 8" LPS LINE FROM HEADER TO EXISTING 8" LPS PIPE.  
ALT. M1: ABANDON EXISTING STEAM SUPPLY LINE TO POOL HEAT EXCHANGER. VERIFY PIPE IS CONNECTED TO HEAT EXCHANGER IN FIELD.
- ② BASE BID: CONNECT EXISTING STEAM CONDENSATE FROM POOL SYSTEM TO NEW HEADER AS SHOWN.  
ALT-M1: ABANDON EXISTING STEAM RETURN LINE FROM POOL HEAT EXCHANGER. VERIFY PIPE IS CONNECTED TO HEAT EXCHANGER IN FIELD.
- ③ 6" BLIND FLANGE AND SHUT OFF GATE VALVE FOR FUTURE CONNECTION.
- ④ 20" STEAM SUPPLY HEADER.
- ⑤ 4" THICK CONCRETE HOUSE KEEPING PAD.
- ⑥ 8" COMBUSTION AIR INTAKE TROUGH WALL WITH MFR PROVIDED WALL CAP.
- ⑦ 8" FLUE DISCHARGE THROUGH WALL WITH MFR PROVIDED WALL CAP.
- ⑧ BOILER WATER LEVEL (VERIFY WITH BOILER MFR).
- ⑨ BOILER FEED WATER CONTROL VALVE.
- ⑩ REFER TO BOILER BLOW DOWN SEPARATOR DETAIL ON SHEET M2.2 FOR MORE PIPING INFO.
- ⑪ TEMPERATURE REGULATOR AND SOLENOID VALVES.
- ⑫ EXTEND & CONNECT TO CW WITH RPZ.
- ⑬ TERMINATE AUTOMATIC SURFACE BLOW DOWN SYSTEM (PROVIDED BY BOILER MFR) AT BLOW DOWN SEPARATOR.
- ⑭ TERMINATE SLOW & QUICK OPEN BOTTOM BLOW DOWN PIPING AT BLOW DOWN SEPARATOR.
- ⑮ CHEMICAL FEED SYSTEM AND TANK. FIELD PIPE TO BOILER FEED TANK SYSTEM AS REQUIRED.
- ⑯ BOILER SERVICE CLEARANCE AND TUBE PULL OUT SHOWN FOR REFERENCE. FIELD LOCATE BOILERS TO ALLOW FOR SERVICE PER MFR. RECOMMENDATIONS.
- ⑰ 2" MAKE-UP WATER. EXTEND AND CONNECT TO HVAC MAKE-UP CW WITH RPZ. FIELD VERIFY.
- ⑱ 2 1/2" VENT PIPE THROUGH ROOF WITH GOOSE NECK FROM BSD.
- ⑲ BOILER/HEATER EMERGENCY SHUT OFF SWITCH LOCATED & WIRED PER AHJ REQUIREMENTS.



ABANDONED EXISTING CHIMNEY



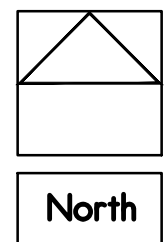
**2 BOILER ROOM PIPING DIAGRAM**  
SCALE: N/A



**1 BOILER ROOM MECHANICAL NEW WORK**  
SCALE: 1/4" = 1'-0"

#### MECHANICAL NEW WORK PLANS

SCALE: AS NOTED

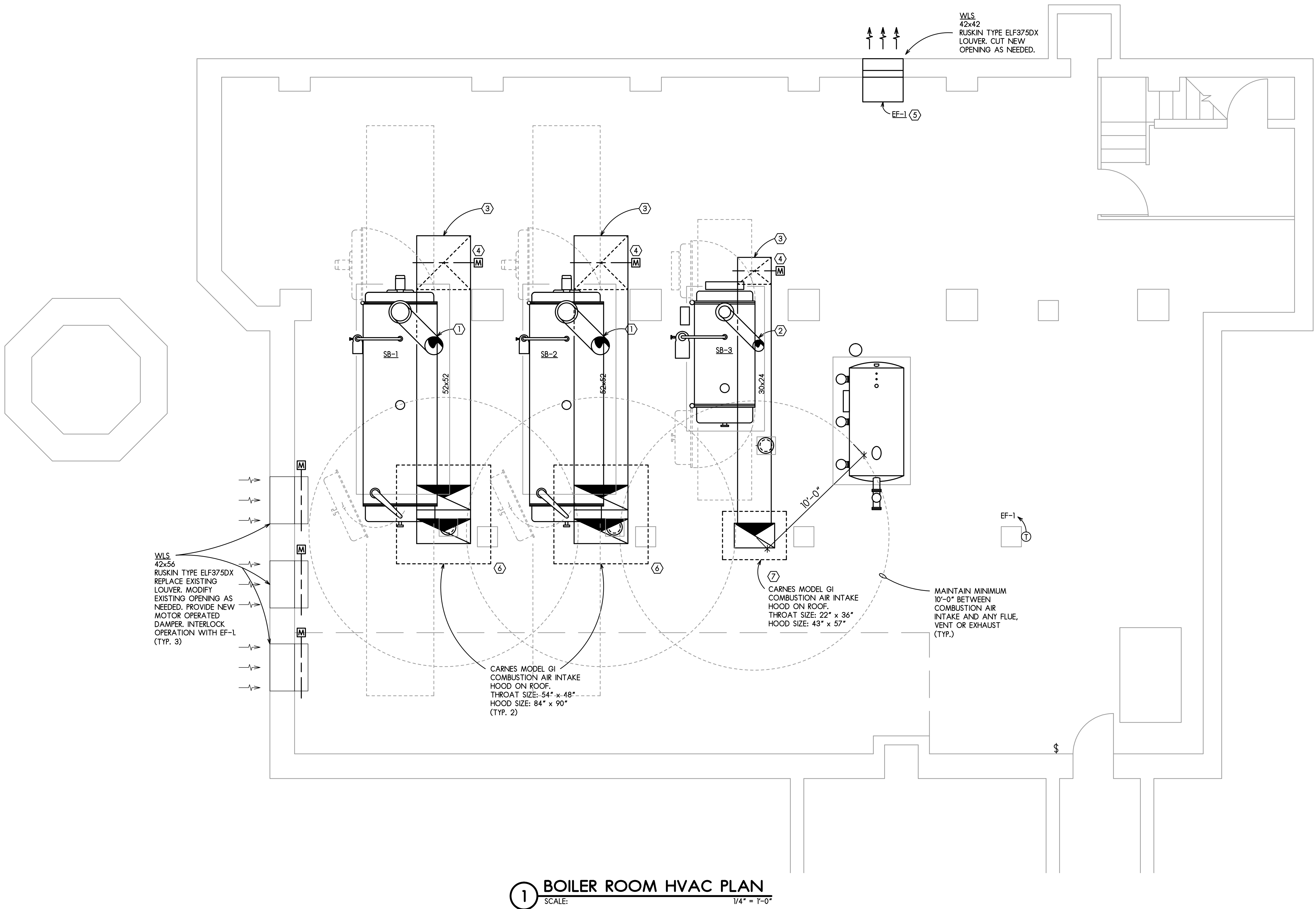


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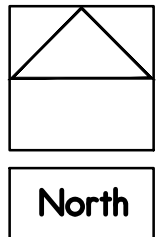
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PROJECT NUMBER
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SHEET NUMBER
M.1



**1 BOILER ROOM HVAC PLAN**  
SCALE: 1/4" = 1'-0"

**MECHANICAL VENTILATION PLAN**

SCALE: 1/4" = 1'-0"



**KEYED NOTES**

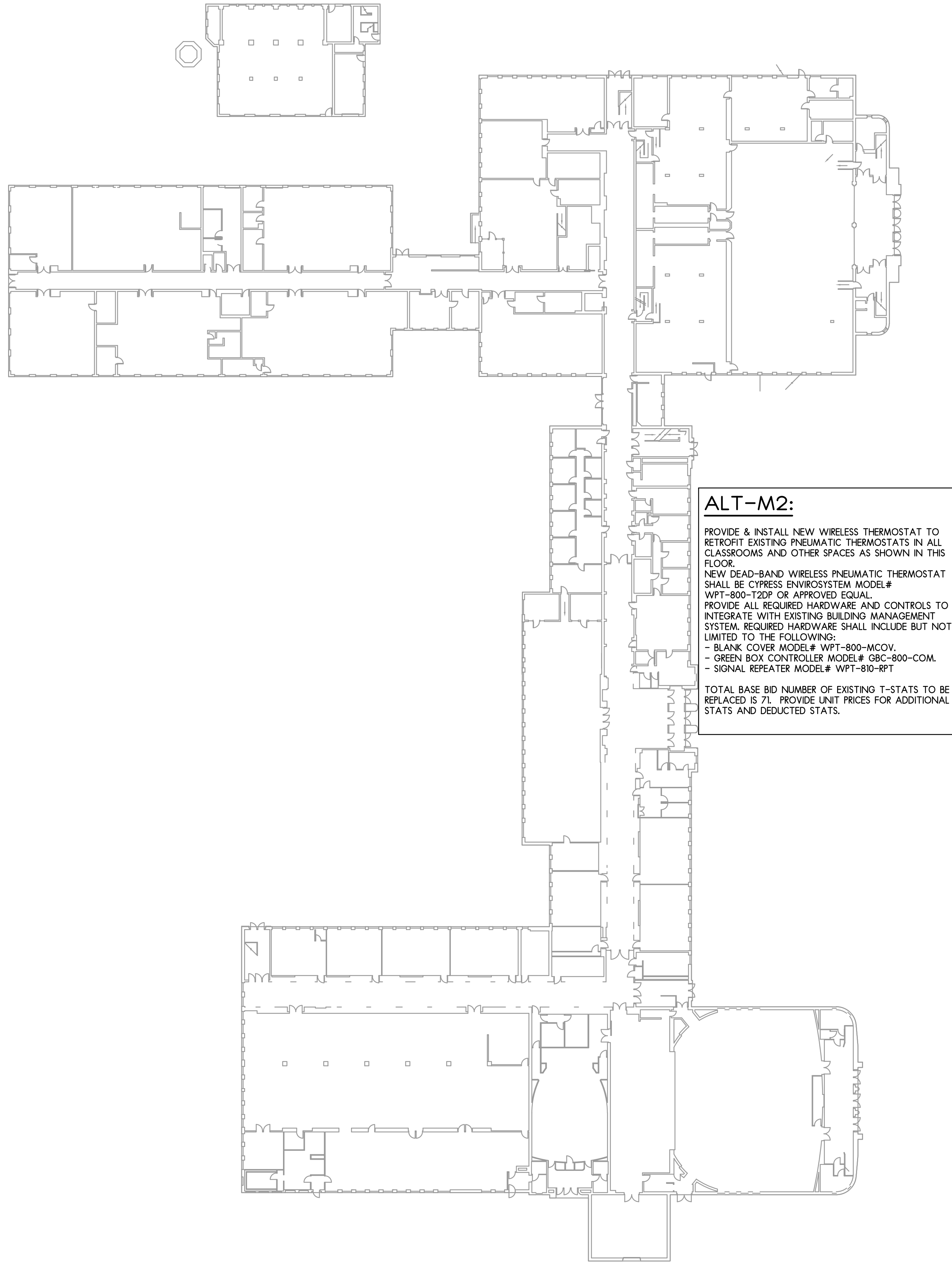
- 16" BOILER FLUE STACK WITH MOD. SEE DETAIL FOR TERMINATION.
- 10" BOILER FLUE STACK WITH MOD. SEE DETAIL FOR TERMINATION.
- OUTSIDE AIR DUCT DROP TO 24" ABOVE BOILER.
- INTERLOCK MOTOR OPERATED DAMPER WITH BOILER OPERATION.
- CUT NEW OPENING IN EXISTING WALL TO INSTALL NEW FAN AND COLLAR. PATCH AND SEAL OPENING AS REQUIRED. FIELD COORDINATE AND LOCATE EXACT LOCATION WITH EXISTING STRUCTURE. PROVIDE LINTEL AS NEEDED. MOUNT BOTTOM OF FAN APPROXIMATELY 8'-0" ABOVE EXTERIOR GRADE.
- CUT (2) NEW 48"x22" OPENINGS IN EXISTING ROOF TO INSTALL NEW C/A INTAKE HOOD AND CURB. FLASH AROUND NEW CURB AS REQUIRED. FIELD COORDINATE AND LOCATE EXACT LOCATION WITH EXISTING STRUCTURE. SPLIT 48x48 C/A DUCT INTO (2) 48x22 RISERS TO AVOID CONCRETE BEAM.
- CUT NEW 36"x22" OPENING IN EXISTING ROOF TO INSTALL NEW C/A INTAKE HOOD AND CURB. FLASH AROUND NEW CURB AS REQUIRED. FIELD COORDINATE AND LOCATE EXACT LOCATION WITH EXISTING STRUCTURE.

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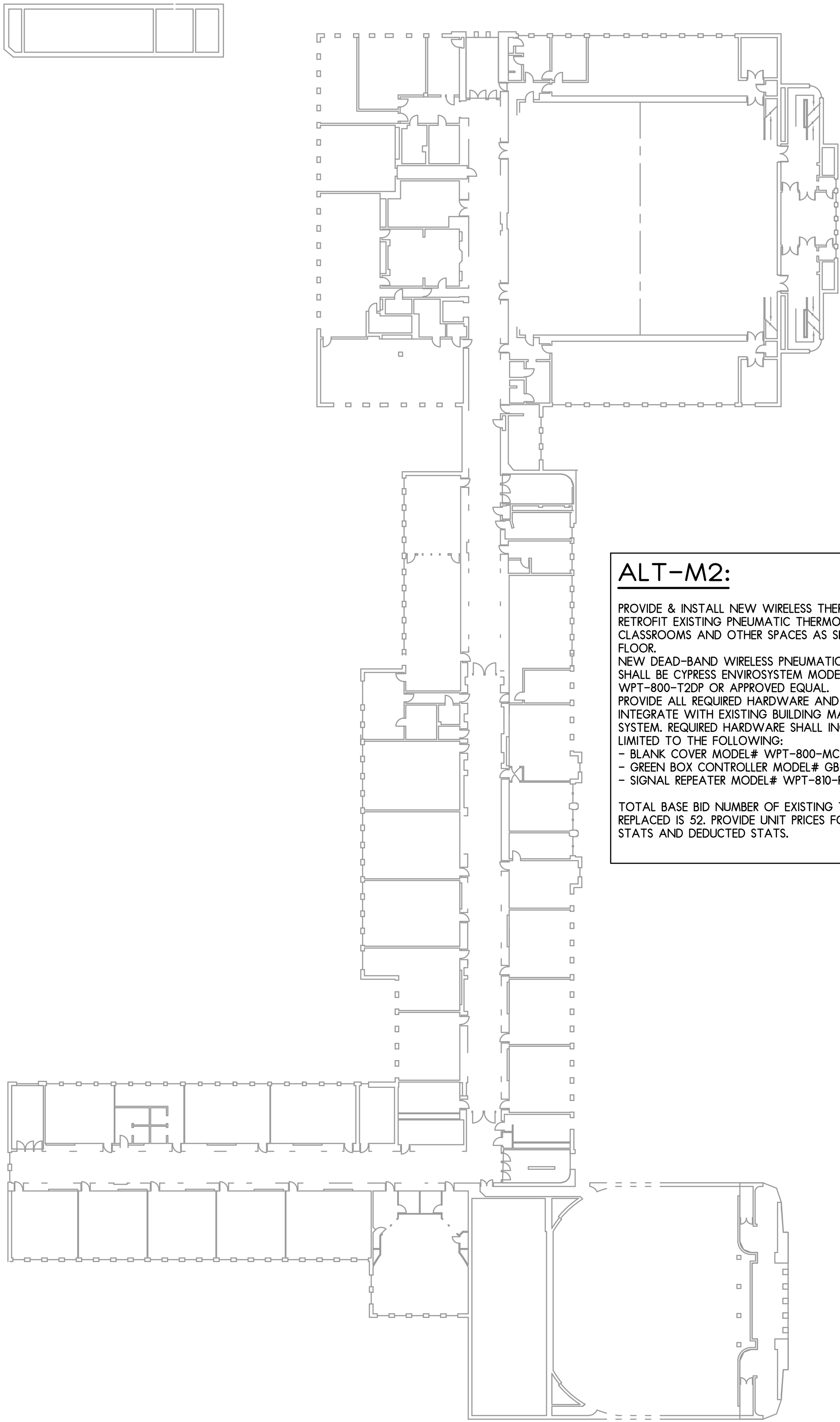
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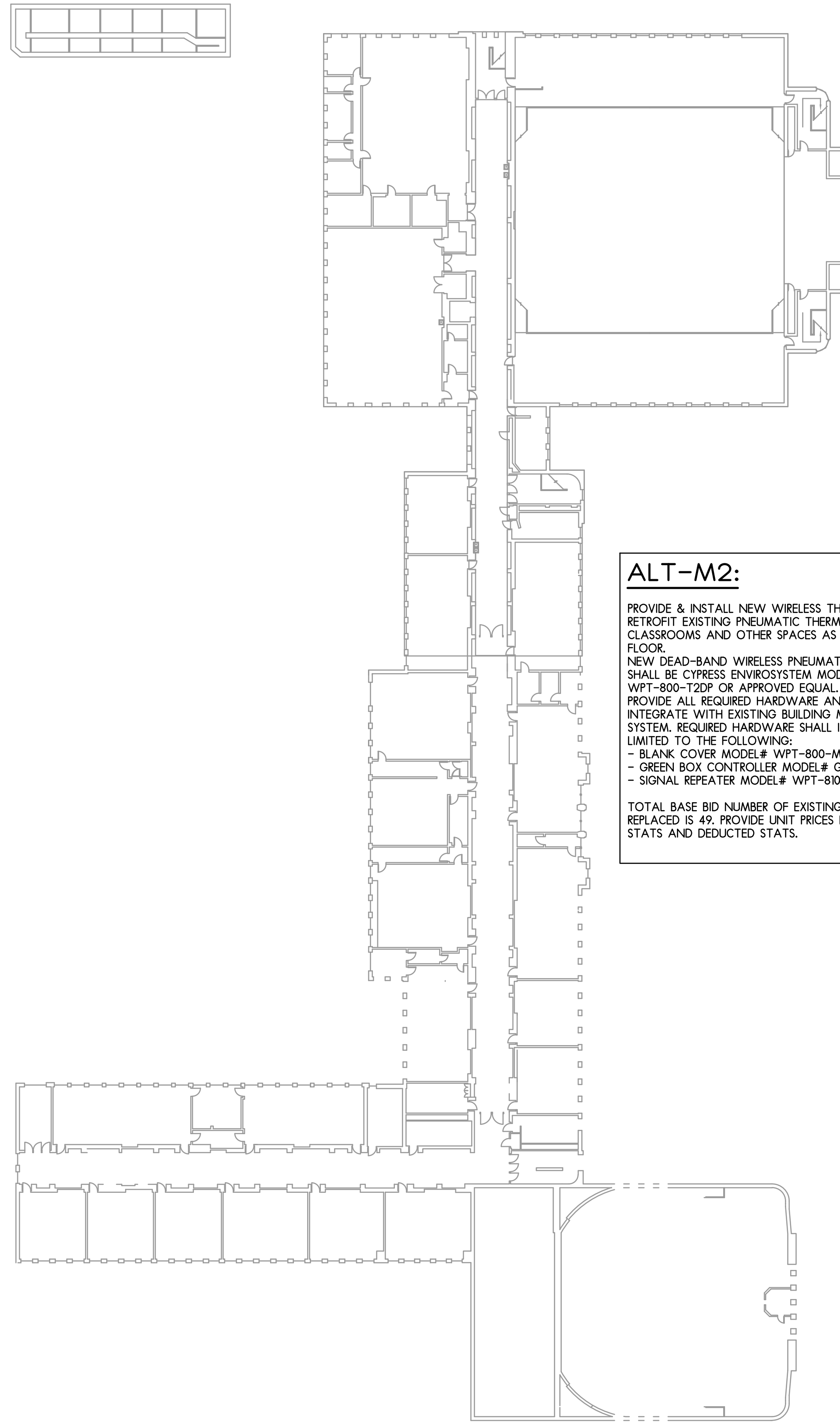
DATE: 02-29-2016
PROJECT NUMBER
<b>25107</b>
SHEET NUMBER
<b>M1.2</b>



1 FIRST FLOOR PLAN  
SCALE: 1/32" = 1'-0"



2 SECOND FLOOR PLAN  
SCALE: 1/32" = 1'-0"



3 THIRD FLOOR PLAN  
SCALE: 1/32" = 1'-0"

## MECHANICAL OVERALL PLANS

SCALE:

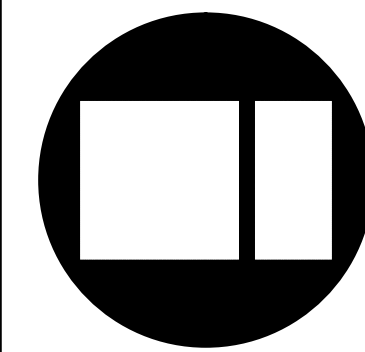
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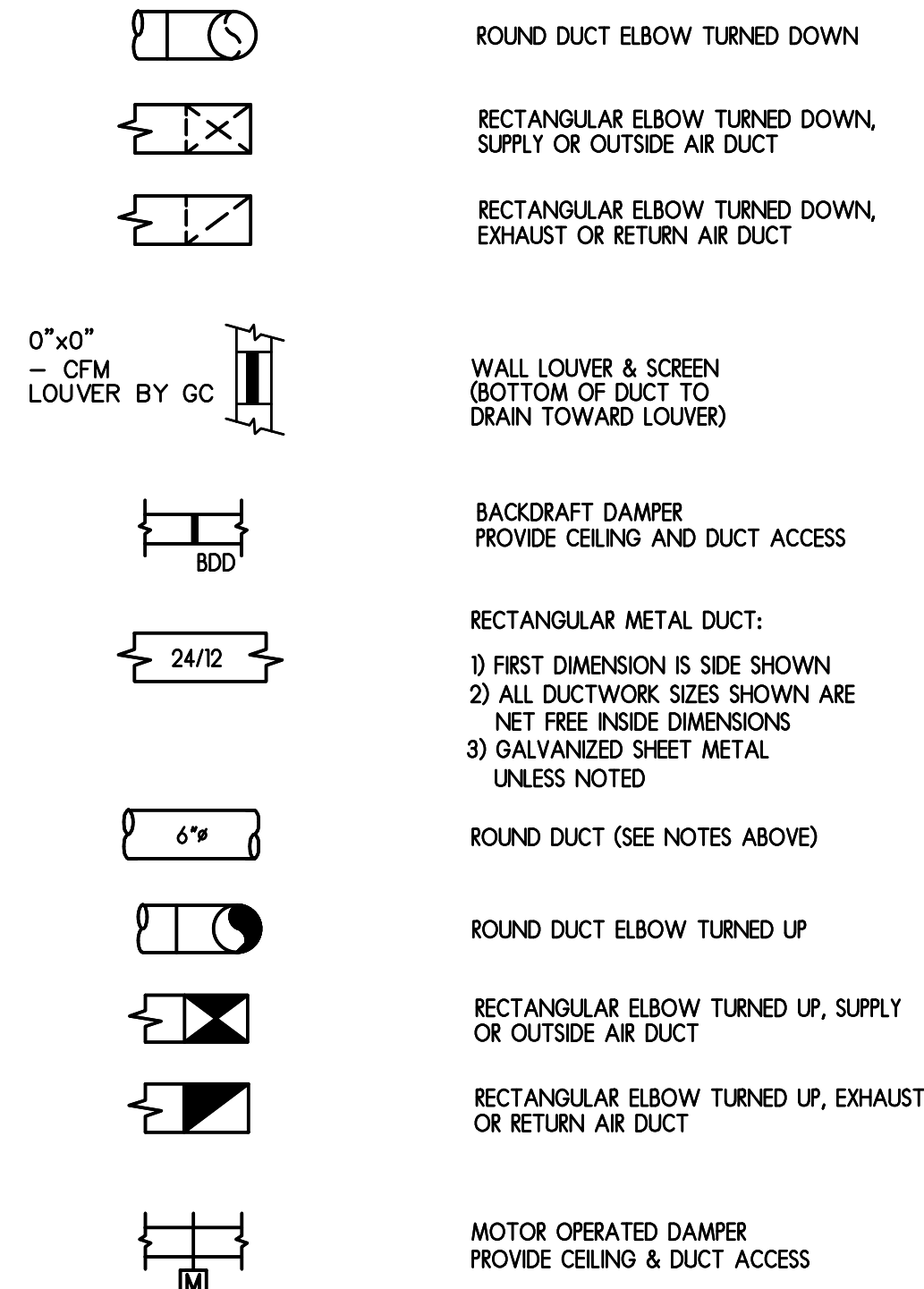
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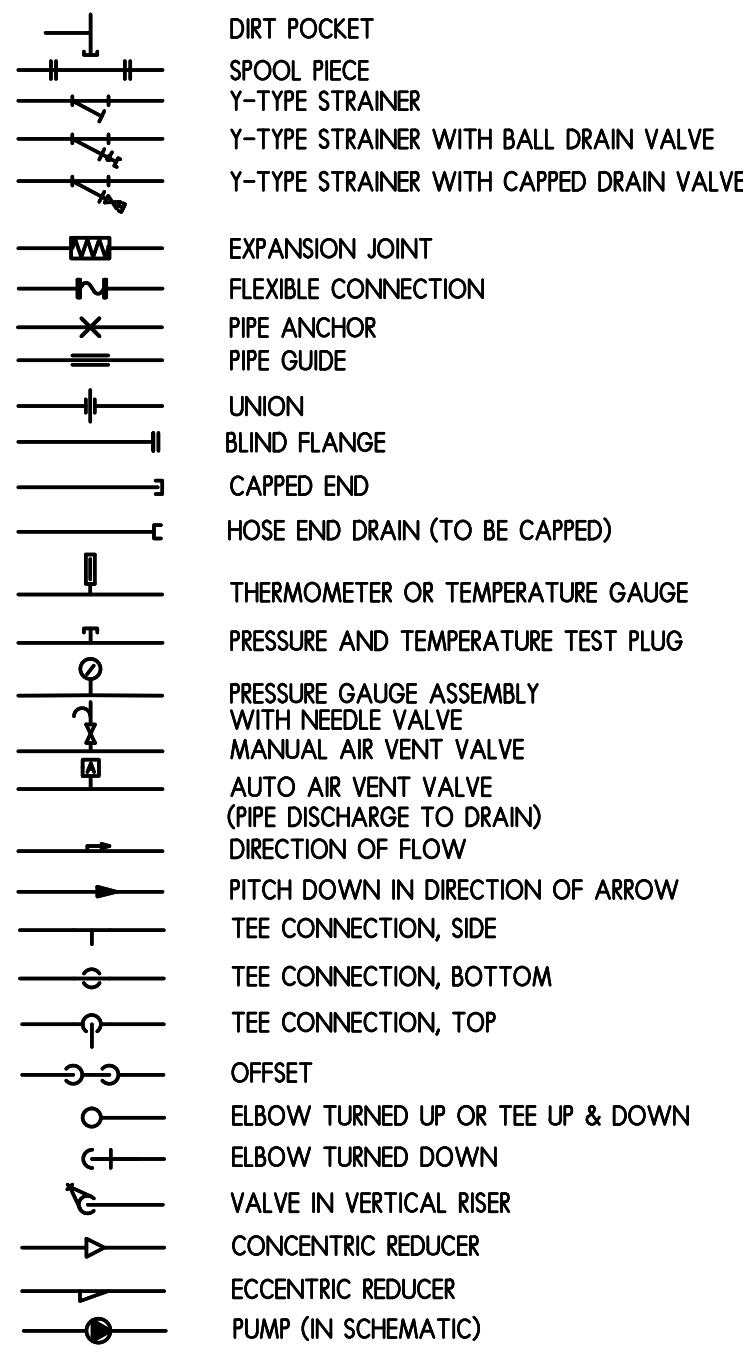


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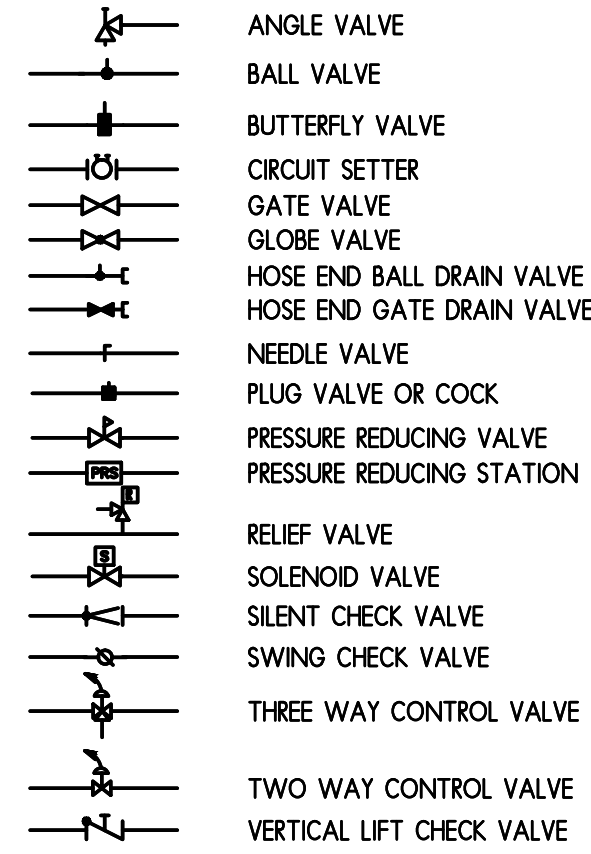
DUCT AND EQUIPMENT SYMBOLS



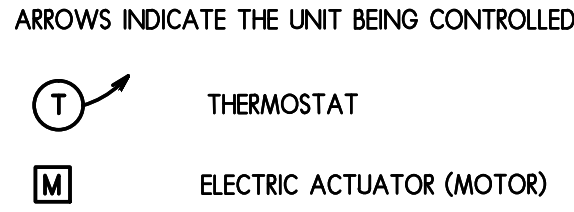
PIPING SYMBOLS



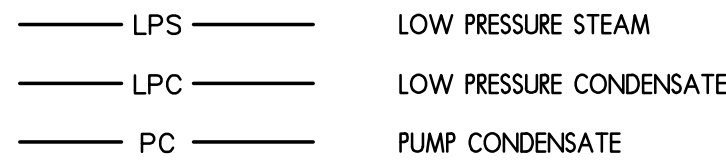
VALVE SYMBOLS



CONTROL SYMBOLS



HVAC PIPING LEGEND



DEMOLITION GENERAL NOTES

- VERIFY EXACT SIZE AND LOCATION OF THE EXISTING UTILITIES BEFORE START OF DEMOLITION.
- RELOCATE, REMOVE AND ADJUST ALL MECHANICAL AND ASSOCIATED ELECTRICAL ITEMS AS REQUIRED TO COORDINATE WITH NEW WORK.
- ALL MECHANICAL ITEMS SHOWN ON DEMOLITION PLANS ARE EXISTING AND ARE SHOWN IN SCHEMATIC FORM ONLY.
- IN AREAS WHERE EXISTING CONSTRUCTION IS REMOVED AND NO ADDITIONAL CONSTRUCTION IS INDICATED, PATCH ADJACENT CONSTRUCTION TO MATCH EXISTING.
- REFER TO ARCHITECTURAL PLANS FOR COORDINATION OF ALL EQUIPMENT.
- CONNECTIONS TO, AND SHUTDOWNS OF, THE EXISTING SYSTEMS SHALL BE COORDINATED WITH OWNER AS TO CREATE MINIMAL INTERFERENCE WITH OWNER'S OPERATION AND RESULTING DOWNTIME OF EXISTING SERVICES. CONTRACTORS SHALL SUBMIT TO OWNER FOR REVIEW AND APPROVAL OF THE PROPOSED PHASING PLAN FOR CONNECTING NEW TO EXISTING SERVICES.
- CONTRACTOR SHALL COMPLY WITH GENERAL CONDITIONS AND PROTECTION PROVISIONS SPECIFIED.
- CONTRACTOR SHALL VERIFY EXISTING CONDITIONS BEFORE BEGINNING WORK. CONTRACTOR SHALL PROTECT EXISTING UTILITIES FROM DAMAGE DURING CONSTRUCTION. ANY EXISTING UTILITIES AND SERVICES DAMAGED SHALL BE REPAIRED AT NO EXPENSE TO OWNER. THE CONTRACTOR SHALL TEMPORARILY MOVE OR TAKE EQUIPMENT OUT OF SERVICE AS NECESSARY TO COMPLETE WORK. SUCH SERVICES SHALL BE REPAIRED IN ACCORDANCE WITH THE SPECIFICATIONS.

DEMOLITION DEFINITIONS:

CERTAIN ABBREVIATIONS OF SYMBOLS, WHEN APPLIED TO PRESENT (OR EXISTING) LINE, DEVICE OR EQUIPMENT, SHALL HAVE FOLLOWING MEANINGS:

NC	NEW CONNECTION TO PRESENT PIPING, DEVICE, MANHOLE, SEWER, DUCT, WIRING, EQUIPMENT, ETC. INSTALL, TEST, COVER, PAINT, ETC. SAME AS NEW WORK. IF IN SEWER MANHOLE, PROVIDE FLOW CHANNEL IN BOTTOM.
VL	VERIFY EXACT LOCATION IN FIELD. THIS NOTE APPLIES TO ALL PRESENT OR EXISTING UTILITIES AND CONSTRUCTION WHETHER CALLED FOR OR NOT.
P	TO REMAIN UNCHANGED. IF CHANGE CANNOT BE AVOIDED, CHANGE "P" TO "PXR", AT NO INCREASE IN CONTRACT PRICE. VERIFY LOCATION.
PX	TO BE COMPLETELY REMOVED, INCLUDING UNNEEDED CONNECTIONS, PIPING, DUCTS, WIRING, BASES, ETC. OF EVERY KIND. OTHER DISTURBED WORK OF EVERY KIND RESTORED, PATCHED, TESTED, COVERED, PAINTED, ETC. TO EQUAL ORIGINAL CONDITION. REMOVED MATERIALS MUST NOT BE REUSED UNLESS OTHERWISE SPECIFIED OR DIRECTED BY ARCHITECT.

HVAC ABBREVIATIONS

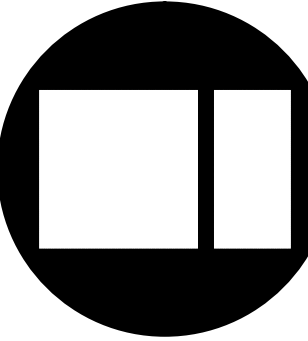
AFF	ABOVE FINISHED FLOOR	HZ	HERTZ	VOL	VOLUME
APD	AIR PRESSURE DROP	ID	INSIDE DIAMETER	W/	WITH
BOD	BACKDRAFT DAMPER	IF	INLINE FAN	W/O	WITHOUT
BOT	BOTTOM OF DUCT	IN	INCH	WB	WET BULB
BTU	BRITISH THERMAL UNIT	IP	INLINE PUMP	WC	WATER COLUMN
BTUH	BTU PER HOUR	KW	KILOWATT	WG	WATER GAUGE
CA	COMBUSTION AIR	LAT	LEAVING AIR TEMPERATURE	WLS	WALL LOUVER AND SCREEN
CAD	COMBUSTION AIR DAMPER	LB	POUND	WN	WINTER
CEB	CONCRETE EQUIPMENT BASE	LPB	LOW PRESSURE BOILER	WPD	WATER PRESSURE DROP
CFM	CUBIC FEET PER MINUTE	LPR	LOW PRESSURE RETURN	WTD	WATER TEMPERATURE DROP
CUH	CABINET UNIT HEATER	LPS	LOW PRESSURE SUPPLY		
CUV	CLASSROOM UNIT VENTILATOR	MAX	MAXIMUM		
CV	FLOW COEFFICIENT	MBH	1000 BTU/HOUR		
Δ(DELTA)	DIFFERENTIAL, DIFFERENCE	MCC	MOTOR CONTROL CENTER		
D	DRIP	MECH	MECHANICAL		
DB	DRY BULB	MIN	MINIMUM		
DIA	DIAMETER	MOD	MOTOR OPERATED DAMPER		
DPR	DAMPER	NC	NEW CONNECTION		
DWG	DRAWING	N.C.	NORMALLY CLOSED		
EA	EXHAUST AIR DUCT	O/A	OUTSIDE AIR		
EAG	EXHAUST AIR GRILLE	OAD	OUTSIDE AIR DAMPER		
EAR	EXHAUST AIR REGISTER	OAI	OUTSIDE AIR INTAKE		
EAT	ENTERING AIR TEMPERATURE	PC	PLUMBING CONTRACTOR		
EC	ELECTRICAL CONTRACTOR	PD	PRESSURE DROP		
ESP	EXTERNAL STATIC PRESSURE	PH	PHASE		
EWIT	ENTERING WATER TEMPERATURE	PRE	POWER ROOF EXHAUSTER (AIR)		
EF	EXHAUST FAN	PSI	POUNDS PER SQUARE INCH		
ELEC	ELECTRIC OR ELECTRONIC	PSIG	POUNDS PER SQUARE INCH (GAUGE)		
ET	EXPANSION TANK	R	RSE		
F	FAHRENHEIT	RECIRC	RECIRCULATION		
F & BP	FACE AND BYPASS	REQD	REQUIRED		
F & TT	FLOAT AND THERMOSTAT TRAP	RH	RELATIVE HUMIDITY		
FBO	FURNISHED BY OTHERS	RPM	REVOLUTIONS PER MINUTE		
FFA	FROM FLOOR ABOVE	SP	STATIC PRESSURE		
FFB	FROM FLOOR BELOW	SPEC	SPECIFICATION		
FLA	FULL LOAD AMPS	SLH	SUSPENDED UNIT HEATER		
FPW	FEET PER MINUTE	T/C	TEMPERATURE CONTROL		
FT	FOOT	TCC	TC CONTRACTOR		
GC	GENERAL CONTRACTOR	TEMP	TEMPERATURE		
GAL	GALLON	TFA	TO FLOOR ABOVE		
GPM	GALLONS PER MINUTE	TFB	TO FLOOR BELOW		
HP	HORSE POWER	T-STAT	THERMOSTAT		
HVAC	HEATING, VENTILATION AND AIR CONDITIONING	TSP	TOTAL STATIC PRESSURE		
HX	HEAT EXCHANGER	TYP	TYPICAL		
		VEL	VELOCITY		

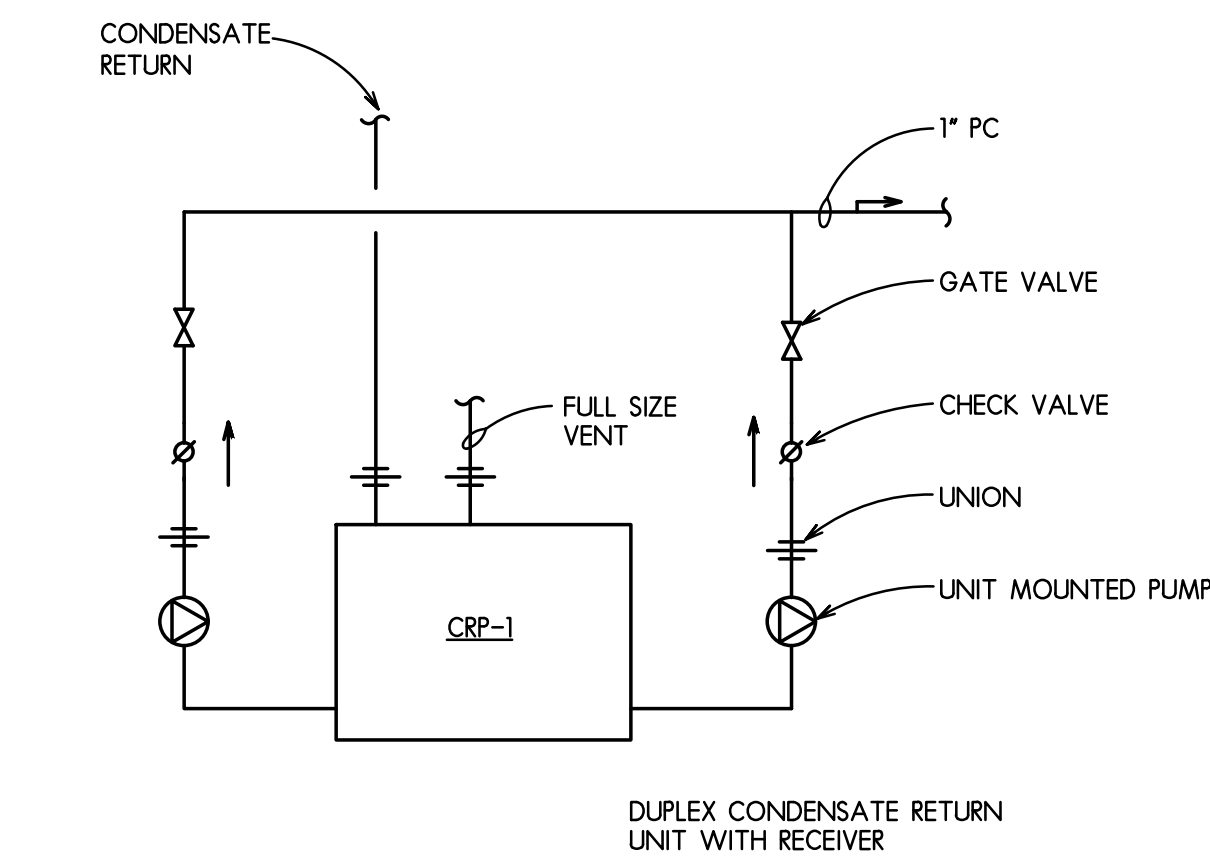
GENERAL NOTES

- DRAWINGS ARE GENERALLY DIAGRAMMATIC. EACH CONTRACTOR SHALL MAKE REQUIRED CHANGES FROM THE GENERAL ROUTING SHOWN ON THESE DRAWINGS SUCH AS OFF SETS, BENDS OR CHANGES IN ELEVATION DUE TO COORDINATION WITH THE WORK OF OTHER TRADES AND THE BUILDING CONSTRUCTION. ALL CHANGES SHALL BE MADE WITHOUT ADDITIONAL COST TO THE OWNER. FOR PRESENT CONSTRUCTION, VERIFY ALL EXISTING CONDITIONS PRIOR TO BIDDING TO AVOID CONFLICT. IT IS INTENDED THAT ALL EQUIPMENT, MATERIAL, DEVICES, ETC., SHALL BE LOCATED SYMMETRICALLY WITH THE ARCHITECTURAL ELEMENTS, NOTWITHSTANDING THE FACT THAT LOCATIONS INDICATED BY THESE DRAWINGS MAY BE DISTORTED FOR CLARNESS OF PRESENTATION.  
  
EACH CONTRACTOR SHALL CHECK DRAWINGS OF THE OTHER TRADES TO VERIFY SPACES IN WHICH THEIR WORK WILL BE INSTALLED IS CLEAR OF OBSTRUCTIONS. MAINTAIN MAXIMUM HEADROOM AND IF SPACE CONDITIONS APPEAR INADEQUATE, NOTIFY ARCHITECT BEFORE PROCEEDING WITH THE INSTALLATION.  
  
FURNISH ALL TRADES ADVANCE INFORMATION ON LOCATIONS AND SIZES OF PIPING, DUCTWORK, EQUIPMENT, FRAMES, BOXES, SLEEVES AND OPENINGS NEEDED FOR WORK, AND ALSO FURNISH INFORMATION AND SHOP DRAWINGS TO PERMIT TRADES AFFECTED TO INSTALL THEIR WORK PROPERLY AND WITHOUT DELAY.
- WHERE THERE IS EVIDENCE THAT WORK OF ONE TRADE WILL INTERFERE WITH WORK OF OTHER TRADES, ALL TRADES SHALL ASSIST IN WORKING OUT SPACE CONDITIONS TO MAKE SATISFACTORY ADJUSTMENTS.
- HVAC CONTRACTOR TO REVIEW, PRIOR TO BIDDING, ALL DRAWINGS TO COORDINATE VARIOUS WORK AS CALLED FOR. CONTRACTOR SHALL CAREFULLY CHECK ALL DRAWINGS FOR ALL TRADES AND ANY LACK OF COORDINATION BETWEEN HIS WORK AND DRAWINGS FOR JOB CONDITIONS SHALL BE IMMEDIATELY REPORTED TO ARCHITECT.
- ALL SHEETMETAL DUCTWORK SHALL BE CONSTRUCTED TO THE LATEST SMACNA STANDARDS.
- SHEETMETAL DUCT SIZES MAY BE ALTERED TO FIT JOB CONDITIONS, BUT NET FREE AREAS MUST BE MAINTAINED. INCREASE SHEETMETAL DUCT SIZE TO ALLOW FOR DUCT LINING WHERE USED. WRAP ALL DUCTWORK EXCEPT AS NOTED.
- ALL DUCTWORK TO BE HELD TIGHT TO STRUCTURAL ROOF JOISTS, BEAMS, ETC., AS CLEARANCE IS MINIMAL. COORDINATE WITH OTHER CONTRACTORS TO AVOID CONFLICT.
- OUTDOOR INTAKE SHEETMETAL DUCTWORK SHALL BE WATER TIGHT WITH SOLDERED SEAMS. PITCH DUCTWORK TO WALL LOUVER AND SCREEN TO DRAIN ALL MOISTURE TO BUILDING EXTERIOR. INTAKES TO BE INSULATED WITH 2" RIGID INSULATION.
- CONTRACTOR SHALL PROVIDE ALL DUCT DROPS AND OFFSETS TO AVOID INTERFERENCES WITH JOISTS, OTHER DUCTS, LIGHTS, PIPES, ETC.
- ALL THERMOSTATS LOCATED TO MATCH ADJACENT LIGHT SWITCHES AND WITH PLASTIC OR CAST GUARDS AS SPECIED. ALL THERMOSTATS LOCATED ON EXTERIOR WALLS OR COLUMNS MUST BE MOUNTED ON THERMAL INSULATING BLOCKS.
- HEATING, VENTILATING, AIR CONDITIONING AND ELECTRICAL DESIGNS ARE BASED ON THE REQUIREMENTS FOR THE SPECIFIED EQUIPMENT MANUFACTURER. CONDUITS, DISCONNECTS, BREAKERS, FUSES AND WIRE SIZES ARE SELECTED ON THE BASIS OF SPECIFIED EQUIPMENT MANUFACTURER. INCREASED CURRENT REQUIREMENTS NECESSITATING LARGER WIRE, BREAKERS, FUSES, SWITCHES, ETC. TO ACCOMMODATE ANY ALTERNATE OR SUBSTITUTE MANUFACTURER'S EQUIPMENT OTHER THAN AS SHOWN ON DRAWINGS OR SCHEDULES SHALL BE PROVIDED WITHOUT INCREASE IN CONTRACT PRICE BY THE CONTRACTOR FURNISHING EQUIPMENT.

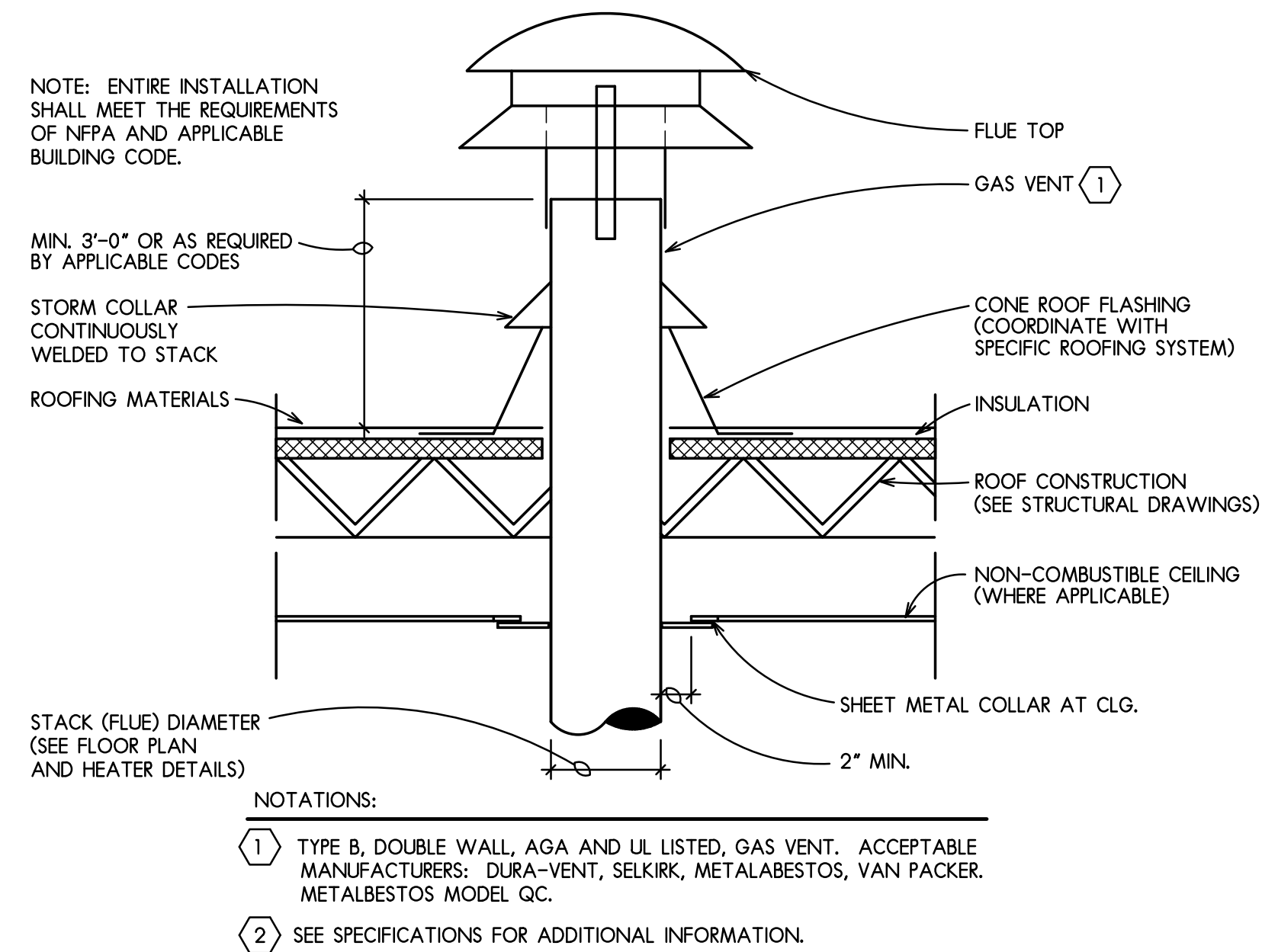
MECHANICAL SYMBOLS, NOTES & ABBREVIATIONS

SCALE: AS NOTED

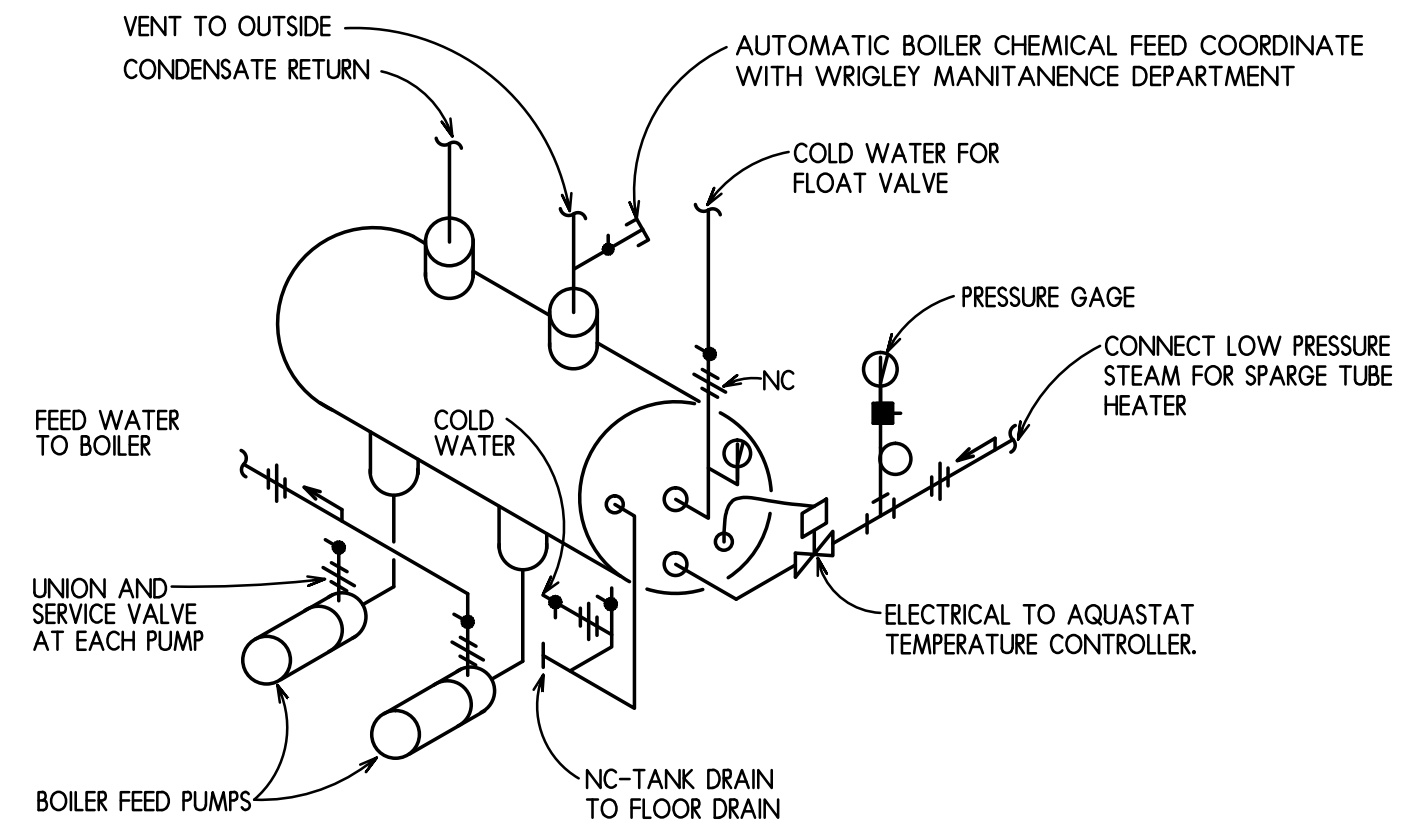




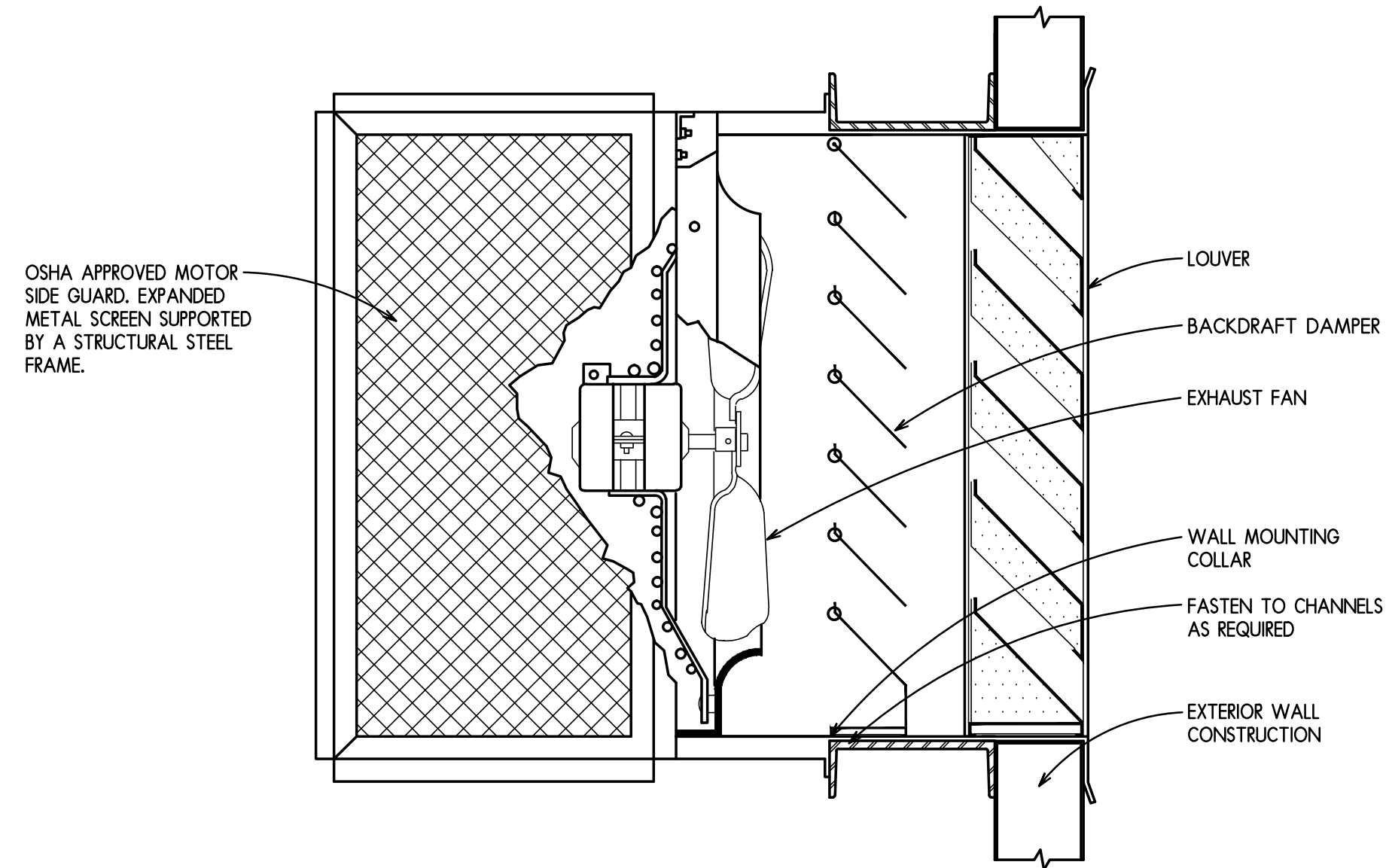
1 CONDENSATE RECEIVER PIPING DETAIL  
NTS



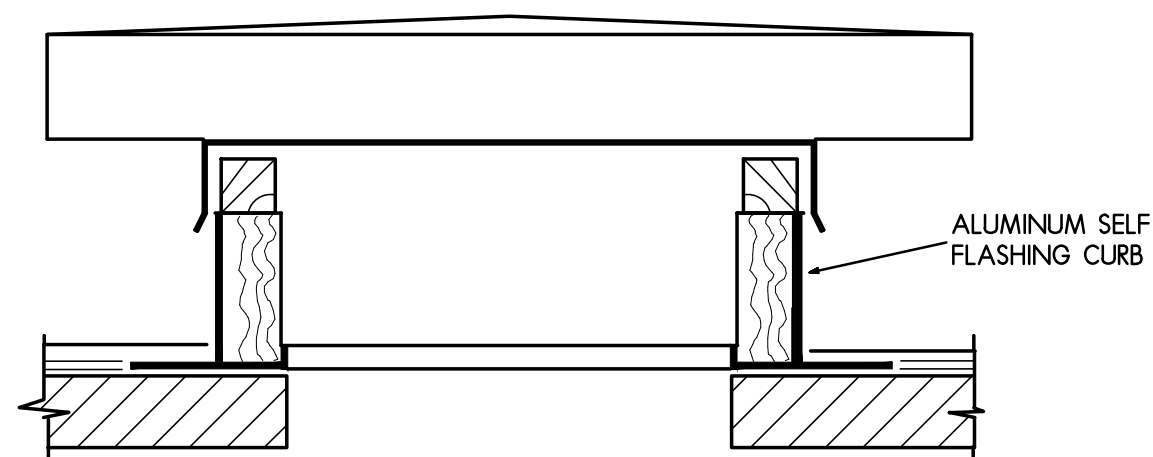
2 FLUE THRU ROOF  
NO SCALE



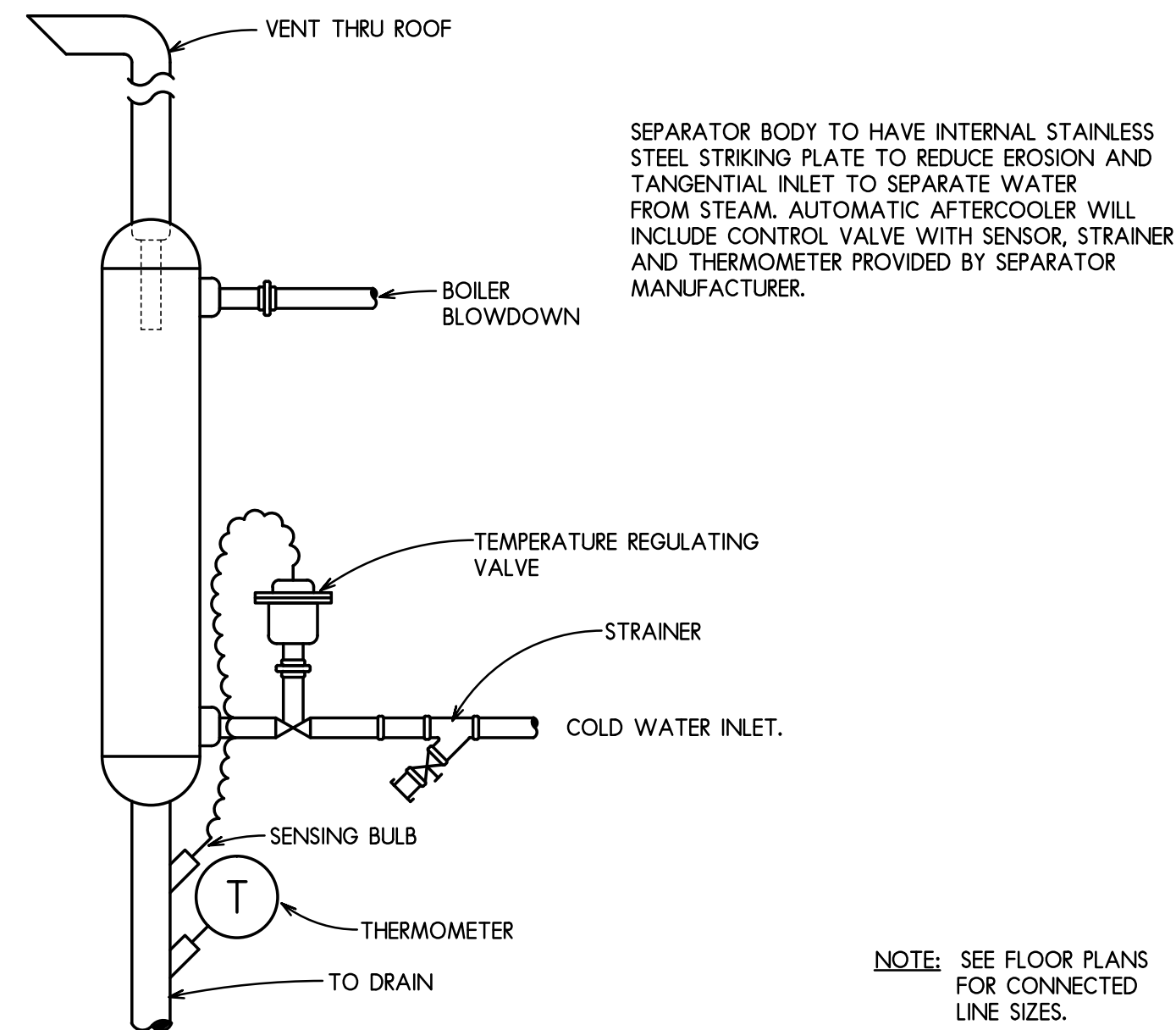
3 BOILER FEED TANK AND PUMPS  
NTS



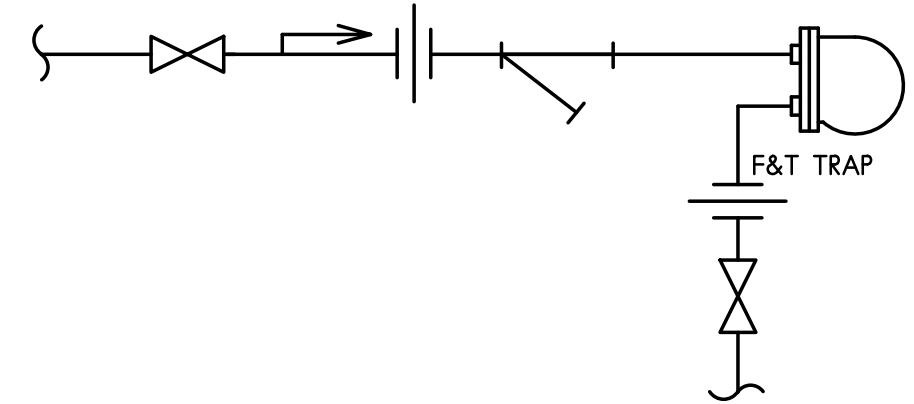
4 PROPELLER FAN DETAIL  
NTS



5 ROOF CURB DETAIL  
NTS



6 BLOWDOWN SEPARATOR DETAIL  
NO SCALE



7 STEAM TRAP CONNECTION DETAIL  
NTS

STEAM TRAP SCHEDULE					
PLAN NO.	ST-1 & 2	ST-3	ST-4	ST-5	
SERVICE	S. HEADER	SB-1	SB-2	SB-3	
MANUFACTURER	SPIRAX SARCO	SPIRAX SARCO	SPIRAX SARCO	SPIRAX SARCO	
MODEL	FT-15	FT-15	FT-15	FT-15	
TYPE	F&T	F&T	F&T	F&T	
CONNECTION SIZE	1-1/2"	1"	1"	3/4"	
MAX PRESSURE PSI	15	15	15	15	
CAPACITY (LBS/HR)	1,700	250	250	175	
NOTES	1	1	1	1	

NOTES: SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION.  
1. CAPACITY IS MEASURED IN # / HOUR AT 1/2 PSI PRESSURE DIFFERENTIAL.

POOL HEATER (PH) SCHEDULE	
PLAN NO.	PH-1
MANUFACTURER	LOCHINVAR
MODEL	CPND652
INPUT MBH	650
OUTPUT MBH (NET)	579
GPM	55
WPD (FT OF HEAD)	10
FUEL	NATURAL GAS
RATING	-
NOTES	1, 2, 3, 4, 5, 6

NOTES: SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION.  
1. PROVIDE WITH FLOW SWITCH, LOW WATER CUT OFF, ALL BRONZE PUMP.  
2. PROVIDE FORCED DRAFT BURNER.  
3. MOUNT ON 4" CEB.  
4. PROVIDE WITH CURO-NICKEL HEAT EXCHANGER  
5. PROVIDE W/ CAT IV S.S. VENT MATERIAL FOR HOR. VENTING  
6. PROVIDE WITH LONWORKS/BACNET BAS INTERFACE.

BOILER FEED WATER SYSTEM (BFS) SCHEDULE	
GENERAL	PLAN NO.
	LOCATION
	SERVICE
	MANUFACTURER
	MODEL
RECEIVER	TYPE
	CAPACITY (EDR)
	MATERIAL
	VOL (GAL)
	INLET SIZE (IN)
PUMP	QUANTITY
	MOUNTING
	GPM
	DISCH. PRESS. (PSI)
	HP/BHP
VACUUM	VOLTS/PHASE
	RPM
	NOTES

NOTES: SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION.  
1. PROVIDE WITH 3 VALVE BY-PASS AROUND MAKEUP VALVE.  
2. PROVIDE WITH AIR GAP FITTING ON MAKEUP ASSEMBLY.  
3. PROVIDE WITH LOW WATER CUTOFF, GAUGE GLASS, DIAL THERMOMETER & DISCHARGE PRESSURE GAUGE.  
4. PROVIDE INLET BASKET STRAINER AND BUTTERFLY SUCTION VALVE.  
5. PROVIDE WITH CONTROL PANEL-SEE SPECS FOR REQUIREMENT.

CONDENSATE VACUUM PUMP (VCP) SCHEDULE	
GENERAL	PLAN NO.
	LOCATION
	SERVICE
	MANUFACTURER
	MODEL
RECEIVER	TYPE
	CAPACITY (EDR)
	MATERIAL
	VOL (GAL)
	INLET SIZE (IN)
PUMP	QUANTITY
	MOUNTING
	GPM
	DISCH. PRESS. (PSI)
	HP/BHP
VACUUM	VOLTS/PHASE
	RPM
	NOTES

NOTES: SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION.  
1. PROVIDE WITH WATER LEVEL GAUGE & COMPOUND GAUGE.  
2. PROVIDE WITH INLET STRAINER, SOLENOID VALVE, DISCHARGE VALVE, VACUUM SWITCH, AND ANGLE THERMOMETER.  
3. PROVIDE WITH CONTROL PANEL-SEE SPECS FOR REQUIREMET.

STEAM BOILER (SB) SCHEDULE			
PLAN NO.	SB-1	SB-2	SB-3
LOCATION	BOILER PLANT	BOILER PLANT	BOILER PLANT
MANUFACTURER	CLEAVER BROOKS	CLEAVER BROOKS	CLEAVER BROOKS
MODEL	CBLE-200	CBLE-200	CB-50
TYPE	FIRE TUBE	FIRE TUBE	FIRE TUBE
OPERATING PRESSURE (PSI)	10	10	10
FIRING INPUT (MBH)	8,165	8,165	2,092
STEAM CAP. (LBS/HR)	6,900	6,900	1,725
BOILER HP	200	200	50
FUEL	N. GAS	N. GAS	N. GAS
FIRING STAGES	FULL MOD.	FULL MOD.	FULL MOD.
ELECTRICAL	208/3/60	208/3/60	208/3/60
HP	15	15	2.0
NOTES	1, 2, 3	1, 2, 3	1, 2, 3

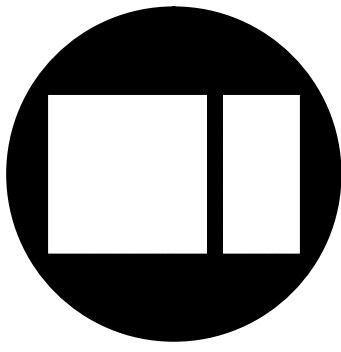
NOTES: SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION.  
1. PROVIDE STANDARD TRIM AS SPECIFIED.  
2. PROVIDE FORCED DRAFT BURNER AND 5 PSI GAS TRAIN.  
3. MOUNT ON 4" CEB.

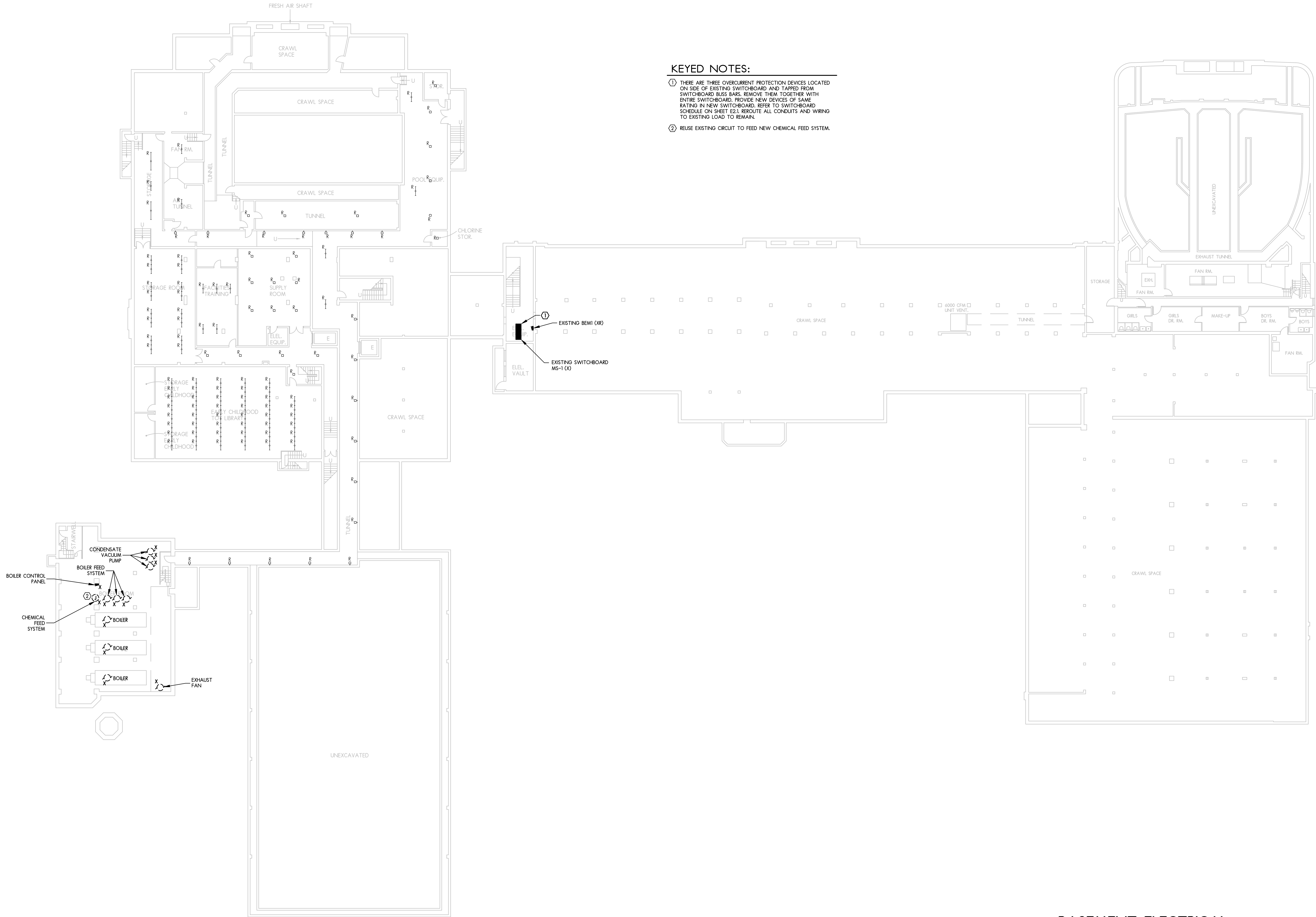
BLOWDOWN SEPARATOR (BDS) SCHEDULE	
PLAN NO.	BDS-1, 2, 3
LOCATION	BOILER ROOM
SERVICE	SB-1, SB-2, SB-3
TANK DATA	MANUFACTURER
	MODEL
	DIAMETER (IN)
	HEIGHT (IN)
	INLET SIZE (IN)
AFTER COOLER	VENT SIZE (IN)
	DRAIN SIZE (IN)
	OPERATING WEIGHT (LBS)
	MODEL
	TYPE
VACUUM	DRAIN SIZE
	WATER INLET (IN)
NOTES	1

NOTES: SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION.  
1. PROVIDE WITH FLOOR STAND, TEMP. REGULATOR VALVE & SOLENOID VALVE.

EXHAUST FAN (EF) SCHEDULE	
PLAN NO.	EF-1
SERVICE	BOILER ROOM SUMMER VENTILATION
MANUFACTURER	COOK
MODEL	30A9B
TYPE	PROPELLER
CFM	7,200
ESP (IN W.C.)	0.5
MAX SONES	55
HP/BHP	2.0/1.73
DRIVE	BELT
VOLT/PH	208/3
WEIGHT (LBS)	320
NOTES	1, 2, 3, 4

NOTES: SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION.  
1. CONTROLLED WITH REVERSE ACTING THERMOSTAT SET AT 90°F (ADJUSTABLE).  
2. PROVIDE WALL COLLAR.  
3. PROVIDE BACKDRAFT DAMPER.  
4. PROVIDE MOTOR SIDE WIRE GUARD.

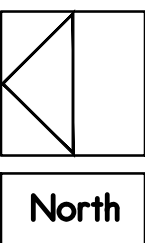




- KEYED NOTES:**
- 1 THERE ARE THREE OVERCURRENT PROTECTION DEVICES LOCATED ON SIDE OF EXISTING SWITCHBOARD AND TAPPED FROM SWITCHBOARD BUS BARS. REMOVE THEM TOGETHER WITH ENTIRE SWITCHBOARD. PROVIDE NEW DEVICES OF SAME RATING IN NEW SWITCHBOARD. REFER TO SWITCHBOARD SCHEDULE ON SHEET E2.1. REROUTE ALL CONDUITS AND WIRING TO EXISTING LOAD TO REMAIN.
  - 2 REUSE EXISTING CIRCUIT TO FEED NEW CHEMICAL FEED SYSTEM.

**BASEMENT ELECTRICAL  
DEMOLITION PLAN**

SCALE: 1/16" = 1'-0"

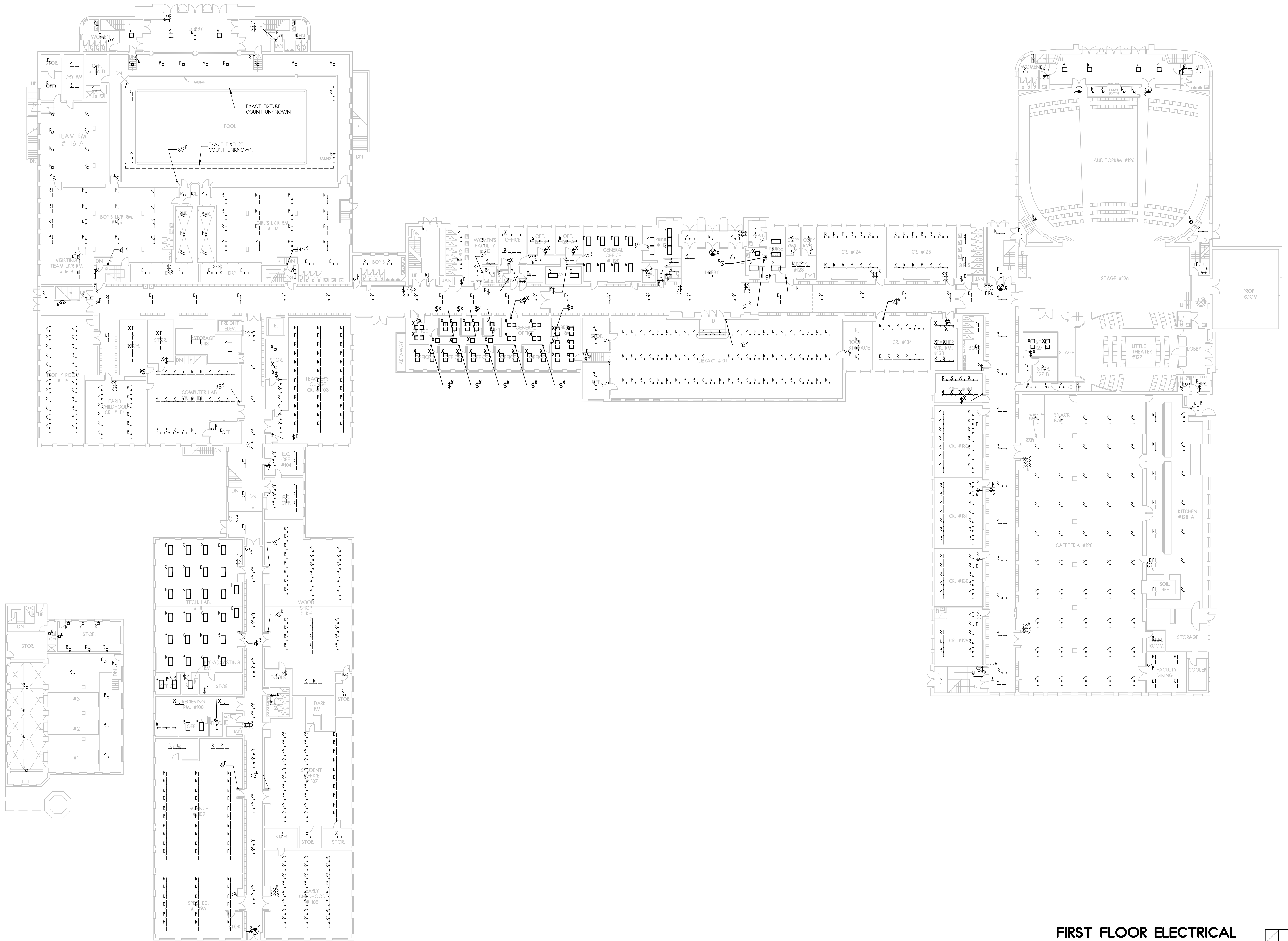


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HVAC AND ELECTRICAL RENOVATIONS - ROCKFORD IL  
ROCKFORD PUBLIC SCHOOLS 205**

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**FIRST FLOOR ELECTRICAL  
DEMOLITION PLAN**

SCALE: 1/16" = 1'-0"

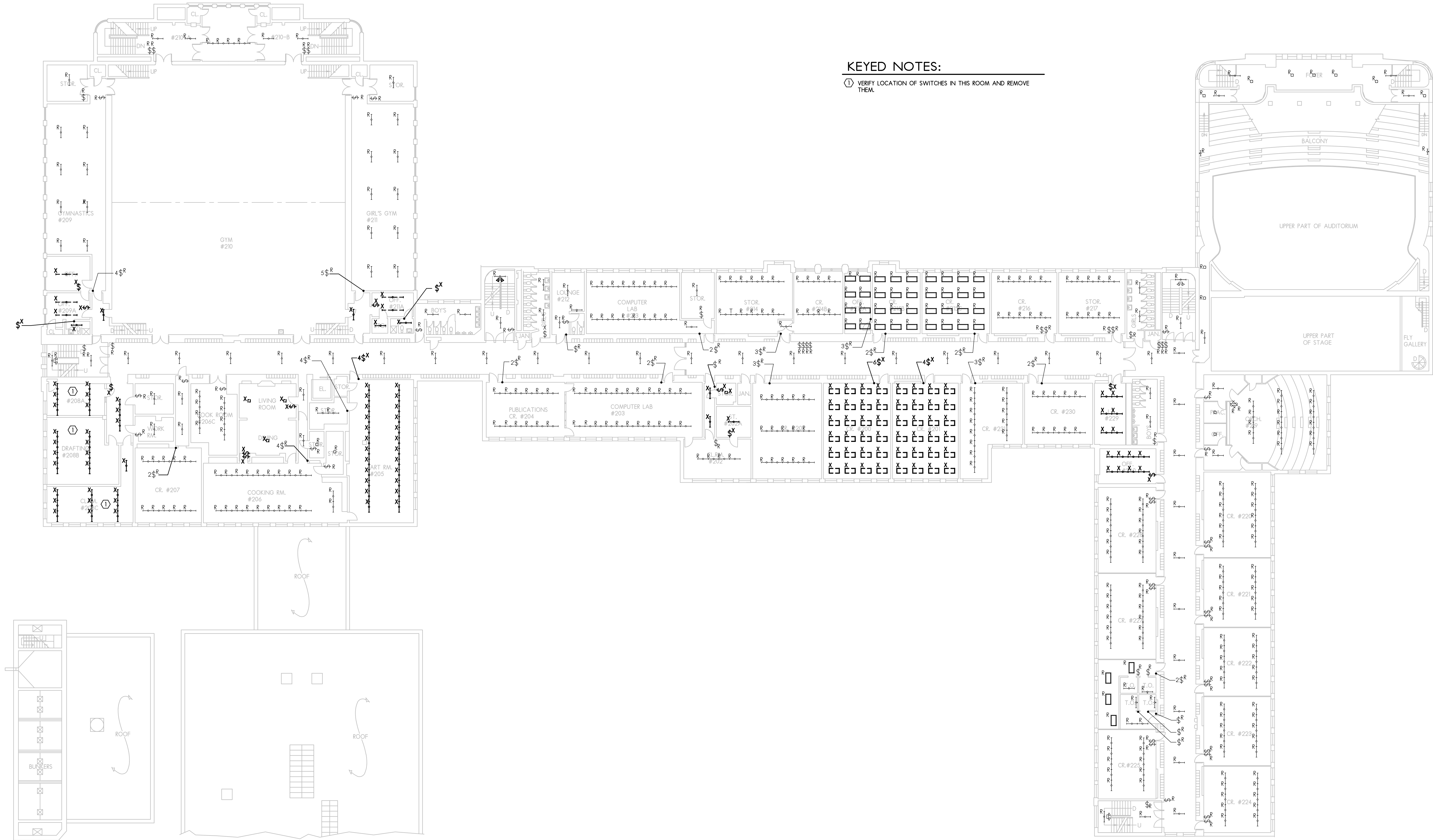
North

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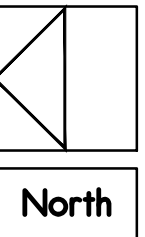
DATE: 02-29-2016
PROJECT NUMBER
25107
SHEET NUMBER
ED1.1



KEYED NOTES:  
① VERIFY LOCATION OF SWITCHES IN THIS ROOM AND REMOVE THEM.

SECOND FLOOR ELECTRICAL  
DEMOLITION PLAN

SCALE: 1/16" = 1'-0"



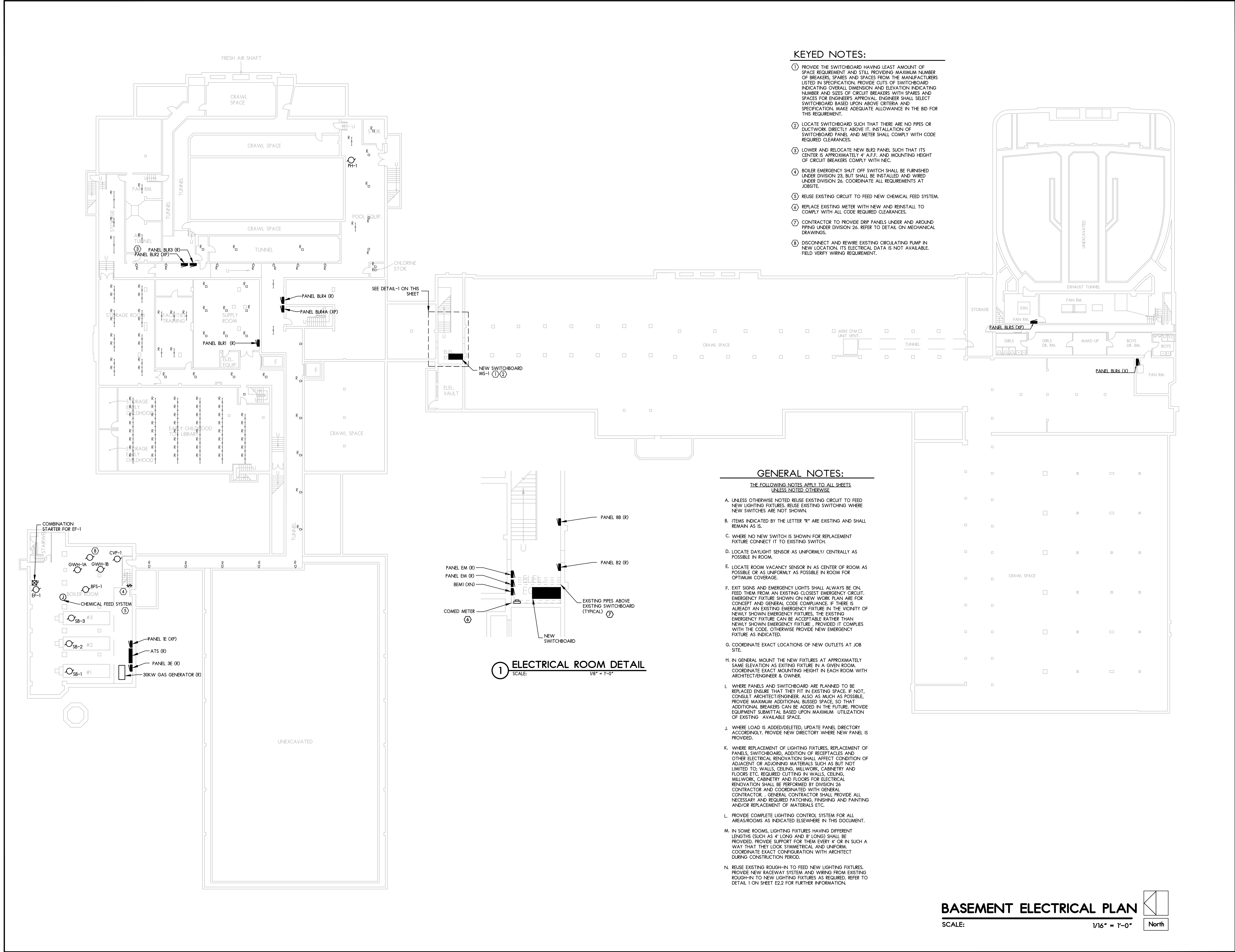
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KEYED NOTES:

1. PROVIDE THE SWITCHBOARD HAVING LEAST AMOUNT OF SPACE REQUIREMENT AND STILL PROVIDING MAXIMUM NUMBER OF BREAKERS, SPARES AND SPACES FROM THE MANUFACTURERS LISTED IN SPECIFICATION. PROVIDE CUTS OF SWITCHBOARD INDICATING OVERALL DIMENSION AND ELEVATION INDICATING NUMBER AND SIZES OF CIRCUIT BREAKERS WITH SPARES AND SPACES FOR ENGINEERS APPROVAL. ENGINEER SHALL SELECT SWITCHBOARD BASED UPON ABOVE CRITERIA AND SPECIFICATION. MAKE ADEQUATE ALLOWANCE IN THE BID FOR THIS REQUIREMENT.
2. LOCATE SWITCHBOARD SUCH THAT THERE ARE NO PIPES OR DUCTWORK DIRECTLY ABOVE IT. INSTALLATION OF SWITCHBOARD PANEL AND METER SHALL COMPLY WITH CODE REQUIRED CLEARANCES.
3. LOWER AND RELOCATE NEW BLR2 PANEL SUCH THAT ITS CENTER IS APPROXIMATELY 4' A.F.F. AND MOUNTING HEIGHT OF CIRCUIT BREAKERS COMPLY WITH NEC.
4. BOILER EMERGENCY SHUT OFF SWITCH SHALL BE FURNISHED UNDER DIVISION 23, BUT SHALL BE INSTALLED AND WIRED UNDER DIVISION 26. COORDINATE ALL REQUIREMENTS AT JOBSITE.
5. REUSE EXISTING CIRCUIT TO FEED NEW CHEMICAL FEED SYSTEM.
6. REPLACE EXISTING METER WITH NEW AND REINSTALL TO COMPLY WITH ALL CODE REQUIRED CLEARANCES.
7. CONTRACTOR TO PROVIDE DRIP PANELS UNDER AND AROUND PIPING UNDER DIVISION 26. REFER TO DETAIL ON MECHANICAL DRAWINGS.
8. DISCONNECT AND REWIRE EXISTING CIRCULATING PUMP IN NEW LOCATION. ITS ELECTRICAL DATA IS NOT AVAILABLE. FIELD VERIFY WIRING REQUIREMENT.

GENERAL NOTES:

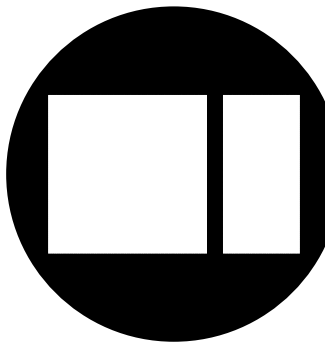
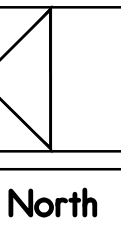
THE FOLLOWING NOTES APPLY TO ALL SHEETS UNLESS NOTED OTHERWISE

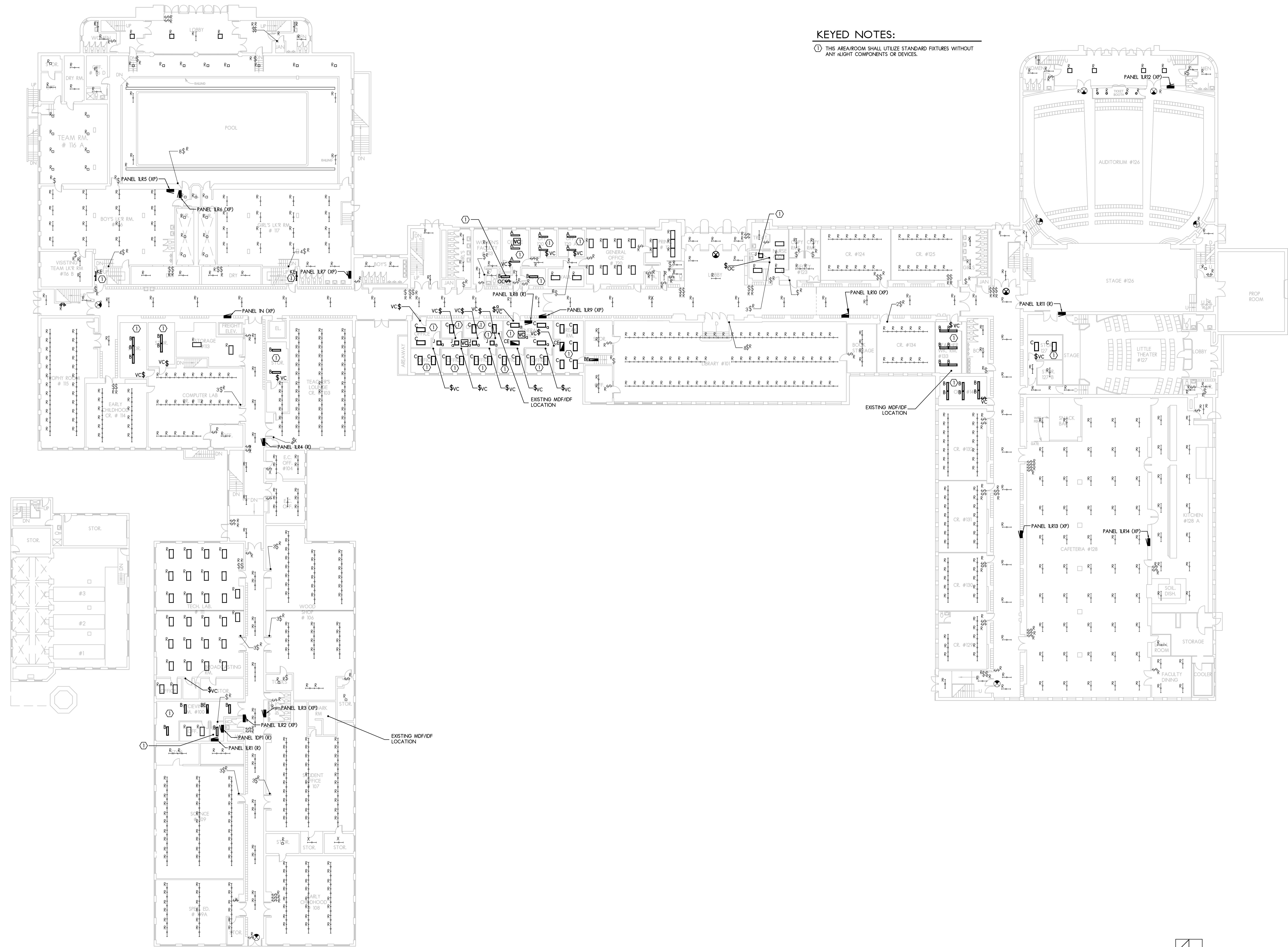
- A. UNLESS OTHERWISE NOTED REUSE EXISTING CIRCUIT TO FEED NEW LIGHTING FIXTURES. REUSE EXISTING SWITCHING WHERE NEW SWITCHES ARE NOT SHOWN.
- B. ITEMS INDICATED BY THE LETTER "R" ARE EXISTING AND SHALL REMAIN AS IS.
- C. WHERE NO NEW SWITCH IS SHOWN FOR REPLACEMENT FIXTURE CONNECT IT TO EXISTING SWITCH.
- D. LOCATE DAYLIGHT SENSOR AS UNIFORMLY CENTRALLY AS POSSIBLE IN ROOM.
- E. LOCATE ROOM VACANCY SENSOR IN AS CENTER OF ROOM AS POSSIBLE OR AS UNIFORMLY AS POSSIBLE IN ROOM FOR OPTIMUM COVERAGE.
- F. EXIT SIGNS AND EMERGENCY LIGHTS SHALL ALWAYS BE ON. FEED THEM FROM AN EXISTING CLOSEST EMERGENCY CIRCUIT. EMERGENCY FIXTURE SHOWN ON NEW WORK PLAN ARE FOR CONCEPT AND GENERAL CODE COMPLIANCE. IF THERE IS ALREADY AN EXISTING EMERGENCY FIXTURE IN THE VICINITY OF NEWLY SHOWN EMERGENCY FIXTURES, THE EXISTING EMERGENCY FIXTURE CAN BE ACCEPTABLE RATHER THAN NEWLY SHOWN EMERGENCY FIXTURE. PROVIDED IT COMPLIES WITH THE CODE. OTHERWISE PROVIDE NEW EMERGENCY FIXTURE AS INDICATED.
- G. COORDINATE EXACT LOCATIONS OF NEW OUTLETS AT JOB SITE.
- H. IN GENERAL MOUNT THE NEW FIXTURES AT APPROXIMATELY SAME ELEVATION AS EXISTING FIXTURE IN A GIVEN ROOM. COORDINATE EXACT MOUNTING HEIGHT IN EACH ROOM WITH ARCHITECT/ENGINEER & OWNER.
- I. WHERE PANELS AND SWITCHBOARD ARE PLANNED TO BE REPLACED ENSURE THAT THEY FIT IN EXISTING SPACE. IF NOT, CONSULT ARCHITECT/ENGINEER. ALSO AS MUCH AS POSSIBLE, PROVIDE MAXIMUM ADDITIONAL BUSSED SPACE, SO THAT ADDITIONAL BREAKERS CAN BE ADDED IN THE FUTURE. PROVIDE EQUIPMENT SUBMITTAL BASED UPON MAXIMUM UTILIZATION OF EXISTING AVAILABLE SPACE.
- J. WHERE LOAD IS ADDED/DELETED, UPDATE PANEL DIRECTORY ACCORDINGLY. PROVIDE NEW DIRECTORY WHERE NEW PANEL IS PROVIDED.
- K. WHERE REPLACEMENT OF LIGHTING FIXTURES, REPLACEMENT OF PANELS, SWITCHBOARD, ADDITION OF RECEPTACLES AND OTHER ELECTRICAL RENOVATION SHALL AFFECT CONDITION OF ADJACENT OR ADJOINING MATERIALS SUCH AS BUT NOT LIMITED TO; WALLS, CEILING, MILLWORK, CABINETRY AND FLOORS ETC. REQUIRED CUTTING IN WALLS, CEILING, MILLWORK, CABINETRY AND FLOORS FOR ELECTRICAL RENOVATION SHALL BE PERFORMED BY DIVISION 26 CONTRACTOR AND COORDINATED WITH GENERAL CONTRACTOR. GENERAL CONTRACTOR SHALL PROVIDE ALL NECESSARY AND REQUIRED PATCHING, FINISHING AND PAINTING AND/OR REPLACEMENT OF MATERIALS ETC.
- L. PROVIDE COMPLETE LIGHTING CONTROL SYSTEM FOR ALL AREAS/ROOMS AS INDICATED ELSEWHERE IN THIS DOCUMENT.
- M. IN SOME ROOMS, LIGHTING FIXTURES HAVING DIFFERENT LENGTHS (SUCH AS 4' LONG AND 8' LONG) SHALL BE PROVIDED. PROVIDE SUPPORT FOR THEM EVERY 4' OR IN SUCH A WAY THAT THEY LOOK SYMMETRICAL AND UNIFORM. COORDINATE EXACT CONFIGURATION WITH ARCHITECT DURING CONSTRUCTION PERIOD.
- N. REUSE EXISTING ROUGH-IN TO FEED NEW LIGHTING FIXTURES. PROVIDE NEW RACEWAY SYSTEM AND WIRING FROM EXISTING ROUGH-IN TO NEW LIGHTING FIXTURES AS REQUIRED. REFER TO DETAIL ON SHEET E2.2 FOR FURTHER INFORMATION.

BASEMENT ELECTRICAL PLAN

SCALE:

1/16" = 1'-0"

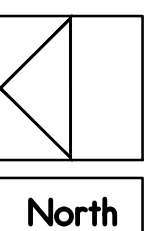




KEYED NOTES:  
① THIS AREA/ROOM SHALL UTILIZE STANDARD FIXTURES WITHOUT ANY LIGHT COMPONENTS OR DEVICES.

FIRST FLOOR ELECTRICAL PLAN

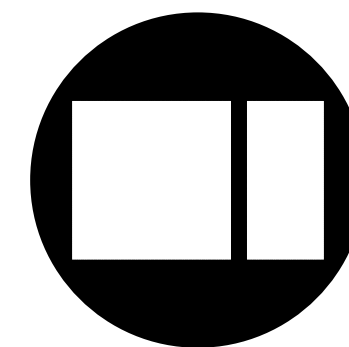
SCALE: 1/16" = 1'-0"



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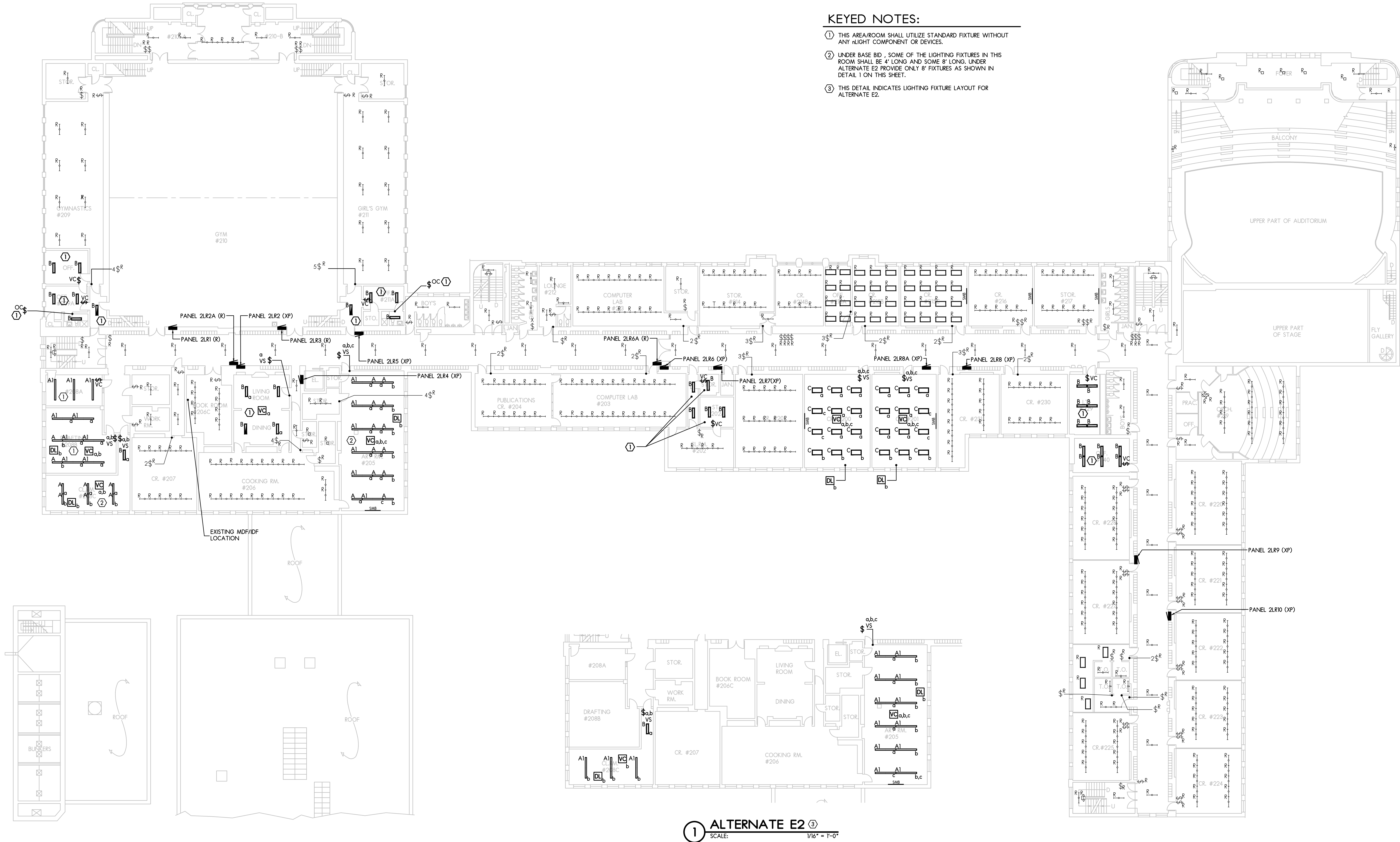
DATE: 02-29-2016
PROJECT NUMBER
25107
SHEET NUMBER
E1.1



Larson & Darby Group  
Architects Engineers Interiors

Rockford Office - 4001 Harmon Ave., Suite 100, Rockford, IL 61105  
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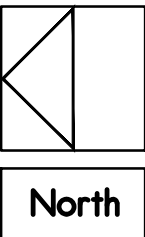
KEYED NOTES:

- ① THIS AREA/ROOM SHALL UTILIZE STANDARD FIXTURE WITHOUT ANY FLIGHT COMPONENT OR DEVICES.
- ② UNDER BASE BID, SOME OF THE LIGHTING FIXTURES IN THIS ROOM SHALL BE 4' LONG AND SOME 8' LONG. UNDER ALTERNATE E2 PROVIDE ONLY 8' FIXTURES AS SHOWN IN DETAIL 1 ON THIS SHEET.
- ③ THIS DETAIL INDICATES LIGHTING FIXTURE LAYOUT FOR ALTERNATE E2.

① ALTERNATE E2 ③  
SCALE: 1/16" = 1'-0"

SECOND FLOOR ELETRICAL PLAN

SCALE: 1/16" = 1'-0"



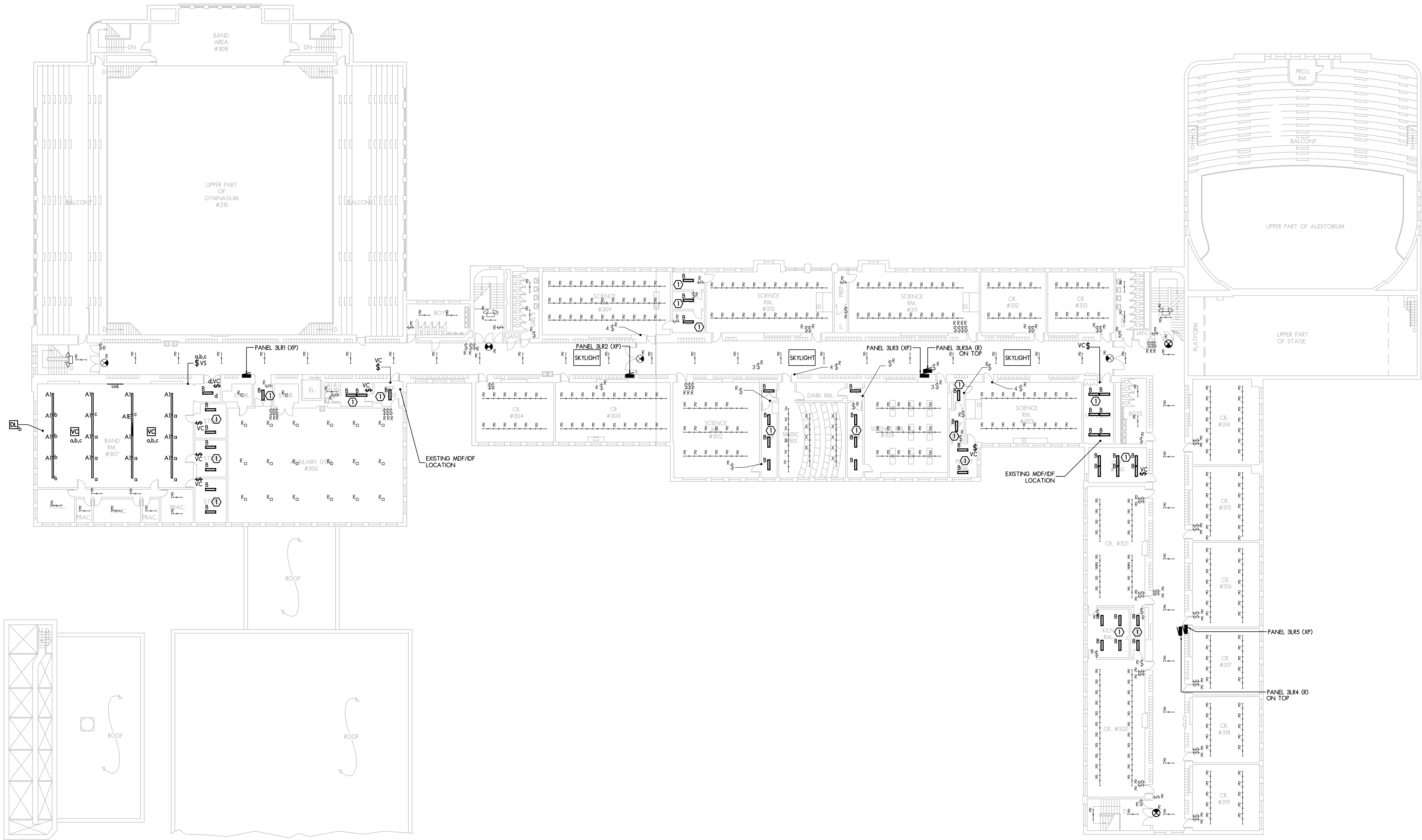
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SHEET NUMBER
E1.2

Larson & Darby Group  
Architects Engineers Interiors  
Rockford Office - 400 Harmon Ave., Suite 100, Rockford, IL 61101 Tel: (815) 484-0739 Fax: (815) 278-8647



KEYED NOTES:  
① THIS AREA/ROOM SHALL UTILIZE STANDARD FIXTURES WITHOUT ANY ALIGHT COMPONENTS OR DEVICES.

THIRD FLOOR ELECTRICAL PLAN  
SCALE: 1/16" = 1'-0" North

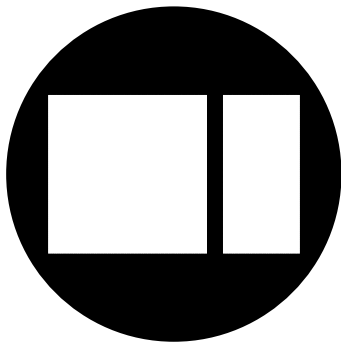
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HVAC AND ELECTRICAL RENOVATIONS - ROCKFORD IL  
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GENERAL ELECTRICAL SYMBOLS

	JUNCTION BOX- EXPOSED OR IN CEILING
	JUNCTION BOX - WALL MOUNTED
LIGHTING SYMBOLS	
	FLUORESCENT LIGHTING FIXTURE. SIZE AND TYPE AS INDICATED ON SCHEDULE.
	FLUORESCENT STRIP LIGHTING FIXTURE. SIZE AND TYPE AS INDICATED ON SCHEDULE.
	INCANDESCENT, FLUORESCENT OR HID LIGHTING FIXTURE. SIZE AND TYPE AS INDICATED ON SCHEDULE.
	WALL MOUNTED FLUORESCENT LIGHTING FIXTURE. SIZE AND TYPE AS INDICATED ON SCHEDULE.
	WALL MOUNTED INCANDESCENT, HID, OR FLUORESCENT LIGHTING FIXTURE. SIZE AND TYPE AS INDICATED ON SCHEDULE.
	INCANDESCENT, FLUORESCENT OR HID WALL WASH LIGHTING FIXTURE- SIZE AND TYPE AS INDICATED ON SCHEDULE.
	FLUORESCENT LIGHTING FIXTURE WIRED TO LIFE SAFETY CIRCUIT.
	FLUORESCENT LIGHTING FIXTURE WIRED TO CRITICAL CIRCUIT.
	BATTERY PACK, EMERGENCY LIGHTING UNIT
	REMOTE HEAD CONNECTED TO BATTERY PACK.
	"X" INDICATES FIXTURE. SHADED QUADRANTS INDICATES DIRECTION OF LIGHTED FACES. ARROWS INDICATE DIRECTION OF ARROWS.
	3W, XXa LIGHT SWITCH, SINGLE POLE UNLESS NOTED OTHERWISE:
	"a" SWITCHLEG
	"D" DIMMER SWITCH
	"K" KEY OPERATED
	"P" PILOT LIGHT
	"XX" CIRCUIT NUMBER
	"VC" VACANCY SENSOR SWITCH
	"WP" WEATHERPROOF
	"2P" TWO POLE
	"3P" THREE POLE
	"3W" THREE-WAY
	"4W" FOUR-WAY
	"VS" VACANCY SWITCH
	DAYLIGHT SENSOR
	OCCUPANCY SENSOR
	VACANCY SENSOR
	TIME CLOCK
	PHOTOCELL

POWER SYMBOLS

WALL	FLOOR BOX	POKE THROUGH	ABOVE COUNTER
ADJACENT LETTERS IN THE SYMBOLS ABOVE INDICATE THE FOLLOWING:			
	"GF" RECEPTACLE HAS GROUND FAULT CIRCUIT INTERRUPTER		
	"VP" RECEPTACLE HAS WATERPROOF COVER		
	"XX" RECEPTACLE CIRCUIT NUMBER		
	SPECIAL PURPOSE OUTLET - SEE SCHEDULE		
	"XX" INDICATES OUTLET TAG		
	PUSH-BUTTON STATION		
	PUSH PLATE STATION		
	MANJAL MOTOR CONTROL		
	"K" KEY OPERATED		
	"P" PILOT LIGHT		
	"T" THERMAL OVERLOAD PROTECTION		
	MOTOR - SEE SCHEDULE, "XX" INDICATES TAG		
	FUSED DISCONNECT SWITCH, "AS" INDICATES AMPERE RATING OF SWITCH AND "AF" INDICATES AMPERE RATING OF FUSE		
	NON-FUSED DISCONNECT SWITCH, CIRCUIT BREAKER IN ENCLOSURE,		
	SURFACE MOUNTED DISTRIBUTION PANELBOARD		
	SURFACE MOUNTED NORMAL BRANCH CIRCUIT PANELBOARD		
	RECESSED MOUNTED NORMAL BRANCH CIRCUIT PANELBOARD		
	TRANSFORMER		
	LIGHT RELAY/POWER PACK		
	GROUNDING ELECTRODE CONDUCTOR		
	POWER METER		

ELECTRICAL ABBREVIATIONS

AC	ABOVE COUNTER	NC	NORMALLY CLOSED
AFF	ABOVE FINISHED FLOOR	NEC	NATIONAL ELECTRICAL CODE
AIC	AVAILABLE INTERRUPTING CAPACITY	NL	NIGHT LIGHT
ATS	AUTOMATIC TRANSFER SWITCH	NO	NORMALLY OPEN
C	CONDUIT	PH	PHASE (A)
EC	ELECTRICAL CONTRACTOR	PNL	PANEL
EF	EXHAUST FAN	R	REMAIN
EM	EMERGENCY	SW	SWITCH
EDH	ELECTRIC DUCT HEATER	TTC	TELEPHONE TERMINAL
ESUH	ELECTRIC SUSPENDED UNIT HEATER	UNO	UNIT VENTILATOR
ETR	EXISTING TO REMAIN	U	UNLESS NOTED OTHERWISE
EWC	ELECTRIC WATER COOLER	VP	WEATHER PROOF
EVH	ELECTRIC WATER HEATER	X	EXISTING TO BE REMOVED
EX	EXISTING	XR	EXISTING TO BE RELOCATED
FBO	FURNISHED BY OTHERS	XN	EXISTING RELOCATED IN NEW LOCATION
FLA	FULL LOAD AMPS		
FVNR	FILL VOLTAGE NON-REVERING		
GF	GROUND FAULT INTERRUPTER		
GRD	GROUND		
HP	HORSEPOWER		
JB	JUNCTION BOX		
KW	KILOWATTS		
KVA	KILO VOLT AMPERES		
LTO	LIGHTING		
MAX	MAXIMUM		
MC	MECHANICAL CONTRACTOR		
MFG	MANUFACTURER		
MIN	MINIMUM		
MTD	MOUNTED		
MV	MERCURY VAPOR		

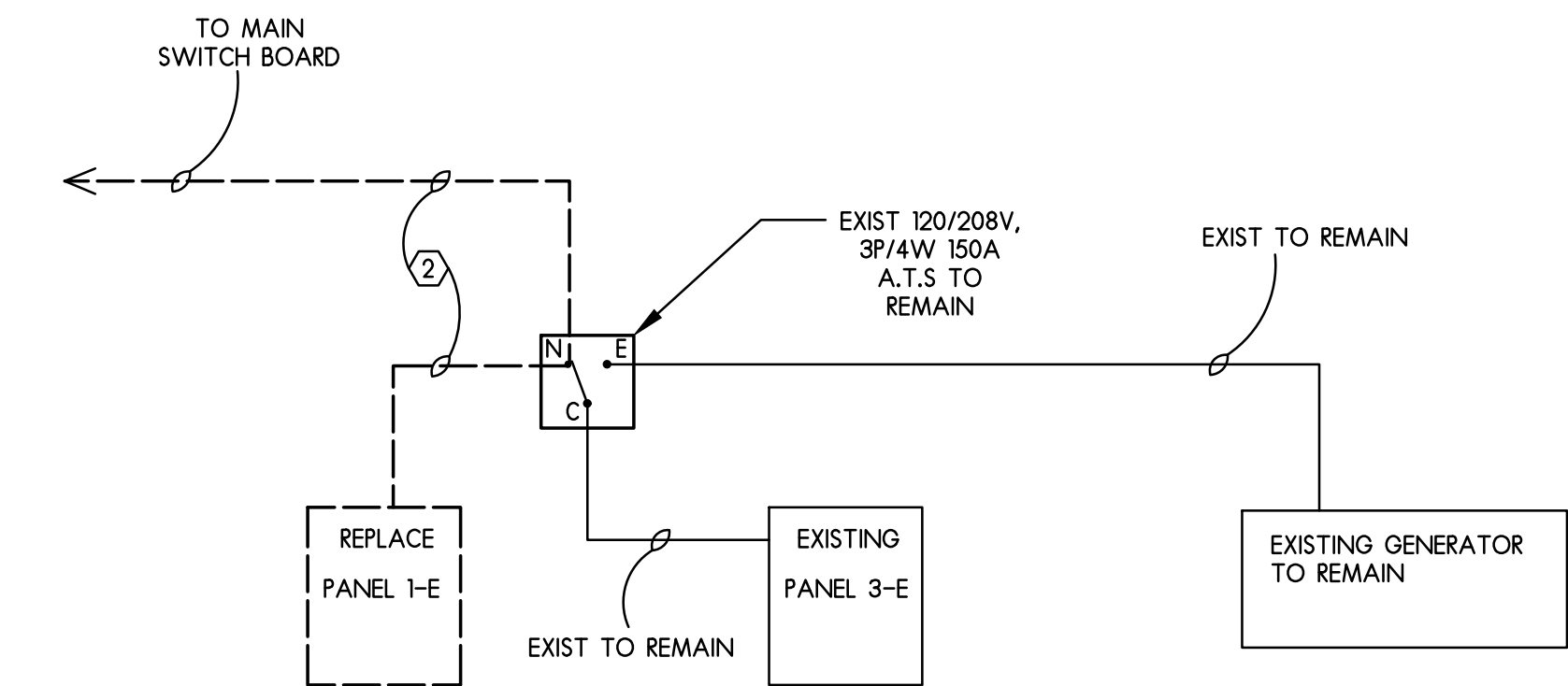
GENERAL ELECTRICAL NOTES

- REFER TO ARCHITECTURAL PLANS AND SPECIFICATIONS FOR ADDITIONAL GENERAL NOTES WHICH WILL APPLY HERE.
- DO NOT SCALE DRAWINGS.
- NOTES ON DRAWINGS SHALL APPLY TO ALL SIMILAR CONDITIONS WHETHER THEY ARE REPEATED OR NOT.
- THE CONTRACTOR MUST VISIT THE SITE TO FAMILIARIZE HIMSELF WITH THE EXISTING SITE AND BUILDING CONDITIONS WHICH WILL BE AFFECTED DURING CONSTRUCTION PRIOR TO SUBMITTING HIS BID PROPOSAL. CONTRACTOR IS CAUTIONED THAT THE PROJECT IS A REMODELING JOB AND IT IS ASSUMED THAT HE HAS INCLUDED FUNDS IN HIS BID TO COVER UNFORESEEN ITEMS WHICH MUST BE MOVED, RELOCATED OR ADJUSTED TO FIT HIS WORK. NO EXTRA COMPENSATION WILL BE ALLOWED FOR ANY EXTRA WORK CAUSED BY FAILURE TO VISIT, EXAMINE OR VERIFY.
- ALL EXISTING EQUIPMENT IS TO REMAIN OPERATIONAL DURING CONSTRUCTION PERIOD. ALL TEMPORARY WIRING OR REROUTING OF CIRCUITRY TO ACHIEVE THIS IS BY THE ELECTRICAL CONTRACTOR. SHUTDOWN OF EXISTING SERVICES SHALL ONLY BE PERMITTED UPON WRITTEN APPROVAL FROM THE OWNER AND THEN ONLY FOR THAT DATE AND DURATION AGREED UPON. INCLUDE ALL PREMIUM TIME CHARGES IN THE BASE BID.
- EXISTING CONDUIT IN SAME PLACE MAY BE REUSED WHERE POSSIBLE, PULL NEW WIRE AS REQUIRED. ALL UNUSED CONDUIT, WIRE, JUNCTION BOXES, ETC. WILL BE REMOVED. RELOCATED EXISTING CONDUIT SHALL NOT BE ALLOWED.
- BOXES LOCATED ON OPPOSITE SIDES OF NON-FIRE RATED WALLS SHALL BE OFFSET A MINIMUM OF 6" HORIZONTALLY. BOXES ON OPPOSITE SIDES OF FIRE RATED WALL SHALL BE OFFSET A MINIMUM OF 24" HORIZONTALLY. "THRU THE WALL" BOXES SHALL NOT BE ALLOWED WITHOUT PRIOR WRITTEN APPROVAL OF THE ARCHITECT/ENGINEER.
- ELECTRICAL CONTRACTOR SHALL VERIFY TOTAL CONNECTED LOAD/HP WITH ALL OTHER TRADES PRIOR TO WIRING OF ALL OTHER TRADES' EQUIPMENT. MAKE ANY CHANGES TO OVERCURRENT DEVICES AND FEEDER SIZE PER ELECTRICAL CODE AS REQUIRED.
- ELECTRICAL CONTRACTOR SHALL VERIFY ALL FURNITURE, MODULAR FURNITURE AND EQUIPMENT LOCATIONS WITH ARCHITECTURAL PLANS, ELEVATIONS AND REVIEWED SHOP DRAWINGS. PRIOR TO MAKING THE ACTUAL ELECTRICAL INSTALLATION, THIS CONTRACTOR SHALL ADJUST RECEPTACLES, OUTLETS OR CONNECTION LOCATIONS TO ACCOMMODATE FURNITURE AND/OR EQUIPMENT.
- ALL EXPOSED CABLES IN PLENUM CEILING SHALL BE APPROVED FOR PLENUM APPLICATION.
- PROVIDE SLEEVES/CONDUITS FOR LOW VOLTAGE CABLES WHEN THEY TRAVERSE ABOVE NON ACCESSIBLE CEILING SPACE. ALSO, PROVIDE SLEEVES THROUGH MASONRY WALLS FOR LOW VOLTAGE CABLES. VERIFY SLEEVE/CONDUIT SIZE REQUIREMENTS AND LOCATION WITH THE CONTRACTOR INSTALLING LOW VOLTAGE SYSTEM.
- THE ELECTRICAL CONTRACTOR SHALL VERIFY SIZE OF ALL EXISTING OPENINGS, DOORS, ETC., FOR REMOVING EQUIPMENT AND MATERIAL OUT OF BUILDING. ELECTRICAL CONTRACTOR SHALL PROVIDE ANY NEW OR ENLARGED OPENINGS IN EXISTING BUILDING CONSTRUCTION REQUIRED TO FACILITATE EXITING OF HIS EQUIPMENT/MATERIAL AND RESTORE SUCH OPENINGS TO THEIR ORIGINAL STATE AFTER COMPLETION.
- VERIFY QUANTITY AND SIZE OF LUOS PROVIDED IN OTHER TRADES' EQUIPMENT (FOR EXAMPLE, CHILLER, ELEVATOR, FIRE PUMP ETC.) BEFORE STARTING ANY WORK ASSOCIATED WITH SUCH EQUIPMENT. IF THEIR LUOS CANNOT ACCOMMODATE THE CABLES INDICATED IN ELECTRICAL DOCUMENT, PROVIDE LUG FITTINGS TO ACCOMMODATE CHANGE IN THE CABLES. PROVIDE SUCH FITTINGS IN A JUNCTION BOX AS CLOSE AS POSSIBLE TO THEIR EQUIPMENT. IF ALLOWED BY THE EQUIPMENT MANUFACTURER, SUCH FITTINGS MAY BE INSTALLED IN THEIR EQUIPMENT RATHER THAN IN A SEPARATE JUNCTION BOX.
- MAIN SERVICE ENTRANCE EQUIPMENT SHALL HAVE LABEL FOR SERVICE ENTRANCE TYPE, AND SHALL BE GROUNDED PER ELECTRICAL CODE.
- ALL SWITCHES IN COMMON AREAS SUCH AS HALLWAYS, CORRIDORS, VESTIBULES, STAIRS, PUBLIC WASHROOMS ETC. SHALL BE KEYED TYPE WHETHER SPECIFICALLY INDICATED OR NOT.
- PROVIDE SEPARATE DEDICATED GROUNDING CONDUCTOR IN EACH FEEDER AND BRANCH CIRCUIT WIRING CIRCUIT.
- THE ELECTRICAL DRAWINGS SHOW DIRECT PRINCIPLE WORK WHICH MUST BE ACCOMPLISHED UNDER THIS CONTRACT. INDIRECT AND INCIDENTAL WORK WILL ALSO BE NECESSARY DUE TO CHANGES AFFECTING EXISTING ARCHITECTURAL, MECHANICAL, PLUMBING OR OTHER SYSTEMS. SUCH INCIDENTAL WORK IS ALSO PART OF THIS CONTRACT. INSPECT THOSE AREA, AND ASCERTAIN WORK NEEDED AND DO THAT WORK IN ACCORDANCE WITH THE CONTRACT REQUIREMENTS, AT NO ADDITIONAL COST.
- PROVIDE REMOTE TEST AND INDICATING STATION IN A READILY ACCESSIBLE AND VISIBLE SPACE FOR EACH DUCT SMOKE DETECTOR. VERIFY ITS EXACT LOCATION WITH OWNER.
- WHERE "NM" IS INDICATED NEXT TO A DEVICE, CONTRACTOR SHALL VERIFY ITS REQUIREMENT IN FIELD. THIS INCLUDES VERIFICATION OF DEVICE TYPE, LOCATION, WIRING CONDUIT AND CIRCUIT BREAKER ETC. PROVIDE APPROPRIATE DEVICE, WIRING, CONDUIT, CIRCUIT BREAKER ETC. AS REQUIRED.
- PROVIDE RED PLASTIC SIGN AT MAIN WATER SERVICE METER INDICATING "MAIN GROUND LOCATION."
- PROVIDE ARC-FLASH LABELS ON NEW EQUIPMENT IN ACCORDANCE WITH NEC.
- WHERE EQUIPMENT DEVICES ARE INDICATED TO BE REMOVED, REMOVE ACCESSIBLE, UNUSABLE CONDUITS & WIRING. IF CONDUITS ARE NOT ACCESSIBLE THEY MAY BE ABANDONED. MAINTAIN CONTINUITY TO THE LOAD WHICH IS TO REMAIN.
- PROVIDE PULL STRINGS IN ALL CONDUITS FOR LOW VOLTAGE CABLES FOR TELE/DATA SOUND SYSTEM, SECURITY SYSTEM ETC.
- WHERE EXISTING HVAC EQUIPMENT IS SHOWN TO BE REMOVED, REMOVE ITS ASSOCIATED STARTER, DISCONNECT SWITCH, CONDUIT WIRING ETC. FIELD VERIFY LOCATION OF STARTER, DISCONNECT, ETC.
- ONLY OCCUPANCY/VACANCY SENSORS & REQUIRED SWITCHES ARE INDICATED. PROVIDE POWER PACKS (CONTROL RELAYS) AS REQUIRED. LOCATE SENSORS TO PROVIDE OPTIMUM COVERAGE OF THE DEVICE.
- PROVIDE GROUND BUS BAR IN EACH PANEL WHETHER SPECIFICALLY INDICATED OR NOT.
- ARMORED (BX) CABLES ARE NOT ALLOWED.

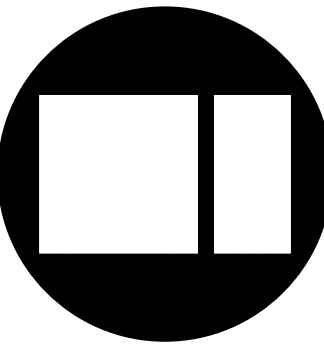
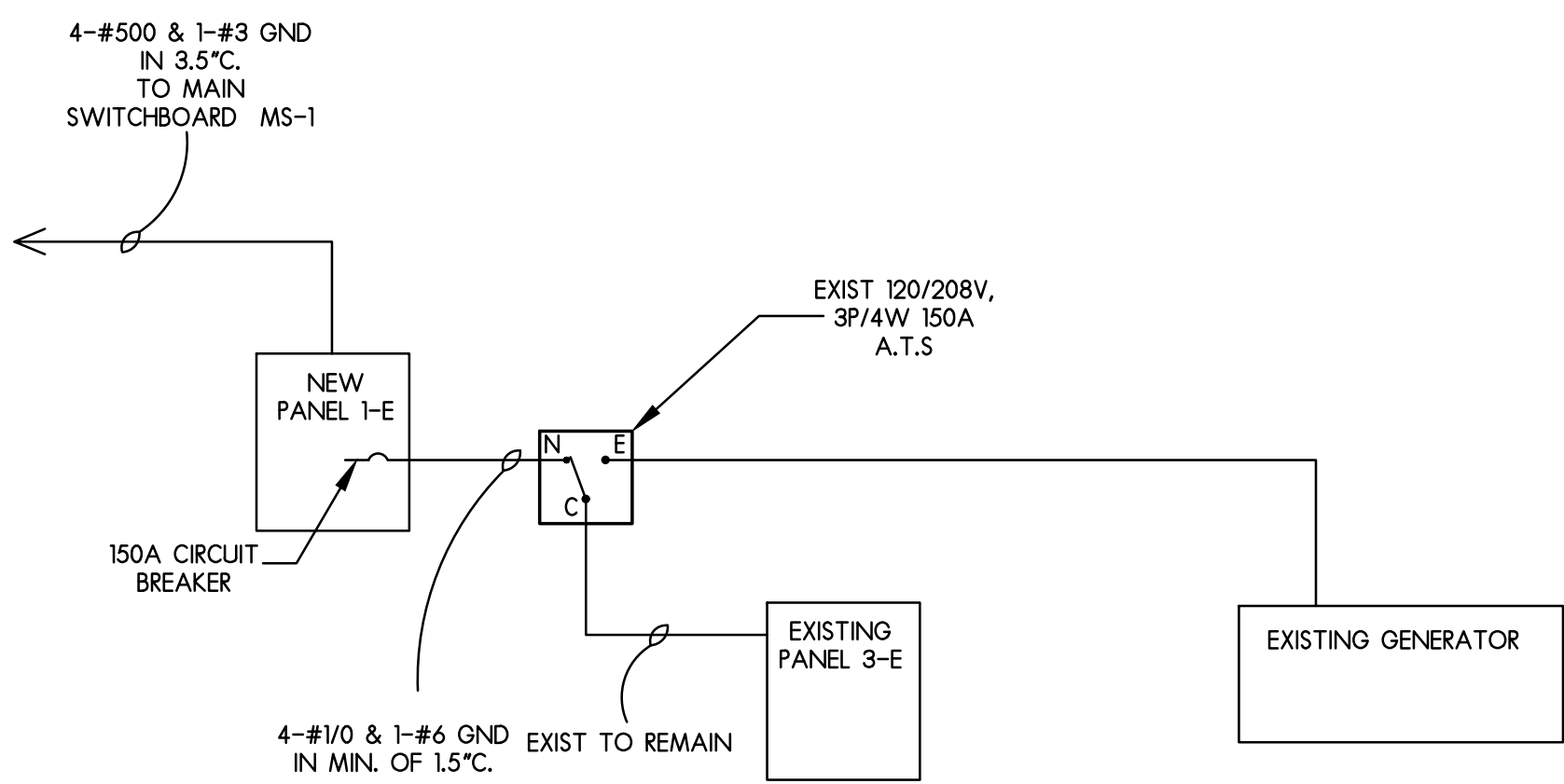
KEYED NOTES:

- THIS DIAGRAM REPRESENTS WIRING OF EXISTING PANEL IE, 3E AND ASSOCIATED A.T.S. REPLACE PANEL IE, 3E AND ASSOCIATED CONDUIT AND WIRING AS INDICATED IN DETAIL-A ON THIS SHEET.
- EXISTING WIRING SEEMS TO BE OF 1/0 CONDUCTORS. REMOVE AND PROVIDE ALL NEW WIRING.
- THIS REPRESENTS NEW CONFIGURATION FOR PANEL IE & 3E.

EXISTING PANEL IE & 3E WIRING



NEW PANEL IE & 3E WIRING



ISSUED FOR:	DATE
NO	06-24-16
DRAWN	
APPROVED	

DATE: 02-29-2016	PROJECT NUMBER
25107	SHEET NUMBER
E2.0	

ELECTRICAL- SCHEDULES, SYMBOLS, NOTES & ABBREVIATIONS

SCALE:

NONE

PANEL SCHEDULE								(3)(4)(5)(6)		
PANEL NAME	MOUNTING	VOLTAGE	PHASE & WIRE	CIRCUIT BREAKERS	SPACES	SPARE	MLO (AMP)	MCB (AMP)	MIN. A.I.C (AMP)	REMARKS
BASEMENT LEVEL										
BLR1	SURFACE	115/230	3/4	20-20A-1P				50-3P		①
BLR2-E	SURFACE	110/220	3/4	2-35A-3P, 2-50A-3P 3-XXA-3P	1		200			②
BLR2-N	SURFACE	110/220	3/4	2-35A-3P, 2-50A-3P 3-XXA-3P	1		200		13159	
BLR3	SURFACE	—	3/4	4-40A-3P, 1-50A-3P 1-60A-3P	24					①
BLR4	SURFACE	—	—	6-20A-1P-GFCI, 4-20A-1P	14					①
BLR4A-E	SURFACE	120/208	3/4	1-50A-3P, 2-90A-3P 1-70A-3P			225			②
BLR4A-N	SURFACE	120/209	3/4	1-50A-3P, 2-90A-3P 1-70A-3P			225		20101	
BLR5-E	SURFACE	110/220	3/4	3-15A-3P, 1-XXA-3P 2-50A-3P	3		200			②
BLR5-N	SURFACE	110/220	3/4	3-15A-3P, 1-XXA-3P 2-50A-3P	3		200		8090	⑧
BLR6	SURFACE	110/220		4			50			⑦
B2	SURFACE	120/208	3/4	3-35A-3P, 1-20A-3P, 2-80A-3P 2-30A-3P, 1-15A-3P, 1-100-3P 7-20A-1P, 2-15A-1P	3			200		①
EM	SURFACE	120/240	1/3	1-60A-2P, 1-30A-2P 12-20A-1P	8		100			①
EM EXIT	SURFACE	120/240	1/3	1-20A-2P, 1-15A-2P	4					①
8B	SURFACE	120/208	3/4	2-20A-3P, 1-30A-3P 1-15A-3P, 1-100A-2P 2-15-1P	7		100			①
1E-E	SURFACE	120/208	3/4	6-20A-3P, 1-50A-3P, 1-60A-3P 2-20A-2P, 1-20A-1P	6			100		②
1E-N	SURFACE	120/208	3/4	REFET TO PANEL SCHEDULE			400		9000	
3E	SURFACE	120/208	3/4	2-20A-3P, 1-50A-3P, 1-100A-3P, 2-20A-2P, 1-15A-1P	1			150		①
BEM1	SURFACE			TOTAL 20 CIRCUIT BREAKERS	12			200		① ⑨
FIRST FLOOR										
1N-E	FLUSH	115/230	3/4	40-20A-1P				100		②
1N-N	FLUSH	115/230	3/4	40-20A-1P				100	17583	⑭
1LR1	SURFACE	—	3/4	1-100A-3P, 1-50A-2P 7-20A-2P, 8-20A-1P	3					①
1LR2-E	FLUSH	115/230	3/4	40-20A-1P			200			②
1LR2-N	FLUSH	115/230	3/4	40-20A-1P			200		8530	
1LR3-E	FLUSH	110/220	3/4	TOTAL 12 CIRCUIT BREAKERS			50			②
1LR3-N	FLUSH	110/220	3/4	TOTAL 12 CIRCUIT BREAKERS			50		8530	⑭
1LR4	SURFACE			3-20A-2P, 17-20A-1P	1					①
1LR5-E	SURFACE	120/240	1/3	TOTAL 20 CIRCUIT BREAKERS	—		100			②
1LR5-N	SURFACE	120/240	1/3	TOTAL 20 CIRCUIT BREAKERS	—		100		11714	⑭
1LR6-E	FLUSH	115/230	3/4	40-20A-1P			100			②
1LR6-N	FLUSH	115/230	3/4	40-20A-1P			100		11714	
1LR7-E	SURFACE	—	—	TOTAL 12 CIRCUIT BREAKERS	1					②
1LR7-N	SURFACE	—	—	TOTAL 12 CIRCUIT BREAKERS	1				24999	⑭
1LR8	SURFACE	120/208	1/3	2-20A-2P, 12-20A-1P	4			100-2P		①
1LR9-E	FLUSH	115/230	3/4	32-20A-1P						②
1LR9-N	FLUSH	115/230	3/4	32-20A-1P				70	37729	
1LR10-E	FLUSH	115/230	3/4	40-20A-1P				100		②
1LR10-N	FLUSH	115/230	3/4	40-20A-1P				100	12905	
1LR11	FLUSH	—	3/4	2-20A-3P, 12-20A-1P				TWO MCB		①
1LR12-E	FLUSH	115/230	3/4	24-20A-1P			100	90		②
1LR12-N	FLUSH	115/230	3/4	24-20A-1P			100	90	5892	
1LR13-E	FLUSH	115/230	—	28-20A-1P				TWO MCB 90A,115A		②
1LR13-N	FLUSH	115/230	—	28-20A-1P				TWO MCB 90A,115A	6934	⑭
1LR14-E	FLUSH	115/230	3/4	40-20A-1P				70		②
1LR14-N	FLUSH	115/230	3/4	40-20A-1P				70	6934	

MOTOR AND EQUIPMENT SCHEDULE															
EQUIP. TAG	DESIGNATED TAG	LOAD					CONDUIT & WIRE SIZE	SOURCE OF POWER		PROTECT (AMPERES)	STARTER		DISCONNECT (AMP.)		NOTES
		VOLTS	PHASE	H.P.	AMP	KVA		PANEL	CCT. NO.		SIZE	TYPE	SIZE	TYPE	
BFS-1	BOILER FEED WATER SYSTEM (TRIPLEX)	208	3	0.5			3 #12, 1 #12G - 3/4" C.	1E	25/27/29	20-3P	WE	—	20-3P	TOGGLE	(15)
		208	3	0.5			3 #12, 1 #12G - 3/4" C.	1E	1/3/5	20-3P	WE	—	20-3P	TOGGLE	(15)
		208	3	0.5			3 #12, 1 #12G - 3/4" C.	1E	7/9/11	20-3P	WE	—	20-3P	TOGGLE	(15)
CVP-1	CONDENSATE VACUUM PUMP (DUPLEX)	208	3	2 AT 5			3 #4, 1 #8G - 1" C.	1E	2/4/6	60-3P	WE	—	60-3P	SAFETY	(15)
SB-1	STEAM BOILER	208	3	15			3 #2, 1 #8G - 1 1/4" C.	1E	20/22/24	90-3P	WE	—	100-3P	SAFETY	
SB-2	STEAM BOILER	208	3	15			3 #2, 1 #8G - 1 1/4" C.	1E	8/10/12	90-3P	WE	—	100-3P	SAFETY	
SB-3	STEAM BOILER	208	3	2			3 #12, 1 #12G - 3/4" C.	1E	14/16/18	20-3P	WE	—	20-3P	TOGGLE	
EF-1	EXHAUST FAN	208	3	2			3 #12, 1 #12G - 3/4" C.	1E	13/15/17	20-3P	1	FVNR	20-3P	TOGGLE	
GWH-1A	GAS WATER HEATER	120	1		12.1		2 #12, 1 #12G - 3/4" C.	1E	37	20-1P	—	—	20-1P	TOGGLE	
GWH-1B	GAS WATER HEATER	120	1		12.1		2 #12, 1 #12G - 3/4" C.	1E	39	20-1P	—	—	20-1P	TOGGLE	

PANEL SCHEDULE						③④⑤⑥				
PANEL NAME	MOUNTING	VOLTAGE	PHASE & WIRE	CIRCUIT BREAKERS	SPACES	SPARE	MLO (AMP)	MCB (AMP)	MIN. A.I.C (AMP)	REMARKS
SECOND FLOOR										
2LR1	FLUSH	120/208	3/4	1-20A-3P, 25-20A-1P	2		100			①
2LR2-E	FLUSH	115/230	—	36-20A-1P				TWO MCB 100A		②
2LR2-N	FLUSH	115/230	—	36-20A-1P				TWO MCB 100A	17132	⑩
2LR2A	FLUSH	120/208	3/4	3-20A-2P, 11-20A-1P (1 = 2 MINI)	10			100		①
2LR3	FLUSH	120/208	3/4	1-30A-2P, 1-20A-3P 26-20A-1P			100			①
2LR4-E	FLUSH	110/220	3/4	TOTAL 16 CIRCUIT BREAKERS			50			②
2LR4-N	FLUSH	110/220	3/4	TOTAL 16 CIRCUIT BREAKERS			50		23256	⑭
2LR5-E	FLUSH	115/230	3/4	TOTAL 12 CIRCUIT BREAKERS				70		②
2LR5-N	FLUSH	115/230	3/4	TOTAL 12 CIRCUIT BREAKERS				70	23256	⑭
2LR6-E	FLUSH	115/230	3/4	28-20A-1P				70		②
2LR6-N	FLUSH	115/230	3/4	28-20A-1P				70	24767	
2LR6A	SURFACE	110/220	3/4	1-60A-3P, 3-20A-2P, 2-15A-2P, 4-20A-1P	7					①
2LR7-E	FLUSH	110/220	3/4	TOTAL 12 CIRCUIT BREAKERS			50			②
2LR7-N	FLUSH	110/220	3/4	TOTAL 12 CIRCUIT BREAKERS			50		24767	⑭
2LR8-E	FLUSH	115/230	3/4	28-20A-1P				70		②
2LR8-N	FLUSH	115/230	3/4	28-20A-1P				70	12720	
2LR8A-E	FLUSH	110/220	3/4	TOTAL 8 CIRCUIT BREAKERS			50			②
2LR8A-N	FLUSH	110/220	3/4	TOTAL 8 CIRCUIT BREAKERS			50		12720	⑭
2LR9-E	FLUSH	115/230	3/4	TOTAL 12 CIRCUIT BREAKERS			50			②
2LR9-N	FLUSH	115/230	3/4	TOTAL 12 CIRCUIT BREAKERS			50		7025	⑭
2LR10-E	FLUSH	115/230	3/4	28-20A-1P				70		②
2LR10-N	FLUSH	115/230	3/4	28-20A-1P				70	7025	
THIRD FLOOR										
3LR1-E	FLUSH	115/230	3/4	24-20A-1P				70		②
3LR1-N	FLUSH	115/230	3/4	24-20A-1P				70	15356	
3LR2-E	FLUSH	115/230	3/4	36-20A-1P				70		②
3LR2-N	FLUSH	115/230	3/4	36-20A-1P				70	27302	
3LR3-E	FLUSH	115/230	3/4	36-20A-1P				70		②
3LR3-N	FLUSH	115/230	3/4	36-20A-1P				70	13224	
3LR3A	SURFACE			6-20A-1P, 4-20A-1P 1-20A-2P	4					①
3LR4	SURFACE	—	—	2-20A-2P, 2-20A-1P	10					①
3LR5-E	FLUSH	115/230	3/4	28-20-1P				70		②
3LR5-N	FLUSH	115/230	3/4	28-20-1P				70	6657	

MAIN SWITCHBOARD MS-1				
VOLTAGE : 120/208 V		MAIN TYPE: MCB		OCB TYPE: CIRCUIT BREAKER
PHASE: 3PH,4W		BUS AMP: 2000AMP		FAULT DUTY: 81578 AMP
CCT. NO.	LOAD DESCRIPTION	DEVICE RATING (AMP)		NOTES
		FRAME	TRIP	
1	LTG PANELS A1,A2,A4,A5	400-3P	275-3P	
2	OFF	400-3P	300-3P	
3	LTG PANELS C3,C6,C10,C11	400-3P	275-3P	
4	LTG PANELS C4,C4A,C7,C8	250-3P	225-3P	
5	LTG PANELS B1,B3,B5	250-3P	225-3P	
6	LTG PANELS B2,B4,B6	400-3P	225-3P	
7	LTG D1	200-3P	150-3P	
8	PWR. PANEL E1	200-3P	200-3P	
9	PWR. PANEL B2	250-3P	225-3P	
10	PWR. A1	200-3P	175-3P	
11	PWR. PANEL C1, PUMP ROOM	200-3P	150-3P	
12	LTG. PANEL F1	100-3P	50-3P	
13	POWER PANEL D1			(13)
14	FEEDER 140, 240, 340	400-3P	250-3P	(14)
15	AUDITORIUM WING	400-3P	400-3P	(15)
16	(16)	100-3P	100-3P	(16)
17	PANEL 1E	400-3P	400-3P	
18	SPACE	400-3P		
19	SPACE	400-3P		
20	SPACE	400-3P		
21	SPACE	400-3P		

Panel 1-E				PLUS GROUND BUS			Project Number: 25107 SURFACE Mounting: 9000	
Voltage: 120/208V, 3PH, 4W Mains: 400A M.L.O.							Min. A.I.C.	
G K T	BRKR T (A/F)	DESCRIPTION	PH. A LOAD (VA)	PH. B LOAD (VA)	PH. C LOAD (VA)	DESCRIPTION	BRKR (A/F)	C K T
3			333				60	2
20			4200					4
5				333				4
3		BFS-1 ( B )		4200				4
7					333			3
20			333		4200			3
9			5800				90	8
11		BFS-1 ( C )		333				10
3				5800				12
13					333			3
20			940		5800		20	14
15			940					14
17		EF-1		940				16
3				940				18
19				940			90	20
21			5800					22
23		8/10/12 (V)		5800				24
25					5800		60	3
27			333					26
3		BFS-1(A)		333				28
29					333			30
31							20	32
33		20A-3P (20/22/24) (V)						34
35						20A-3P (19/21/23) (V)		36
37		1	1500				150	38
39		1	5530					40
41		1		1500				42
20		20A-1P (36) (V)		5530				42
Connected Load Phase A:			25.71 KVA			208.92		
Connected Load Phase B:			25.71 KVA			Maximum connected Amps		
Connected Load Phase C:			24.21 KVA					

KEYED NOTES:

- 1 EXISTING PANEL SHALL REMAIN.
- 2 REPLACE PANEL WITH NEW. SOME OF THE PANELS DO NOT HAVE ANY INFORMATION ABOUT RATING OR AMPCITY OF PANELS. PROVIDE NEW PANELS OF THE SAME RATING AND SAME AMPCITY
- 3 MOST OF THE EXISTING PANELS DO NOT HAVE NAME TAGS. PROVIDE LABELS ON PANELS READING NAME TAG INDICATED IN THE EXISTING PANEL. THE RATING OF THE PANEL OR BREAKERS ARE BASED UPON THE SURVEY AT THE TIME OF DESIGN. VERIFY ALL EXISTING CIRCUIT BREAKERS AND PROVIDE NEW CIRCUIT BREAKERS TO MATCH THE PANELS. UNLESS DIFFERENT RATED CIRCUIT BREAKERS ARE NOTED TO BE PROVIDED.
- 4 TRACE ALL WIRING FOR PANEL BACK TO SERVICE. PROVIDE SCHEMATIC DIAGRAM FOR ALL PANELS INDICATING FEEDER INFORMATION (CONDUIT AND WIRE QUANTITY AND WIRE SIZES) AND RATING OF OVERCURRENT PROTECTION IN DISTRIBUTION PANELS OF EXISTING PANELS. PROVIDE A COMPLETE FORMAL SCHEMATIC DIAGRAM IN ACCORDANCE WITH INDUSTRY STANDARDS. THE FORMAT OF WIRING DIAGRAM SHALL BE ACCEPTABLE TO ENGINEER AND OWNER.
- 5 AT THE END OF PANEL NAME "E2" INDICATES EXISTING AND "N" INDICATES NEW. FOR EXAMPLE: BU2X2Z INDICATES EXISTING AND NEW. THE "X" INDICATES THE PANEL OR BREAKER INDICATES THE CHARACTERISTICS OF NEW PANEL BU2Z. PROVIDE NAME TAG ON NEW PANELS "WITHOUT 'N'". FOR EXAMPLE: NAME PANEL BU2X2Z SHALL HAVE LABEL BU2Z.
- 6 ALL NEW PANELS SHALL HAVE GROUND BAR IN ADDITION TO PHASE & NEUTRAL BARS. SOME OF THE EXISTING PANELS MAY HAVE GROUND BARS TO FEED ANOTHER PANEL. PROVIDE DOUBLE BUS FOR NEW REPLACEMENT PANEL AS REQUIRED TO FEED SUB-FEED ANOTHER PANEL. VERIFY NEED FOR DOUBLE BUS AT JOBSITE.
- 7 REMOVE THIS PANEL COMPLETELY. INCLUDING ALL ASSOCIATED CONDUITS, CONDUIT BUNDLES, WIRING ETC. CURRENTLY THIS HAS 4-1 POLE CIRCUIT BREAKERS. PROVIDE 4 CIRCUIT BREAKERS OF SIMILAR RATING IN PANEL BU2Z, AND REFEED THE LOAD FROM CIRCUIT BREAKER IN PANEL BU2Z.
- 8 ADDITION TO BREAKERS SHOWN, PROVIDE 4-1P CIRCUIT BREAKERS SHOWN IN FEED 7. PROVIDE.
- 9 RELOCATE THIS PANEL AS SHOWN ON THE FLOR PLAN.
- 10 PROVIDE PANEL OF THE SAME RATING AS EXISTING AND WITH TWO LARGE CIRCUIT BREAKERS AS EXISTING PANEL.
- 11 THIS CIRCUIT BREAKER SHALL REPLACE EXISTING OVERCURRENT PROTECTION DEVICES MOUNTED ON SIDE OF EXISTING SWITCHBOARD AS INDICATED VIA NOTE-1 ON SHEET EDO. PROVIDE TWO SETS OF OVERCURRENT PROTECTION DEVICES TO THAT OF EXISTING DEVICES.
- 12 THERE IS NO LABEL INDICATED ON EXISTING 100A-3P DEVICE WHICH IS MOUNTED ON SIDE OF SWITCHBOARD. TRACE THE LOAD TO DETERMINE EQUIPMENT SERVED FROM THIS DEVICE AND PROVIDE NEW LABEL ACCORDINGLY.
- 13 THERE IS NO MARKING ON CIRCUIT BREAKERS. BASED UPON THE EXISTING PANEL IT SEEMS TO BE EITHER 800A OR 1000A CIRCUIT BREAKER. PROVIDE NEW CIRCUIT BREAKER OF THE SAME RATING AS EXISTING.
- 14 PROVIDE NEW PANEL WITH SAME NUMBER OF CIRCUIT BREAKERS AND BUSSED SPACES AS EXISTING.
- 15 BOILER FEED SYSTEM SHALL CONSIST OF FACTORY ASSEMBLED PUMPING SYSTEM INCLUDING FACTORY MOUNTED AND CIRCUIT WIRED CONTROL PANEL TO SERVE THREE PUMPS. PROVIDE TWO SEPARATE FEEDS FROM FACTORY MOUNTED CONTROL PANEL TO SERVE THREE PUMPS. PROVIDE DISCONNECT SWITCH FOR EACH FEED. ALL WIRING FROM CONTROL PANEL TO PUMPS SHALL BE PRE-WIRED FROM CONTROL PANEL.
- 16 CONDENSATE VACUUM PUMP SYSTEM SHALL CONSIST OF FACTORY ASSEMBLED PUMPING SYSTEM INCLUDING FACTORY MOUNTED AND CIRCUIT WIRED CONTROL PANEL TO SERVE TWO PUMPS. PROVIDE ONE FEED FROM PANEL BULK TO CONTROL PANEL TO SERVE BOTH PUMPS. PROVIDE DISCONNECT SWITCH FOR EACH FEED. ALL WIRING FROM CONTROL PANEL TO PUMPS SHALL BE PRE-WIRED FROM CONTROL PANEL.
- 17 THIS EXISTING LOAD WHICH IS TO REMAIN. TRANSFER LOADING LOAD WHICH IS TO REMAIN FROM EXISTING PANEL TO NEW PANEL. THE INFORMATION IN THIS PANEL DIRECTORY WAS BASED UPON THE EXISTING PANEL DIRECTORY WHICH MAY NOT BE ACCURATE. VERIFY EXISTING CONDITIONS AND PROVIDE APPROPRIATE CIRCUIT BREAKERS, LABELS ETC. AS REQUIRED. REMOVE ALL UNUSED CONDUIT AND WIRING.



GENERAL NOTES:

1. SUFFIX "A" AFTER THE LIGHT FIXTURE TYPE DENOTES THE LIGHT IS EMERGENCY TYPE. FOR EXAMPLE FIXTURE TYPE "AE" OR "AE1" INDICATES THAT IT IS AN EMERGENCY FIXTURE SAME AS TYPE "A", THIS FIXTURE SHALL ALWAYS BE ON.
2. REFER TO GENERAL LIGHTING CONTROL NOTES ON THIS SHEET AND "TYPICAL LIGHTING CONTROL FLOOR PLAN BASE BID" FOR MORE DETAILS. DIMENSIONS NOTED OTHERWISE PROVIDE LIGHT MODULES INSIDE EACH LIGHTING FIXTURES AS INDICATED IN ABOVE MENTIONED NOTES AND IN ABOVE DIMENSIONS. ALL LIGHTING FIXTURES SHALL BE PROVIDED. LIGHT MODULES ARE PROVIDED AND FIXTURES ARE MOUNTED IN ONE CONTINUOUS ROW PROVIDE CATSE CONTROL WIRING AND POWER WIRING INSIDE FIXTURES RATHER THAN EXTERNAL EXPOSED WIRING.
3. PROVIDE FIXTURE IN ENTIRE LENGTH OF COVE. CONTRACTOR CAN USE 8' LONG FIXTURES IN LIEU OF 4' LONG FIXTURES, DEPENDING UPON LENGTH OF COVE. VERIFY EXACT LENGTH OF COVE TO QUOTE.
4. PROVIDE ONE LIGHT MODULE NEXT TO GROUP OF THESE FIXTURES IN A GIVEN ZONE.
5. VERIFY CEILING TRIM AT JOISTE.
6. PROVIDE ADDITIONAL CONNECTORS, CLIPS AS REQUIRED TO MEET ALL REQUIREMENTS INDICATED IN GENERAL NOTE "N" ON THIS SHEET.

N1. AS INDICATED IN THIS DOCUMENT, PROVIDE COMPLETE LIGHTING CONTROL SYSTEM BASED UPON nLIGHT SYSTEM MANUFACTURED BY ACUITY BRANDS, INC. UNLESS OTHERWISE NOTED, PROVIDE nLIGHT MODULE INSIDE EACH LIGHTING FIXTURE. FOR CERTAIN FIXTURES ( SUCH AS TYPE "D" AND TYPE "H") INSTALL ONE nLIGHT MODULE NEXT TO GROUP OF FIXTURES FOR GIVEN ZONE. ADDITIONALLY, WHERE THESE FIXTURES ARE INSTALLED, PROVIDE nLIGHT COMPATIBLE SWITCHES, VACANCY SENSORS, DAYLIGHTS SENSOR ETC. AS SHOWN ON FLOOR PLAN. PROVIDE CAT 5e WIRING TO INTERCONNECT THESE DEVICES. REFER TO "TYPICAL LIGHTING CONTROL FLOOR PLAN"DETAIL ON THIS SHEET FOR TYPICAL WIRING DIAGRAM.

N2. UNDER BASE BID, PROVIDE COMPLETELY OPERATIONAL SYSTEM AS INDICATED ABOVE ON A ROOM BY ROOM BASIS. MEANING EACH ROOM WILL BE INSTALLED AND WIRED AS A STANDALONE SYSTEM. IN ADDITION TO THAT, MAKE A PROVISION SUCH THAT, ALL ROOMS CAN BE INTEGRATED AS ONE OVERALL SYSTEM IN FUTURE BY ADDITION OF BRIDGES, GATEWAYS AND ADDITIONAL NETWORK CABLING AND CONNECTING TO OWNER'S SERVER EQUIPMENT.

N3. IN ADDITION TO ABOVE, PROVIDE AN ALTERNATE COST TO PROVIDE A COMPLETELY FUNCTIONAL SYSTEM SO THAT ALL ROOMS AND ALL DEVICES ARE INTEGRATED AS ONE SYSTEM. UNDER ALTERNATE, INCLUDE BRIDGES, GATEWAYS, POWER SUPPLIES, CABLING ETC. AS REQUIRED.

N4. CONTRACTOR SHALL PROVIDE ALL DEVICES, EQUIPMENT, INSTALLATION, CABLING, TESTING, TRAINING ETC. FOR INDIVIDUAL STAND ALONE SYSTEMS (UNDER BASE BID) AS WELL AS AN OVERALL SYSTEM FOR ENTIRE BUILDING (UNDER AN ALTERNATE E-1).

N5. LIGHTING FIXTURES FOR STORAGE ROOMS, SMALL OFFICES, CLOSETS ETC INDICATED VIA SPECIFIC NOTE SHALL BE STANDARD LED FIXTURES AND SHALL NOT HAVE ANY nLIGHT FEATURE AND SHALL NOT HAVE ANY PROVISION FOR nLIGHT SYSTEM. REFER TO KEY NOTE-6 ON THIS SHEET.

KEYED NOTES:

- ① TYPICAL 120V POWER WIRING SHOWN VIA SOLID LINE.
- ② TYPICAL 200V POWER SOURCE TO ROOM LIGHTING FIXTURES. FED FROM EXISTING ROUGH-INS.
- ③ TYPICAL CAT5E CABLE SHOWN VIA DASHED LINE.
- ④ PROVIDE WIRING INSIDE LIGHTING FIXTURES WHEN FIXTURES ARE MOUNTED IN ROW.
- ⑤ WHERE EXISTING FIXTURES ARE REMAINING, EXISTING WIRING SHALL REMAIN AS IS. WHERE LIGHTING FIXTURES ARE REPLACED IN CORRIDOR PROVIDE A-NIGHT CONTROL FOR CORRIDOR LIGHTING.
- ⑥ A-NIGHT FLOUORE CONTROL SYSTEM IS NOT REQUIRED IN SMALL OFFICES, CLOSETES, STORAGE ROOM ETC. AS INDICATED VIA KEYED NOTE 10 ON SHEETS EL0A, EL1A, EL12, EL2A, EL3 AND EL3A.
- ⑦ IN CLASSROOMS 8 BUTTON SWITCH SHALL BE A-CYCLE BRANDS AND MODELS: 4P00M 4X DK, IT SHALL HAVE 4 BUTTONS TO TURN LIGHTS ON FOR 4 ZONES OF LIGHTING IN A ROOM, 2 RAISE AND LOWER BUTTONS FOR DIMMING AND TWO MASTER ON & OFF BUTTONS. THIS SWITCH SHALL ALLOW DIMMING OF LIGHTS.
- ⑧ DUAL TECHNOLOGY VACANCY SENSOR, CUBY BRANDS, MODEL: T201 NOT TO BE APPROVED. THE EXACT MODEL NUMBER SHALL DEPEND UPON THE SIZE OF THE ROOM AND LOCATION FOR BEST COVERAGE.
- ⑨ DAY LIGHT SENSOR, CUBY BRANDS MODEL: mCmADCX OR APPROVED EQUIAL.
- ⑩ THIS DETAIL PROVIDES CONCEPTUAL WIRING DIAGRAM BASED UPON NIGHT SYSTEM MANUFACTURED BY CUBY BRAND, MODEL: T201. CUBY BRANDS' LIGHT SYSTEM PRODUCTS: DUAL BROWN 430-750-7002. UNDER BASE BID, PROVIDE STAND ALONE NIGHT LIGHT CONTROL SYSTEM FOR ROOMS WHERE NIGHT MODULES ARE PROVIDED. THIS DETAIL IS TYPICAL AND DOES NOT REFLECT THE NATURE OF THE INDIVIDUAL ROOM LAYOUT FOR QUANTITY OF FIXTURES AND DEVICES. IF THERE IS ANY EMERGENCY FIXTURE INSIDE A ROOM/AREA DO NOT CONNECT TO NIGHT SYSTEM. EMERGENCY LIGHTING FIXTURES SHALL ALWAYS BE ON.
- ⑪ PROVIDE CUTOFF UNDER ALTERNATE EI FOR WORK INDICATED IN THIS DETAIL. THE ALTERNATE CUTO SHALL BE PROVIDED: BRIDGES, GATEWAY AND REQUIRED NETWORK CABLEING AND SLOTTED. NOT INCLUDE BASE BID WORK INDICATED VIA NOTE 10 AND 13.
- ⑫ WIRING TO BRIDGE SHALL BE PROVIDED UNDER ALTERNATE I UNDER BASE BID MAKE A PROVISION SUCH THAT THIS WIRING CAN EASILY BE PROVIDED IN CASE IF ALTERNATE EI IS NOT ACCEPTED.
- ⑬ WORK IN THIS AREA SHALL BE PROVIDED AS BASED IN DETAIL. THIS WORK SHALL BE PART OF BASE BID.
- ⑭ IN GENERAL, CLASSROOMS SHALL HAVE THREE LIGHTING TYPES: 1) ONE FOR EACH SHARTBOARD, 2) FOR FIXTURES AT EXTERIOR WINDOWS AND TIED WITH DAYLIGHT SENSOR AND 3) FOR REMAINING FIXTURES. REFER TO THE MODIFIER CLOSURE COORDINATE IN THIS. ALL LIGHTS AND CONTROLS SHALL BE DIMMABLE.
- ⑮ IN GENERAL LARGE OFFICES, CAFETERIA ETC. SHALL HAVE ONE VACANCY TYPE ON/OFF CONTROL REFER TO FLOOR PLAN FOR ANY VARIATIONS TO THIS. ALL LIGHTS AND CONTROLS IN THIS AREA/ ROOM SHALL BE DIMMABLE.
- ⑯ TERMINATE CAT 5e CABLE FOR A-NIGHT CONTROL SYSTEM INTO MODIFIED CLOSURES. REFER TO SHEETS EL0A, EL12, EL2A, EL3, TO THE MODIFIER CLOSURE COORDINATE IN THIS. ALL LIGHTS IN THE ROOM AT JOBSITE WITH OWNER.

## nLIGHT CONTROLS

