



Maze
Design , Inc.

RICHMOND COMMUNITY SCHOOLS

HVAC UPGRADES / REPLACEMENTS

**VAILE ELEMENTARY SCHOOL
WESTVIEW ELEMENTARY SCHOOL
CHARLES ELEMENTARY SCHOOL**

**RICHMOND, IN
PROJECT #2115-1**



OCTOBER, 2021

PROJECT MANUAL

BIDDING REQUIREMENTS
CONDITIONS OF THE CONTRACT
SPECIFICATIONS

FOR

HVAC Upgrades / Replacements

Vaile Elementary School
300 South 14th Street

Westview Elementary School
1707 Southwest A Street

Charles Elementary School
2400 Reeveston Road

RICHMOND, IN
PROJECT 2115-1

MAZE DESIGN, INC.
124 South 8th Street
Richmond, Indiana 47374
Phone: (765)962-1300

Date: 10/29/2021

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| INVITATION TO BID |
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Issued By:
MAZE DESIGN, INC.
124 South 8th Street
Richmond, Indiana 47374
(765) 962-1300

1. You are invited to bid on a Prime Contract for the following project:

HVAC Upgrades / Replacements

Vaile Elementary School
300 South 14th Street

Westview Elementary School
1707 Southwest A Street

Charles Elementary School
2400 Reeveston Road

RICHMOND, IN
PROJECT 2115-1

2. Bids will be received for a Single Prime Contract consisting of General Construction, Plumbing, Heating Ventilating and Air Conditioning Construction, Electrical Construction.
3. Richmond Community Schools will receive Bids until **2:00 PM EST on Tuesday, November 30, 2021**, at the Administration Building, 300 Hub Etchison Parkway, Richmond, Indiana. Bids will be opened publicly and read aloud immediately after specified closing time. All interested parties are invited to attend. Bids received after the specified closing time will be logged in with time of receipt, opened, read aloud, and forwarded for appropriate action by the Board, with full reservation of the Board to reject any or all Bids due to the lateness.
4. A mandatory Pre-bid conference is scheduled for **Tuesday November 9th, 2021 at 9:00 a.m.**
Meeting schedule is as follows:
9:00a.m. to 9:45a.m. Charles Elementary School
10:00a.m. to 10:30a.m. Vaile Elementary School
10:45a.m. to 11:15a.m. Westview Elementary School
5. Bidding Documents may be examined at the Engineer's office:

Maze Design, Inc.
124 South 8th Street

Richmond, Indiana 47374

6. Bidding Documents may be obtained at Eastern Engineering Plan room www.easternengineering.com at contractors cost.
7. Bid security in the amount of five percent (5%) of the bid, must accompany each Bid in accordance with the Instructions to Bidders.
8. Guaranty Bonds in the form of a Performance Bond and a Labor and Material Payment Bond, in an amount equal to one hundred percent (100%) of the Contract Sum, will be required.
9. Wage scale per the Davis Bacon Act see specifications.

10. **SUBMISSION OF BIDS**

The Bid, bid security, and 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 indicated below and shall be identified with the Project name, division of work and the Bidder's name and address. 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.

Dr. Curtis Wright
Richmond Community Schools
300 Hub Etchison Parkway
Richmond, Indiana 47374

INSTRUCTIONS TO BIDDERS

ARTICLE 1
DEFINITIONS

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

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

1.3 Addenda are written or graphic instruments issued by the Engineer 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 signed 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 person or entity who submits a Bid.

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 and the Bid is made in accordance therewith.

2.1.2 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, for other portions of the Project, if any, being bid concurrently or presently under construction.

2.1.3 Bidders are requested to visit the site, compare the drawings and specifications with any work in place, and inform themselves of all conditions, including other work, if any, being performed. Failure to visit the site will in no way relieve the successful bidder from necessity of furnishing any materials or performing any work that may be required to complete work in accordance with drawings without additional cost to Owner.

2.1.4 By submitting a Bid, the Bidder agrees that he has examined the site, the Specifications and Drawings, all other bidding documents and, where the specifications require, a given result to be produced in any part of the work, that the specifications and drawings are adequate and the required result can be produced under the specifications and drawings.

2.1.5 No claim for any extra will be allowed because of alleged impossibilities in the production of the results specified or because of inadequate or improper drawings and specifications.

2.1.6 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 Eastern Engineering Plan room www.easternengineering.com at contractors cost.

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

3.1.3 In making copies of the Bidding Documents available on the above terms, the Owner and the Engineer do so only for the purpose of obtaining Bids on the Work and do not confer a license or grant permission for any other use 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 Engineer errors, inconsistencies or ambiguities discovered.

3.2.2 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 substitutions will be considered prior to receipt of Bids unless written request for approval has been received by the Engineer at least seven 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 Engineer's decision of approval or disapproval of a proposed substitution shall be final.

3.3.3 If the Engineer 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 Substitutions will be considered after the Contract award when request for approval is submitted in accordance with Section 01631, Product Substitutions.

3.4 ADDENDA

3.4.1 Addenda will be mailed or delivered 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 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 PROCEDURE

4.1 FORM AND STYLE OF BIDS

4.1.1 Bids must be submitted on Indiana State Form No. 96 as prescribed by the State Board of Accounts of Indiana. This Form may be obtained on the internet at <http://www.in.gov/sboa/files/Form96.pdf>.

A separate financial statement is required by Indiana State Form No. 96 on contracts of \$100,000.00 or more. In addition to State Form No. 96, Bidders must also submit Bid Form 96 Supplement which is included with the Bidding Documents. In the space provided for the Bid amount on State Form No. 96, enter the following; "SEE BID FORM 96 SUPPLEMENT." Bidders are to provide Bid amounts on Bid Form 96 Supplement.

4.1.2 All blanks on the bid form shall be filled in by typewriter or manually in ink.

4.1.3 Where so indicated by the makeup of the bid form, sums shall be expressed in both words and figures, and in case of discrepancy between the two, the amount written in words shall govern.

4.1.4 Interlineations, alterations and erasures must be initialed by the signer of the Bid. 4.1.5 Materials supplied for this project are exempt from Indiana state sales tax.

4.1.6 All Bids submitted shall be based on the established minimum wage rates included with the Bidding Documents.

4.1.7 All respective Alternates shall be bid. If no change in the Base Bid is required, indicate no change.

4.1.8 Each Bid shall include the legal name of the Bidder and be signed by the person or persons legally authorized to bind the Bidder to a contract. 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 pledging that the Bidder will 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.

4.2.2 Bid security shall be a satisfactory bid bond, certified check or bank draft for the amount of five percent of the Bid, including all add alternates. If a bid bond is used, it shall be written on AIA Document A310, Bid Bond, 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 The Bid, bid security, and 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 indicated below and shall be identified with the Project name, division of work and the Bidder's name and address. 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.

Dr. Curtis Wright
Richmond Community Schools
300 Hub Etchison Parkway
Richmond, Indiana 47374

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 specified closing time will be logged in with time of receipt, opened, read aloud, and forwarded for appropriate action by the Board, with full reservation of the Board to reject any or all Bids due to the lateness.

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 or telegraphic Bids are invalid and will not receive consideration.

4.4 MODIFICATION OR WITHDRAWAL OF BID

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

4.4.2 Bids may be withdrawn prior to the time and date designated for receipt of Bids. Withdrawn Bids may not be resubmitted.

ARTICLE 5
CONSIDERATION OF BIDS

5.1 OPENING OF BIDS

5.1.1 Bids received on time will be opened publicly and will be read aloud. All interested parties are invited to attend.

5.2 REJECTION OF BIDS

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

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 or irregularities in a Bid received and to accept the Bid which, in the Owner's judgement, 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, 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 SUBMITTALS

6.1.1 The Bidders shall complete and submit, to the Engineer, the Subcontractors and Materials List included with the Bidding Documents.

ARTICLE 7
PERFORMANCE BOND AND PAYMENT BOND

7.1 Performance and payment bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder will be required. Bonds may be secured through the Bidder's usual sources. 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 The Bidder shall deliver the required bonds to the Owner prior to or with the submission of the executed Agreement, or 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 Paragraph 7.2.

7.3 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.

7.4 Bonds shall remain in full force and effect for a period of one year after the date of final acceptance of the Work.

ARTICLE 8

PERMITS

8.1 The Contractors shall obtain all building and other permits and inspection by governing agencies.

ARTICLE 9

FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

9.1 FORM TO BE USED

9.1.1 The Agreement for the Work will be written on AIA Document A101, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment Is a Stipulated Sum. Payment Terms shall be 31 days after pay request are submitted. Pay request shall be submitted Monthly.

9.1.2 It is the Owners intent to award the bid on 12/8/2021 at the school boards meeting.

9.1.3 Contractor shall start submittals and order of material upon award of bid and Letter of Intent issued by RCS.

ARTICLE 10

CONTRACTOR'S INSURANCE

10.1 Insurance requirements are specified in the General and Supplementary Conditions.

ARTICLE 11

OPEN COMPETITION

11.1 Where in these specifications, certain materials, trade names or articles of certain manufacture are mentioned, it is done for the express purpose of establishing a basis of durability and efficiency and not for the purpose of the limiting of competition. Other materials may be used, by following the procedures outlined in Section 1 of these specifications.

ARTICLE 12

EQUAL EMPLOYMENT OPPORTUNITY

12.1 Contractors and all agencies supplying manpower (Union or Non-Union) are hereby notified that the Board of Trustees of the Richmond Community Schools subscribes to the essence of Executive Order #11246 and the "Memorandum of Understanding", not being considered by the Minority Coalition of Richmond, The East Central Indiana Contractors Association and the Richmond Building and Construction Trade Council, and will require the successful contractors to assume the obligation to take whatever affirmative actions are necessary to assure equal employment opportunity in all aspects of employment, irrespective of race, color, religion, national origin, or sex. It is expected that the Contractors will carry out that part of their Contracts pertaining to equal employment opportunity with the same amount of thought and action as they will any other part of the Contracts.

END OF SECTION

BID FORM 96 SUPPLEMENT

BID TO: Board of Trustees
Richmond Community Schools
Administration Building
300 Hub Etchison Parkway
Richmond, Indiana 47374

BID FROM: _____

Address _____

City / State _____

Telephone No. _____

BID FOR:

HVAC Upgrades / Replacements

Vaile Elementary School
300 South 14th Street

Westview Elementary School
1707 Southwest A Street

Charles Elementary School
2400 Reeveston Road

RICHMOND, IN
PROJECT 2115-1

The Undersigned, having visited the site of proposed construction of this project, and having familiarized himself with local conditions affecting the cost of the Work and with all requirements of the Contract Documents and Addenda thereto as prepared by Maze Design, Inc., hereby offers to furnish all labor and materials required by the Contract Documents and Addenda thereto for the completion of the Contracts below for which an amount is provided:

BID SCHEDULE

Base Bid for the project will include the cost for all three buildings. Breakdown is for owner information only.

Vaile Elementary School Base Bid:

_____ Dollars (\$ _____)

Add Alternate #1 Vaile:
Replace Boilers:

_____ Dollars (\$ _____)

Add Alternate #2 Vaile:
Ductwork Cleaning:

_____ Dollars (\$ _____)

Charles Elementary School Base Bid:

_____ Dollars (\$ _____)

Add Alternate #3 Charles:
Replace Boilers:

_____ Dollars (\$ _____)

Add Alternate #4 Charles:
Ductwork Cleaning:

_____ Dollars (\$ _____)

Westview Elementary School Base Bid:

_____ Dollars (\$ _____)

Add Alternate #5 Westview:
Ductwork Cleaning:

_____ Dollars (\$ _____)

ADDENDA RECEIVED

Receipt of Addendum Nos. _____, is hereby acknowledged.

BID ACCEPTANCE

If written notice of the acceptance of this Bid is received by the Undersigned within 60 days after the date for opening of Bids or any time thereafter before this Bid is withdrawn, the Undersigned will, execute the required Agreement and furnish Performance and Payment Bonds in accordance with the Contract Documents and Bid as accepted.

If Bidder is an individual complete the blanks in the following box.

| |
|---|
| <p>IN TESTIMONY WHEREOF, the Bidder (an individual) has hereunto set his hand this _____ day of _____ 20____.</p> <p>Individual _____</p> |
|---|

If Bidder is a partnership complete the blanks in the following box.

| |
|---|
| <p>IN TESTIMONY WHEREOF, the Bidder (a Partnership) have hereunto set their hands this _____ day of _____ 20____.</p> <p>Name of Partnership _____</p> <p>Name of Partners _____</p> <p>_____</p> |
|---|

If Bidder is a Corporation complete the blanks in the following box.

| |
|--|
| <p>IN TESTIMONY WHEREOF, the Bidder (a Corporation) has caused this Bid to be signed by its President and Secretary this _____ day of _____ 20____.</p> <p>Name of Corporation _____</p> <p>President _____</p> <p>Secretary _____</p> |
|--|



CONTRACTOR'S BID FOR PUBLIC WORK - FORM 96

State Form 52414 (R2 / 2-13) / Form 96 (Revised 2013)

Prescribed by State Board of Accounts

PART I

(To be completed for all bids. Please type or print)

Date (month, day, year): _____

1. Governmental Unit (Owner): _____

2. County : _____

3. Bidder (Firm): _____

Address: _____

City/State/ZIPcode: _____

4. Telephone Number: _____

5. Agent of Bidder (if applicable): _____

Pursuant to notices given, the undersigned offers to furnish labor and/or material necessary to complete the public works project of _____

(Governmental Unit) in accordance with plans and specifications prepared by _____

_____ and dated _____ for the sum of

_____ \$ _____

The undersigned further agrees to furnish a bond or certified check with this bid for an amount specified in the notice of the letting. If alternative bids apply, the undersigned submits a proposal for each in accordance with the notice. Any addendums attached will be specifically referenced at the applicable page.

If additional units of material included in the contract are needed, the cost of units must be the same as that shown in the original contract if accepted by the governmental unit. If the bid is to be awarded on a unit basis, the itemization of the units shall be shown on a separate attachment.

The contractor and his subcontractors, if any, shall not discriminate against or intimidate any employee, or applicant for employment, to be employed in the performance of this contract, with respect to any matter directly or indirectly related to employment because of race, religion, color, sex, national origin or ancestry. Breach of this covenant may be regarded as a material breach of the contract.

CERTIFICATION OF USE OF UNITED STATES STEEL PRODUCTS

(If applicable)

I, the undersigned bidder or agent as a contractor on a public works project, understand my statutory obligation to use steel products made in the United States (I.C. 5-16-8-2). I hereby certify that I and all subcontractors employed by me for this project will use U.S. steel products on this project if awarded. I understand that violations hereunder may result in forfeiture of contractual payments.

ACCEPTANCE

The above bid is accepted this _____ day of _____, _____, subject to the following conditions: _____

Contracting Authority Members:

| | |
|--|--|
| | |
| | |
| | |

PART II

(For projects of \$110,000 or more – IC 36-1-12-4)

Governmental Unit: _____

Bidder (Firm) _____

Date (month, day, year): _____

These statements to be submitted under oath by each bidder with and as a part of his bid. Attach additional pages for each section as needed.

SECTION I EXPERIENCE QUESTIONNAIRE

1. What public works projects has your organization completed for the period of one (1) year prior to the date of the current bid?

| Contract Amount | Class of Work | Completion Date | Name and Address of Owner |
|-----------------|---------------|-----------------|---------------------------|
| | | | |
| | | | |
| | | | |
| | | | |

2. What public works projects are now in process of construction by your organization?

| Contract Amount | Class of Work | Expected Completion Date | Name and Address of Owner |
|-----------------|---------------|--------------------------|---------------------------|
| | | | |
| | | | |
| | | | |
| | | | |

3. Have you ever failed to complete any work awarded to you? _____ If so, where and why?

4. List references from private firms for which you have performed work.

SECTION II PLAN AND EQUIPMENT QUESTIONNAIRE

1. Explain your plan or layout for performing proposed work. *(Examples could include a narrative of when you could begin work, complete the project, number of workers, etc. and any other information which you believe would enable the governmental unit to consider your bid.)*

2. Please list the names and addresses of all subcontractors *(i.e. persons or firms outside your own firm who have performed part of the work)* that you have used on public works projects during the past five (5) years along with a brief description of the work done by each subcontractor.

3. If you intend to sublet any portion of the work, state the name and address of each subcontractor, equipment to be used by the subcontractor, and whether you will require a bond. However, if you are unable to currently provide a listing, please understand a listing must be provided prior to contract approval. Until the completion of the proposed project, you are under a continuing obligation to immediately notify the governmental unit in the event that you subsequently determine that you will use a subcontractor on the proposed project.

4. What equipment do you have available to use for the proposed project? Any equipment to be used by subcontractors may also be required to be listed by the governmental unit.

5. Have you entered into contracts or received offers for all materials which substantiate the prices used in preparing your proposal? If not, please explain the rationale used which would corroborate the prices listed.

SECTION III CONTRACTOR'S FINANCIAL STATEMENT

Attachment of bidder's financial statement is mandatory. Any bid submitted without said financial statement as required by statute shall thereby be rendered invalid. The financial statement provided hereunder to the governing body awarding the contract must be specific enough in detail so that said governing body can make a proper determination of the bidder's capability for completing the project if awarded.

BID OF

_____ (Contractor)

_____ (Address)

**FOR
PUBLIC WORKS PROJECTS
OF**

Filed _____, _____

Action taken _____

SUBCONTRACTORS AND MATERIALS LIST

REQUIREMENTS

1.1 The single prime contractor shall submit with their bid a completed subcontractors and materials list. All applicable blanks must be completed.

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

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

1.4 Persons and entities proposed by the Bidder and to whom the Owner and Engineer 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 Engineer.

Sub Contractor / Material list

Subcontractors:

- 1. Mechanical _____
- 2. Electrical _____
- 3. Subfloor Drainage _____
- 4. Duct Cleaning _____

Manufacturers:

- 1. Air Handling Units _____
- 2. Boilers _____
- 3. Humidifiers _____
- 4. Variable Frequency Drives _____
- 5. Control Valves and Damper Operators _____

GENERAL CONDITIONS

REQUIREMENTS

1.1 General Conditions shall be AIA Document A201, entitled, "General Conditions of the Contract for Construction".

SUPPLEMENTARY CONDITIONS

The following supplements modify the "General Conditions of the Contract for Construction," AIA Document A201-1997, 1997 Edition. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect. The term Engineer shall be substituted for the term Architect. The "Engineer" shall fulfill the responsibilities of the Architect.

ARTICLE 1: GENERAL PROVISIONS

1.2 Correlation and Intent of the Contract Documents

1.2.1 Add the following to the end of Subparagraph 1.2.1:

In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Engineer's interpretation.

ARTICLE 3: CONTRACTOR

3.4 Labor and Materials

Add the following Subparagraphs 3.4.4 and 3.4.5 to Paragraph 3.4:

3.4.4 After the Contract has been executed, the Owner and the Engineer will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division 1 of the Specifications).

3.4.5 By making requests for substitutions based on Subparagraph above, the Contractor:

- .1 represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
- .2 represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;
- .3 certifies that the cost data presented is complete and includes all related costs under this Contract except the Engineer's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and
- .4 will coordinate the installation of the accepted

substitute, making such changes as may be required for the Work to be complete in all respects.

3.7 Permits, Fees and Notices

Add the following Subparagraph 3.7.5 to Paragraph 3.7:

3.7.5 The Contractor will be required to observe all ordinances that may in any way affect the nature of the work he is doing and shall be solely responsible for any violations thereof. Also, he shall observe any rules or regulations of the State of Indiana and/or local health officials, and must take such precautions as necessary to avoid unsafe unsanitary conditions.

3.18 Indemnification

Delete Subparagraph 3.18.1 and substitute the following:

3.18.1 The Contractor agrees to indemnify and save harmless the Owner, Lessee, Engineer, their agents and employees, from and against all loss or expense (including costs and attorneys' fees) by reason of liability imposed by law upon the Owner or Lessee, for damages because of bodily injury, including death at any time resulting therefrom sustained by any person or persons or on account of damage to property, including loss of use thereof, arising out of or in consequence of the performance of this work, provided such injury to persons or damage to property is due or claimed to be due to negligence of the Contractor, be construed to include any and all successors to the currently named Owner, irrespective of how such succession occurred and/or who or what the successor(s) is or are.

ARTICLE 4: ADMINISTRATION OF THE CONTRACT

4.4 Resolution of Claims and Disputes

4.4.1 In the second sentence, delete the word "arbitration".

4.4.5 In the second sentence, delete the words "and arbitration".

4.4.6 Delete 4.4.6 without substitution.

4.4.8 Delete the words "or by arbitration".

4.5 Mediation

4.5.1 Delete the words "Arbitration or the".

4.5.2 Delete the third sentence.

4.6 Arbitration

Delete Paragraph 4.6 without substitution.

ARTICLE 7: CHANGES IN THE WORK

7.3 Construction Change Directives

7.3.6 In the first sentence, delete the words "a reasonable allowance for overhead and profit" and substitute "an allowance for overhead and profit in accordance with Clauses 7.3.10.1 through 7.3.10.6 below."

Add the following Subparagraph 7.3.10 to Paragraph 7.3:

7.3.10 In Subparagraph 7.3.6, the allowance for the combined overhead and profit included in the total cost to the Owner shall be based on the following schedule:

- .1 For the Contractor, for Work performed by the Contractor's own forces, 15 percent of the cost.
- .2 For the Contractor, for Work performed by the Contractor's Subcontractor, 5 percent of the amount due the Subcontractor.
- .3 For each SubContractor or Sub-subcontractor involved, for Work performed by that Subcontractor's or Sub-subcontractor's own forces, 15 percent of the cost.
- .4 For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractors, 5 percent of the amount due the Sub-subcontractor.
- .5 Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.6.
- .6 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change involving over 500 be approved without such itemization.

ARTICLE 8: TIME

8.3 Delays and Extensions of Time

8.3.1 In the first sentence, delete the words, "pending arbitration".

ARTICLE 9; PAYMENTS AND COMPLETION

9.3 Applications for Payment

9.3.1 Add the following sentence to Paragraph 9.3.1:

The form of Application for Payment shall be a notarized AIA Document G702, Application and Certification for Payment, supported by AIA Document G703, Continuation Sheet.

Add the following Clauses 9.3.1.3 and 9.3.1.4 to Paragraph 9.3.1:

9.3.1.3 Until the Work is 50 percent complete, the Owner shall pay 90 percent of the amount due the Contractor on account of progress payments. At the time the Work is 50 percent complete and thereafter, the Engineer will authorize remaining partial payments to be paid in full.

9.3.1.4 Escrow account for retainage, applicable to contracts in the amounts of \$100,000 or more, will be established in accordance with Indiana Statutes.

9.6 Progress Payments

Add the following Subparagraphs 9.6.8 through 9.6.13 to Paragraph 9.6:

9.6.8 Upon commencement of the Work, an escrow account shall be established in a financial institution chosen by the Contractor and approved by the Owner.

9.6.9 The escrow agreement shall provide that the financial institution will act as escrow agent, will pay interest on funds deposited in such account in accordance with the provisions of the escrow agreement and will disburse funds from the account upon the direction of the Owner as set forth below. Compensation to the escrow agent for establishing and maintaining the escrow account shall be paid from interest accrued in the escrow account.

9.6.10 As each progress payment is made, the retainage with respect to that payment shall be deposited by the Owner in the escrow account.

9.6.11 The interest earned on funds in the account shall accrue for the benefit of the Contractor until the completion date named in the Construction Contract or the expiration of any authorized extension of such date. Interest earned after such date shall

accrue for the benefit of the Owner. Cost of compensation to the escrow agent paid out of the interest earned shall be borne by the Contractor.

9.6.12 When the Work has been fully completed in a satisfactory manner and the Engineer has issued a final Certificate for Payment, the escrow agent shall pay to the Contractor the full amount of funds in the account, including net balance of the interest paid to the account, but less any interest that may have accrued for the benefit of the Owner, which shall be paid to the Owner.

9.6.13 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor, the escrow agent shall make payment to the Contractor as provided in Subparagraph 9.10.3.

9.7 Failure of Payment

9.7.1 In the first sentence, delete the words, "or awarded by arbitration."

9.10 FINAL COMPLETION AND FINAL PAYMENT

9.10.1 Add the following to the end of Subparagraph 9.10.1:

Final Payment, including all escrowed principal and escrowed income, shall be paid within ninety-one (91) days after the date of Substantial Completion, subject to the requirements of Subparagraph 9.10.2. If at the time of said payment there remain uncompleted minor items, an amount equal to two hundred percent (200%) of the value of each item as determined by the Engineer shall be withheld until the item is completed. The cost for the Engineer's estimate and other efforts necessary to establish the value of the incomplete work will be deducted from the remaining funds owed to the Contractor.

Add the following Paragraph to Article 9:

9.11 Owners Cost Incurred Due To Incomplete Work

9.11.1 The Contractor and the Contractor's surety shall be liable for and shall pay the Owner all sums, including additional architectural fees, incurred and attributable to the Work not being completed by the completion date specified in the Agreement including extensions of time properly granted and within 60 days after Substantial Completion.

ARTICLE 10: PROTECTION OF PERSONS AND PROPERTY

10.1 Safety Precautions and Programs

Add the following Subparagraphs 10.1.2 and 10.1.3 to Paragraph 10.1:

10.1.2 If reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance 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 Engineer in writing.

10.1.3 The Owner shall be responsible for obtaining the services of a licensed laboratory to verify a 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 verify that it has been rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Engineer 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 Engineer 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 Engineer has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Engineer have no reasonable objection.

ARTICLE 11: INSURANCE AND BONDS

11.1 Contractor's Liability Insurance

Add the following Clause 11.1.2.1 to Subparagraph 11.1.2:

11.1.2.1 The insurance required by Subparagraph 11.1.1 shall be written for not less than the following limits, or greater if required by law:

1. Worker's Compensation:

| | |
|---|-----------------------------------|
| (a) State | Statutory |
| (b) Applicable Federal (e.g., Longshoremen's) | Statutory |
| (c) Employer's Liability: | \$ 100,000 per Accident |
| | \$ 100,000 Disease, Policy Limit |
| | \$ 100,000 Disease, Each Employee |

2. Comprehensive or Commercial General Liability (including Premises-Operations; Independent Contractor's Protective; Products and Completed Operations; Broad Form Property Damage):

- (a) Bodily Injury:
- | | |
|--------------|-----------------|
| \$ 500,000 | Each Occurrence |
| \$ 1,000,000 | Aggregate |
- (b) Property Damage:
- | | |
|--------------|-----------------|
| \$ 1,000,000 | Each Occurrence |
| \$ 1,000,000 | Aggregate |
- (c) Products and Completed Operations to be maintained for one year after final payment.
- (d) Property Damage Liability Insurance shall provide X, C, and U coverage.
- (e) Broad Form Property Damage Coverage shall include Completed Operations.
3. Contractual Liability:
- (a) Bodily Injury:
- | | |
|--------------|-----------------|
| \$ 500,000 | Each Occurrence |
| \$ 1,000,000 | Aggregate |
- (b) Property Damage:
- | | |
|--------------|-----------------|
| \$ 500,000 | Each Occurrence |
| \$ 1,000,000 | Aggregate |
4. Personal Injury, with Employment Exclusion deleted:
- | | |
|------------|-----------|
| \$ 500,000 | Aggregate |
|------------|-----------|
5. Business Auto Liability (including owned, non-owned, and hired vehicles):
- (a) Bodily Injury:
- | | |
|--------------|-----------------|
| \$ 500,000 | Each Person |
| \$ 1,000,000 | Each Occurrence |
- (b) Property Damage:
- | | |
|------------|-----------------|
| \$ 500,000 | Each Occurrence |
|------------|-----------------|
7. Umbrella Excess Liability:
\$ 3,000,000 over primary insurance

11.1.3 Add the following to Subparagraph 11.1.3:

Contractor shall submit copies of any endorsements, subsequently issued amending coverage or limits, to the Owner. Should any coverage approach expiration during the Contract period, it shall be renewed prior to its expiration date and certificates again filed with the Owner. Failure to renew and file new certificates with the Owner shall be just cause to withhold periodic payment requests until these requirements are met. All certificates shall be submitted to the Engineer in triplicate for transmittal to the Owner. If this insurance is written on the Comprehensive General Liability policy form, the Certificates shall be AIA Document G705, Certificate of Insurance. If this insurance is written on a Commercial General Liability policy form, ACORD form 25S will be acceptable. Contractor shall also file with the Owner an Indiana State Form #41321, Certificate of Compliance, Workmens Compensation and Occupational Disease.

Add the following Subparagraphs 11.1.4 and 11.1.5 to Paragraph 11.1:

11.1.4 The Contractor will be held responsible for all damage to the work under the construction during the performance and until final completion and acceptance, even though partial payments have been made under the Contract. He will be held answerable for all damages that may occur to persons, to property, animals or vehicles from want of proper shoring, bracing, lighting, watching, boarding or enclosing; and for any accident arising from defective apparatus or any negligence on the part of himself or his employees.

11.1.5 The Contractor covenants and agrees to pay all damages for injury to real or personal property or for any injury or death sustained by any person growing out of any act or deed of the Contractor or of his employees or any of his Subcontractors or their employees.

11.2 Owner's Liability Insurance

Delete Clause 11.2.1 and substitute the following:

11.2.2 The Contractor shall pay all deductible features of the Owner's property insurance and the Owner's Builder's Risk insurance on losses other than those for fire and extended coverage. This property insurance is written with a deductible of \$ 10,000.00 per occurrence with a deductible aggregate of \$ 10,000.00 . This Builder's Risk insurance is written with a deductible of \$10,000.00.

11.5 Performance Bond and Payment Bond

Delete Subparagraph 11.5.1 and substitute the following:

11.5.1 The Contractor shall furnish a Performance Bond and Payment Bond covering faithful performance of the Contract and payment of obligations arising thereunder. Bonds may be obtained through the Contractor's usual source and the cost thereof shall be included in the Contract Sum. The amount of each bond shall be equal to 100 percent of the Contract Sum. Bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

11.5.1.1 The Contractor shall deliver the required bonds to the Owner prior to or with the submission of the executed Agreement, or if the Work is to be commenced prior thereto in response to a letter of intent, the Contractor 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 Subparagraph 11.5.1.1.

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

11.5.1.3 Bonds shall remain in full force and effect for a period of one year after the date of final acceptance of the Work.

ARTICLE 13: MISCELLANEOUS PROVISIONS

Add the following Paragraph 13.8 to Article 13:

13.8 Equal Opportunity

13.8.1 The Contractor shall maintain policies of employment as follows:

13.8.1 The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to insure that applicants are employed and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

13.8.2 The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisement for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

"General Decision Number: IN20210004 10/08/2021

Superseded General Decision Number: IN20200004

State: Indiana

Construction Type: Building

Counties: Brown, Clark, Dearborn, Decatur, Fayette, Floyd, Franklin, Harrison, Henry, Jennings, Ohio, Randolph, Ripley, Rush, Switzerland, Union and Wayne Counties in Indiana.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes and apartments up to and including 4 stories)

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.95 for calendar year 2021 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.95 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2021. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate, if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

| Modification Number | Publication Date |
|---------------------|------------------|
| 0 | 01/01/2021 |
| 1 | 01/29/2021 |
| 2 | 02/12/2021 |
| 3 | 02/26/2021 |
| 4 | 03/26/2021 |
| 5 | 04/09/2021 |
| 6 | 04/30/2021 |

| | |
|----|------------|
| 7 | 05/21/2021 |
| 8 | 06/04/2021 |
| 9 | 06/25/2021 |
| 10 | 07/02/2021 |
| 11 | 07/30/2021 |
| 12 | 08/13/2021 |
| 13 | 08/27/2021 |
| 14 | 09/17/2021 |
| 15 | 10/08/2021 |

ASBE0008-004 03/01/2021

DEARBORN, FAYETTE, FRANKLIN, OHIO, RIPLEY SWITZERLAND AND UNION COUNTIES

| | Rates | Fringes |
|---|----------|---------|
| Asbestos Workers/Insulator (Includes application of all insulating materials, protective coverings, coatings & finishings to all types of mechanical systems)..... | \$ 31.82 | 19.50 |
| HAZARDOUS MATERIAL HANDLER (Includes preparation, wettings, stripping, removal, scrapping, vacuuming, bagging & disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems)..... | \$ 25.00 | 13.70 |
| ----- | | |

ASBE0018-001 06/01/2021

BROWN, DECATUR, HENRY AND RUSH COUNTIES

| | Rates | Fringes |
|---|----------|---------|
| ASBESTOS WORKER/HEAT & FROST INSULATOR (includes application of all insulating materials protective coverings, coatings and finishes to all types of mechanical systems)..... | \$ 33.90 | 21.38 |
| HAZARDOUS MATERIAL HANDLER (includes preparation, wettings, stripping, removal, scrapping, vacuuming, bagging | | |

& disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems).....\$ 23.00 14.40

 ASBE0051-005 03/01/2021

CLARK, FLOYD, HARRISON, and JENNINGS Counties

| | Rates | Fringes |
|--|----------|---------|
| ASBESTOS WORKER/HEAT & FROST INSULATOR (Includes application of all insulating materials, protective coverings, coatings and finishings to all types of mechanical systems)..... | \$ 26.51 | 18.38 |
| HAZARDOUS MATERIAL HANDLER (includes preparation, wettings, stripping, removal, scrapping, vaccuming, bagging & disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems)..... | \$ 19.80 | 13.30 |

 ASBE0079-002 07/01/2017

RANDOLPH AND WAYNE COUNTIES

| | Rates | Fringes |
|--|----------|---------|
| ASBESTOS WORKER/HEAT & FROST INSULATOR (Includes application of all insulating materials, protective coverings, coatings & finishings to all types of mechanical systems)..... | \$ 22.25 | 8.89 |
| HAZARDOUS MATERIAL HANDLER (Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging & disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems))..... | \$ 25.00 | 13.70 |

 BOIL0105-002 01/01/2012

DEARBORN and SWITZERLAND COUNTIES

| | Rates | Fringes |
|-------------------------|----------|---------|
| BOILERMAKER..... | \$ 32.99 | 23.72 |
| ----- | | |
| BOIL0374-001 01/01/2021 | | |

REMAINING COUNTIES

| | Rates | Fringes |
|---------------------------|----------|---------|
| BOILERMAKER..... | \$ 38.53 | 32.20 |
| ----- | | |
| * BRIN0004-019 06/01/2021 | | |

LOUISVILLE
CLARK, FLOYD AND HARRISON COUNTIES

| | Rates | Fringes |
|--|----------|---------|
| BRICKLAYER..... | \$ 29.57 | 15.10 |
| Marble, Tile Layer & Terrazzo Worker..... | \$ 22.64 | 6.05 |
| TILE FINISHER..... | \$ 15.42 | 5.37 |
| ----- | | |
| * BRIN0004-022 06/01/2021 | | |

BROWN, DEARBORN, DECATUR, JENNINGS, OHIO, RIPLEY and SWITZERLAND
COUNTIES

| | Rates | Fringes |
|---|----------|---------|
| Bricklayer, Stonemason..... | \$ 30.53 | 15.95 |
| TERRAZZO FINISHER..... | \$ 20.74 | 11.98 |
| TERRAZZO WORKER/SETTER..... | \$ 33.36 | 15.74 |
| Tile & Marble Finisher..... | \$ 21.02 | 9.37 |
| Tile & Marble Setter; Mosaic Worker..... | \$ 32.61 | 15.73 |
| ----- | | |
| * BRIN0019-002 06/01/2021 | | |

MUNCIE
FAYETTE, FRANKLIN, HENRY, RANDOLPH, RUSH, UNION and WAYNE
COUNTIES

| Rates | Fringes |
|-------|---------|
|-------|---------|

| | | |
|--|----------|-------|
| Bricklayer, Stonemason, Pointer, Caulker & Cleaner..... | \$ 31.75 | 18.07 |
| TERRAZZO FINISHER..... | \$ 20.74 | 11.98 |
| TERRAZZO WORKER/SETTER..... | \$ 33.36 | 15.74 |
| Tile & Marble Finisher..... | \$ 20.74 | 11.98 |
| Tile & Marble Setter; Mosaic Worker..... | \$ 32.61 | 15.73 |

 CARP0002-021 04/01/2021

DEARBORN, JENNINGS, OHIO, RIPLEY AND SWITZERLAND COUNTIES

| | Rates | Fringes |
|-----------------|----------|---------|
| CARPENTER | | |
| Carpenter..... | \$ 27.75 | 22.45 |
| Piledriver..... | \$ 28.06 | 21.77 |

 CARP0104-001 06/01/2021

FAYETTE, HENRY, RANDOLPH, UNION AND WAYNE COUNTIES

| | Rates | Fringes |
|---|----------|---------|
| Carpenters: | | |
| Carpenters, Drywall Installers, Piledrivers..... | \$ 30.10 | 21.52 |
| Millwright..... | \$ 31.03 | 22.06 |
| Soft Floor Layers..... | \$ 28.85 | 18.63 |

 CARP0175-002 04/01/2021

CLARKE, FLOYD AND HARRISON COUNTIES

| | Rates | Fringes |
|-----------------|----------|---------|
| CARPENTER | | |
| Carpenter..... | \$ 26.70 | 22.94 |
| Piledriver..... | \$ 27.01 | 22.94 |

 CARP0999-009 06/01/2018

CLARK, FLOYD, AND HARRISION COUNTIES

| | Rates | Fringes |
|-----------------|----------|---------|
| MILLWRIGHT..... | \$ 27.45 | 23.34 |

 CARP1080-003 06/01/2021

DEARBORN, JENNINGS, OHIO, RIPLEY AND SWITZERLAND COUNTIES

| | Rates | Fringes |
|-------------------------|----------|---------|
| MILLWRIGHT..... | \$ 31.07 | 23.82 |
| ----- | | |
| CARP1775-001 06/01/2021 | | |

BROWN, DECATUR, FRANKLIN AND RUSH COUNTIES

| | Rates | Fringes |
|------------------------------|----------|---------|
| Carpenters: | | |
| Carpenters, Drywall | | |
| Installers, Piledrivers..... | \$ 28.91 | 21.52 |
| Millwright..... | \$ 31.07 | 23.83 |
| Soft Floor Layers..... | \$ 28.85 | 18.63 |
| ----- | | |
| ELEC0071-006 01/02/2019 | | |

DEARBORN, OHIO, and SWITZERLAND COUNTIES

| | Rates | Fringes |
|------------------------------|----------|---------|
| Line Construction: | | |
| Equipment Operator..... | \$ 33.62 | 13.46 |
| Groundman..... | \$ 24.17 | 11.38 |
| Lineman & Cable Splicers.... | \$ 38.27 | 14.48 |
| ----- | | |
| ELEC0212-009 06/01/2021 | | |

DEARBORN, OHIO, and SWITZERLAND COUNTIES

| | Rates | Fringes |
|---------------------------|----------|---------|
| ELECTRICIAN..... | \$ 32.32 | 20.05 |
| ----- | | |
| * ELEC0369-009 05/31/2021 | | |

CLARK, FLOYD, and HARRISON COUNTIES

| | Rates | Fringes |
|-------------------------------|----------|---------|
| ELECTRICIAN..... | \$ 33.85 | 18.72 |
| Line Construction: | | |
| Groundman..... | \$ 13.83 | 6.35 |
| Lineman; Equipment Operator.. | \$ 22.25 | 6.35 |
| ----- | | |
| ELEC0481-002 05/31/2021 | | |

DECATUR, JENNINGS, RIPLEY AND RUSH COUNTIES

| | Rates | Fringes |
|-------------------------|----------|---------|
| ELECTRICIAN..... | \$ 36.30 | 24.85 |
| ----- | | |
| ELEC0725-001 10/01/2020 | | |

BROWN COUNTY

| | Rates | Fringes |
|-------------------------|----------|---------|
| ELECTRICIAN..... | \$ 37.98 | 20.29 |
| ----- | | |
| ELEC0725-008 06/01/2020 | | |

BROWN COUNTY

| | Rates | Fringes |
|-------------------------------|----------|---------|
| Communication Technician..... | \$ 28.67 | 15.07 |

Includes the installation, operation, inspection, maintenance, repair and service of radio, television, recording, voice sound and vision production and reproduction apparatus, equipment and appliances used for domestic, commercial, education, entertainment and private telephone systems.

ELEC0855-001 06/01/2020

FAYETTE, FRANKLIN, HENRY, RANDOLPH, UNION AND WAYNE COUNTIES

| | Rates | Fringes |
|-------------------------|----------|---------|
| ELECTRICIAN..... | \$ 33.17 | 18.19 |
| ----- | | |
| ELEV0034-001 01/01/2021 | | |

| | Rates | Fringes |
|------------------------|----------|------------|
| ELEVATOR MECHANIC..... | \$ 51.23 | 36.365+a+b |

a) PAID HOLIDAYS: New Year's Day, Memorial Day, Independence Day, Labor Day, Vetern's Day, Thanksgiving Day, the Friday after Thanksgiving, and Christmas Day.

b) Employer contributes 8% of regular hourly rate to vacation

pay credit for employee with more than 5 years of service;
6% for less than 5 years' service.

ENGI0103-006 04/01/2021

FAYETTE, HENRY, RANDOLPH, RUSH, UNION, and WAYNE COUNTIES

| | Rates | Fringes |
|----------------------------|----------|---------|
| Power equipment operators: | | |
| GROUP 1..... | \$ 37.08 | 19.96 |
| GROUP 2..... | \$ 36.13 | 19.96 |
| GROUP 3..... | \$ 32.08 | 19.96 |
| GROUP 4..... | \$ 28.30 | 19.96 |

POWER EQUIPMENT OPERATORS

GROUP 1: Air Compressor (pressurizing Shafts, tunnels & drivers) Air Tugger; Auto Patrol; Back Filler; Back Hoe; Boom Cat; Boring Machine; Bull Dozer; Caisson Drilling Machine; Cherry Picker; Compactor (with dozer blade); Concrete Mixer (dual drum); Concrete plant; Concrete Pump; Crane with all attachments; Crane- Electric overhead; Derrick; Ditching Machine (18' and over); Dredge; Elevators (when hoisting material or tools); Fork Lift (machinery); Formless Paver; Generator (power for welders of compressor); Gradall; Helicopter; Helicopter Winch Operator; High Lift-Front End Loader; Hoist-Material and/or Personnel over 3 Floors; Locomotive; Mechanic on job site; Mucking Machine; Panel Board Concrete Plant; Pile Driver; Push Cat; Scoop & Tractor; Scraper-Rubber Tired; Spreader-Tractor Mounted; Straddle Carrier- Ross Type; Sub Base Finish Machine (C.M.I. or smiliar); Tower Crane; Tractor with Backhoe (over 1/2 yard); Welder (craft)

GROUP 2: A Frame Truck; Batcher Plant (automatic dry batch); Bending Machine-Power Driven; Bituminous Mixer; Bituminous Paver; Bituminous Plant Engineer; Boatman; Bull Float; Compactor or Tamper-Self Propelled; Concrete Mixer (21 cu. ft. or over); Concrete Spreader-Power Driven; Dinkey Engine; Ditching Machine; Ditching Machine (less than 18"); Drilling Machine; Finish Machine & Bull Float; Finishing Machine; Fireman-Pile Driving and Boilers; Fork Lift-Masonry & Material; Guniting Machine; Head Greaser; Hoist-Material and/or personnel 3 floors and under; Mechanic in shop; Mesh Depresser-Mesh Placer; P.C.C. Concrete Belt Placer; Ruller-Asphalt, stone & sub base; Sheepsfoot Roller- Self Propelled; Shop Mule; Spreader or Base Paver-Self Propelled; Sub Grader; Throttle valve with

air compressor or boiler; Tractor with Backhoe (1/2 yard & under); Tractor-high lift-farm type; Tractor-Industrial Type; Tractor with Winch; Well Points; Winch Trick

GROUP 3: Air Compressor (210 cu. ft. & over); bituminous Distributor; Chair Cart; Concrete Curing Machine; Concrete Saw; Dope Pot Power Agitated; Flex Plane; Form Grader; Hydrohammer; Jacks-Hydraulic-Power Driven; Minor Equipment opr. 3,4, or 5; Paving Joint Machine; Post Hole Digger; Roller-Earth; Throttle Valve; Track Jack-Power Driven; Tractor-Farm Type; Truck Crane Driver

GROUP 4: Air Compressor (less than 210 cu. ft.); Concrete Mixer (under 21cu. ft.); Conveyor; Generator; Mechanical Heater; Oiler; Operator-2 pieces of miner equipment; Power Broom; Pump; Welding Machine

 ENGI0181-012 04/01/2021

BROWN, CLARK, DEARBORN, DECATUR, FLOYD, FRANKLIN, HARRISON, JENNINGS, OHIO, RIPLEY, and SWITZERLAND COUNTIES

| | Rates | Fringes |
|----------------------------|----------|---------|
| Power equipment operators: | | |
| GROUP A..... | \$ 38.35 | 18.78 |
| GROUP B..... | \$ 35.70 | 18.78 |

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP A: A-Frame Winch Truck, Articulating dump, autograde (CMI), auto patrol, ballast regulator (RR), batcher plant (electrical control concrete), bending machine (pipe), bituminous plant (engineer), bituminous plant, bituminous mixer travel plant, bituminous paver, bituminous roller, boring machine, buck hoist, bull dozer, cable way, Chicago boom, chimney hoist, clamshell concrete mixer (21 cu. ft. or over), concrete paver, concrete pump (crete), construction elevator (Allmac or similar) crane, craneman, crawler backhoe, crawler high-lift, crusher plant, derrick, derrick boat, dinkey, directional/boring machine, dope pots (pipeline), double drum tugger (electric or air), dragline, dredge operator, dredge engineer, drill operator, elevating grader, extendable boom forklift, formless paver, gantry creane, gator (or similar type tiller), gradeall, grader, grademan, greaser (on grease facility servicing heavy equipment), G.P.S System (on equipment within the classifications), grout pump, head greaser, helicopter

crew, Hetherington paver, hoist (motroized, gas or diesel), hydraulic crane, hydro blaster, Industrial type forklift (over 9,000 lbs), laser concrete screed, laser or remote controlled equipment (within the classifications), locomotive crane, locomotive, mechanic, mobile mixer, motor crane, mucking machine, multiple tamping machine (RR) overhead crane, pile driver, pulls push dozer, push boats, roller (sheep foot), rough terrain crane, R.T. backhoe, R.T. endloader, Ross carrier, scoop, shovel, side boom, skidsteer loader (bobcat or similar type), swing crane, tail boom, tar machine (pipeline), tower crane, trench machine, welder (heavy duty), truck mounted concrete pump, truck-mounted drill, vacuum truck, well point, whirleys.

GROUP B: Air Compressor (1 or more, 600 cfm and over) air compressor with throttle valve, bituminous distributor, brakeman, bullfloat, cement gun, concrete mixer, concrete mixer, concrete saw, concrete spreader or puddlers, conveyor, deck hand oiler, deck engine, drill helper, earth roller, electric vibrator compactor (earth or rock), elevator (in-plant, automatic), finishing machine, fireman, form grader, generator, guard-rail dfriver, heater, oiler, Industrial type forklift (9,000 lbs and under), material pump, motor boats, paving joint machine, post hole digger, power broom, power traffic signals, rock roller, rocker spreader, Roller (earth or rock), spike machine (RR), steam jenny, sub grader, tamping machine, truck crane oiler, truck mounted drill oiler, Tugger (one-drum, air or electric) vibrator, vibro-piling hammer-hydraulic hammer or auger, water pump, widener (apsco or similar type) welding machine, JLG lifts and scissor lifts or similar machine.

 IRON0022-002 06/01/2021

BROWN, DECATUR (W 3/4), FAYETTE (W 1/2), FRANKLIN (NW TIP), HENRY, JENNINGS (NW TIP), RANDOLPH (SW TIP), AND RUSH COUNTIES:

| | Rates | Fringes |
|-----------------|----------|---------|
| IRONWORKER..... | \$ 33.99 | 24.70 |

The following holidays shall be observed: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and the day after Thanksgiving and Christmas Day. Any holiday which occurs on a Sunday shall be observed the following Monday, unless the legal observance of these holidays is changed by law.

IRON0044-007 06/01/2021

DEARBORN, DECATUR (REMAINDER OF COUNTY), FAYETTE (SE CORNER),
FRANKLIN (S. 3/4), OHIO, RIPLEY (REM. OF COUNTY), SWITZERLAND
(REM. OF COUNTY), & JENNINGS (NE TIP) COUNTIES:

| | Rates | Fringes |
|------------------------------|----------|---------|
| IRONWORKER | | |
| Fence Erectors..... | \$ 29.75 | 21.40 |
| Structural & Ornamental..... | \$ 31.32 | 21.60 |

IRON0070-007 06/01/2021

CLARK, FLOYD, HARRISON, JENNINGS (S 2/3), SWITZERLAND (SW TIP),
AND RIPLEY (SW TIP) COUNTIES

| | Rates | Fringes |
|-----------------|----------|---------|
| IRONWORKER..... | \$ 31.09 | 23.75 |

IRON0070-019 06/01/2021

DEARBORN, DECATUR (REM. OF COUNTY), FAYETTE (SE CORNER),
FRANKLIN (S. 3/4), OHIO, RIPLEY (REM. OF COUNTY), SWITZERLAND
(REM. OF COUNTY) and JENNINGS (NE TIP) COUNTIES

| | Rates | Fringes |
|------------------------------|----------|---------|
| IRONWORKER, REINFORCING..... | \$ 31.09 | 23.75 |

IRON0147-003 06/01/2021

RANDOLPH COUNTY

| | Rates | Fringes |
|-----------------|----------|---------|
| IRONWORKER..... | \$ 30.35 | 24.22 |

IRON0290-003 06/01/2020

FAYETTE (REMAINDER OF COUNTY), RANDOLPH (S. PART OF COUNTY
EXCLUDING WINCHESTER BUT INCLUDING UNION CITY) UNION AND WAYNE
COUNTIES

| | Rates | Fringes |
|-----------------|----------|---------|
| IRONWORKER..... | \$ 29.68 | 23.55 |

LABO0741-002 06/01/2020

BROWN, DEARBORN, DECATUR, FRANKLIN, JENNINGS, OHIO, and RIPLEY
COUNTIES

| | Rates | Fringes |
|--------------|----------|---------|
| Laborers: | | |
| GROUP 1..... | \$ 23.13 | 16.00 |
| GROUP 2..... | \$ 23.88 | 16.00 |
| GROUP 3..... | \$ 24.13 | 16.00 |

LABORERS CLASSIFICATIONS

GROUP 1: Building and Construction Laborers; Scaffold Builders (other than for masons or plasterers); Railroad Workers; Masonry Wall Washers (interior & exterior); Portable Water Pumps with Discharge up to 3 Inches; Handling of Creosote Lumber or Like Treated Material (excluding railroad material); Asphalt Rakers and Lutemen; Earth Compactors; Jackmen and Sheetmen working ditches deeper than six (6) feet in depth; Laborers in Ditches six (6) feet in depth or deeper; Assembly of Unicrete Pump; Tile Layers (sewer or field) and Sewer Pipe Layers (metallic or non-metallic); Motor driven wheelbarrows and concrete buggies; Hyster Operators; Pump Crete Assemblers; Core Drill Operators; Cement, Lime or Silica Clay Handler (bulk or bag); Handling of toxic material damaging to clothing; Pneumatic Spikers; Deck Engine and Winch Operators; Water main and cable ducking (metallic and non-metallic); Screed Man or Screw Operator on Asphalt Paver; Chain Saw and Demolition Saw Operators; Concrete Saw; Concrete Conveyor Assemblers; Applying of Curing Compound; Sinking of Wellpoints; Dewatering Header Systems.

GROUP 2: Plaster Tenders; Mason Tenders; Mortar Mixers; Welders (acetylene or electric); Cutting Torch or Burner; Cement Nozzle Laborers; Cement Gun Operators; Scaffold Builders for Plasterers; Scaffold Builders for Masons; Water Blast Machine Operators; Air Tool Operators and all Pneumatic Tool Operators; Air and Electric Vibrators and Chipping Hammer Operators; Asbestos Removal; Hazardous Waste Removal; All Boiler Setters Laborers, including Expeditors, Bottom Men, Bell Men and Mason Tenders.

GROUP 3: Dynamite Men, Drillers-air track or wagon drilling for explosives.

LAB00795-001 06/01/2020

CLARK, FLOYD, HARRISON, and SWITZERLAND COUNTIES

| | Rates | Fringes |
|--------------|----------|---------|
| Laborers: | | |
| GROUP 1..... | \$ 20.90 | 16.35 |
| GROUP 2..... | \$ 21.40 | 16.35 |
| GROUP 3..... | \$ 21.90 | 16.35 |

LABORER CLASSIFICATIONS:

GROUP 1: Building and Construction Laborers, Scaffold Builders (other than for Masons or Plasterers), Mechanic Tenders, Rodmen & Chainmen, Signalmen & Flagmen, Window Washers & Cleaners, Waterboys & Toolhousemen, Railroad Workers, Masonry Wall Washers (interior & Exterior), All Portable Water Pumps with Discharge up to three (3) inches, Waterproofing, Handling of creosote lumber or like treated Material (excluding Railroad Material), Asphalt Rakers & Luteman, Kettlemen, Air Tool Operators and all Pneumatic Tool Operators, Air and Electric Vibrators and Chipping Hammer Operators, Earth Compactors, Jackman & Sheetmen working Ditches Deeper Than Six (6) feet in depth, Laborers working Ditches Six (6) feet in Depth or Deeper, Assembly of Unicrete Pump, Tile Layers (sewer or field) & Sewer Pipe Layers (metallic or non-metallic), Motor Driven Wheelbarrows and Concrete Buggies Hyster Operators, Pump Crete Assemblers, Core Drill Operators, Cement, Lime or Silica Clay Handers (bulk or bag), Handling of Toxic Materials Damaging to Clothing, Pneumatic Spikers, Deck Engine & Winch Operators, Water Main & Cable Ducking (Metallic and Non-Metallic), Screed Man or Screw Operator on Asphalt Paver, Chain Saw and Demolition Saw Operators, Concrete Conveyor Assemblers, Asbestos Removal, Hazardous Waste Removal.

GROUP 2: Plaster Tenders, Mason Tenders, Mortar Mixers, Welders (Acetylene or Electric), Cutting Torch or Burner, Cement Nozzle Laborers, Cement Gun Operators, Scaffold Builders when Working for Plasterers, Scaffold Builders When Working for Masons Water Blast Machine Operators.

GROUP 3: Dynamite Men, Drillers-Air Track or Wagon Drilling for Explosives.

LAB01047-001 06/01/2020

FAYETTE, HENRY, RUSH, WAYNE, and UNION COUNTIES

| | Rates | Fringes |
|--------------|----------|---------|
| Laborers: | | |
| GROUP 1..... | \$ 21.93 | 16.00 |
| GROUP 2..... | \$ 22.68 | 16.00 |
| GROUP 3..... | \$ 22.93 | 16.00 |

LABORER CLASSIFICATIONS

GROUP 1: Building and Construction Laborers; Scaffold Builders (other than for Masons or Plasterers); Mechanic Tenders; Civil Engineer Tenders and Surveyor tenders; Rodmen & Chainmen; Signalmen & Flagmen; Window Washers & Cleaners; Waterboys & Toolhousemen; Railroad Workers; Masonry Wall Washers (interior & exterior); Cement Finisher Helpers; All Portable Water Pumps with discharge up to three (3) inches, Waterproofing; Handling of Creosote Lumber or like treated material (excluding railroad material); Asphalt Rakers & Lutemen; Kettlemen; Air Tool Operators and all pneumatic tool operators, air and electric vibrators and chipping hammer operators); Earth Compactors; Jackmen & Sheetmen working ditches deeper than six (6) feet in depth; Laborers working ditches six (6) feet in depth or deeper; Assembly of Unicrete Pump; Tile Layers (sewer or field) & sewer pipe layers (metallic or non-metallic); Motor driven wheelbarrows and concrete buggies; Hyster Operators; Pump Crete Assemblers; Core Drill Operators; Cement, Lime or Silica Clay Handlers (bulk or bag); Handling of Toxic Materials Damaging to Clothing; Pneumatic Spikers; Deck Engine & Winch Operators; Water Main & Cable Ducking (metallic and non-metallic); Screed man or screw operator on asphalt paver; Chain saw and demolition saw operators; Concrete conveyor assemblers; Asbestos removal; Hazardous waste removal.

GROUP 2: Plaster tenders; Mason tenders; Mortar mixers; Welders (acetylene or electric); Cutting torch or burner; Cement nozzle laborers; Cement gun operators; Scaffold builders when working for plasterers; Scaffold builders when working for masons; Water blast machine operators.

GROUP 3: Dynamite men; Drillers-air track or wagon drilling for explosives.

LAB01112-002 06/01/2020

RANDOLPH COUNTY

| | Rates | Fringes |
|--------------|----------|---------|
| Laborers: | | |
| GROUP 1..... | \$ 22.81 | 16.00 |
| GROUP 2..... | \$ 23.56 | 16.00 |
| GROUP 3..... | \$ 23.81 | 16.00 |

LABORER CLASSIFICATIONS

GROUP 1: Building and construction laborers; scaffold builders (other than for masons of plasterers); mechanic tenders; window washers and cleaners; railroad workers; masonry wall washers; portable water pumps with discharge up to 3 inches; signal & flag person

GROUP 2: Waterproofing; hauling of creosote lumber or like treated material (excluding railroad material); asphalt rakers and lutemen; kettlemen; air tool operator; pneumatic tool operator; air & electric vibrators and chipping hammer operator; earth compactors; jackman & sheetmen in ditches more than 6 feet deep; laborers in ditches 6' deep or deeper; assembly of uncrete pump; tile layers (sewer or field); sewer pipe layers; motor- driven wheelbarrows and concrete buggies; hyster operator; pumpcrete assemblers; core drill operator; cement, lime or silica clay handlers; handling of toxic materials damaging to clothing; pneumatic spikers; deck engine & winch operator; water main & cable ducking; screed man or screw operator on asphalt paver; chain saw & demolition saw operator; concrete conveyor assembler; asbestos removal; hazardous waste removal

GROUP 3: Plaster tenders; mortar mixers; welders (acetylene or electric); cutting torch or burner; cement nozzle laborers; cement gun operators; scaffold builders for plasterers; scaffold builders; water blast machine operator

PAIN0012-006 05/01/2020

COMMERCIAL AND INDUSTRIAL

DEARBORN, OHIO, RIPLEY AND SWITZERLAND COUNTIES:

| Rates | Fringes |
|-------|---------|
|-------|---------|

PAINTER

| | | |
|---|----------|-------|
| Bridges, Lead Abatement..... | \$ 26.30 | 11.35 |
| Brush & Roller, Paperhanger, Drywall Taping. | \$ 25.30 | 11.35 |
| Sandblasting, Waterblasting. | \$ 26.05 | 11.35 |
| Spray..... | \$ 25.80 | 11.35 |

PAIN0047-001 06/01/2020

BROWN, DECATUR AND JENNINGS COUNTIES

Rates Fringes

PAINTER

| | | |
|------------------------------|----------|-------|
| Brush, Roller..... | \$ 26.23 | 15.55 |
| Spray and Sand-Blasting..... | \$ 27.23 | 15.55 |

PAIN0118-007 06/01/2020

CLARK, FLOYD AND HARRISON COUNTIES

Rates Fringes

PAINTER

| | | |
|--|----------|-------|
| Brush, Roller, Paperhanger, Spray, Sandblast & Waterblast..... | \$ 19.70 | 14.07 |
|--|----------|-------|

PAIN0387-004 11/01/2020

DEARBORN, FRANKLIN, OHIO, RIPLEY, and SWITZERLAND COUNTIES

Rates Fringes

| | | |
|--------------|----------|-------|
| GLAZIER..... | \$ 27.03 | 15.97 |
|--------------|----------|-------|

PAIN0669-002 05/01/2021

FAYETTE, FRANKLIN, HENRY, RANDOLPH, RUSH, UNION AND WAYNE

Rates Fringes

Painters:

| | | |
|---|----------|-------|
| Brush; Roller; Paperhanging; Drywall Finishers..... | \$ 21.70 | 14.79 |
| Spray/Waterblasting; Sandblasting..... | \$ 22.70 | 14.79 |

PAIN1165-008 07/01/2020

CLARK, FLOYD, HARRISON COUNTIES

| | Rates | Fringes |
|--------------|----------|---------|
| GLAZIER..... | \$ 30.18 | 16.22 |

PAIN1165-015 01/01/2021

BROWN, DECATUR, FAYETTE, HENRY, JENNINGS, RANDOLPH, RUSH,
UNION, and WAYNE COUNTIES

| | Rates | Fringes |
|--------------|----------|---------|
| GLAZIER..... | \$ 29.36 | 17.42 |

PLAS0132-007 06/22/2018

DEARBORN, FRANKLIN (Southern half, south of a line running
East and West established South of Brookville), OHIO, RIPLEY
and SWITZERLAND COUNTIES

| | Rates | Fringes |
|----------------|----------|---------|
| PLASTERER..... | \$ 24.25 | 14.65 |

PLAS0692-003 06/01/2016

AREA #46

BROWN and CLARK COUNTIES

| | Rates | Fringes |
|----------------|----------|---------|
| PLASTERER..... | \$ 25.04 | 13.23 |

PLAS0692-011 04/01/2020

AREA #83

DECATUR, FAYETTE, FRANKLIN, HENRY, RANDOLPH, RUSH, UNION and
WAYNE COUNTIES

| | Rates | Fringes |
|-----------------------------------|----------|---------|
| CEMENT MASON/CONCRETE FINISHER... | \$ 26.00 | 15.54 |

PLASTERER.....\$ 25.49 11.95

PLAS0692-027 04/01/2020

AREA #566

CRAWFORD, DAVIESS, DUBOIS, GIBSON, HARRISON, KNOX, MARTIN,
PERRY, PIKE, POSEY, SPENCER, VANDERBURGH and WARRICK COUNTIES

Rates Fringes

CEMENT MASON/CONCRETE FINISHER...\$ 28.30 18.31

PLAS0692-033 05/01/2019

BROWN, CLARKE, DEARBORN, FLOYD, FRANKLIN (SOUTHERN 1/2),
JENNINGS, OHIO, RIPLEY AND SWITZERLAND COUNTIES

Rates Fringes

CEMENT MASON/CONCRETE FINISHER
AREA #821.....\$ 24.58 14.99

PLUM0136-002 04/01/2021

REMAINING COUNTIES

Rates Fringes

Plumbers and Pipefitters.....\$ 38.97 19,76

PLUM0392-006 06/01/2018

DEARBORN, OHIO, RIPLEY, AND SWITZERLAND COUNTIES

Rates Fringes

Plumbers and Pipefitters.....\$ 32.01 19.67

PLUM0440-004 06/01/2018

FAYETTE, FRANKLIN, HENRY, RANDOLPH, RUSH, UNION and WAYNE
COUNTIES

Rates Fringes

Plumber and Steamfitter.....\$ 37.67 16.79

PLUM0502-001 08/01/2016

CLARK, FLOYD AND HARRISON COUNTIES

| | Rates | Fringes |
|-------------------------|----------|---------|
| PLUMBER/PIPEFITTER..... | \$ 32.00 | 20.13 |

ROOF0042-005 08/01/2021

DEARBORN, OHIO and RIPLEY COUNTIES

| | Rates | Fringes |
|-------------|----------|---------|
| Roofers: | | |
| Roofer..... | \$ 28.85 | 17.05 |

ROOF0075-001 05/01/2020

FAYETTE, RANDOLPH, UNION, and WAYNE Counties

| | Rates | Fringes |
|-------------------|----------|---------|
| ROOFER | | |
| Composition..... | \$ 24.38 | 19.39 |
| Slate & Tile..... | \$ 24.60 | 19.39 |

* ROOF0119-005 09/01/2021

| | Rates | Fringes |
|-------------|----------|---------|
| ROOFER..... | \$ 27.80 | 11.75 |

ROOF0147-003 04/01/2018

CLARK, FLOYD, HARRISON and SWITZWELAND COUNTIES

| | Rates | Fringes |
|-------------|----------|---------|
| ROOFER..... | \$ 24.43 | 10.20 |

SHEE0020-012 07/01/2020

BROWN, DECATUR, FAYETTE, FRANKLIN, HENRY, JENNINGS, RIPLEY,
RUSH AND UNION

| | Rates | Fringes |
|--|-------|---------|
|--|-------|---------|

Sheet metal worker.....\$ 36.21 23.83

SHEE0024-006 06/01/2015

RANDOLPH and WAYNE COUNTIES

Rates Fringes

Sheet metal worker.....\$ 26.27 20.74

SHEE0024-012 06/01/2015

DEARBORN AND OHIO COUNTIES

Rates Fringes

Sheet metal worker.....\$ 26.27 20.74

SHEE0110-007 12/01/2013

CLARK, FLOYD, HARRISON and SWITZERLAND COUNTIES

Rates Fringes

Sheet Metal Worker.....\$ 28.66 18.03

TEAM0135-002 04/01/2021

BROWN, CLARK, DEARBORN, DECATUR, FAYETTE, FLOYD, FRANKLIN,
HENRY, JENNINGS, OHIO, RANDOLPH, RIPLEY, RUSH, SWITZERLAND,
UNION, AND WAYNE COUNTIES

Rates Fringes

Truck drivers:

GROUP 1.....\$ 30.40 .37+A
GROUP 2.....\$ 30.90 .37+A
GROUP 3.....\$ 31.10 .37+A
GROUP 4.....\$ 31.25 .37+A
GROUP 5.....\$ 31.75 .37+A

A: \$36.40 PER DAY & 450.00 PER WEEK.

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: Single Axle Trucks seven(7) cu.yds. or less than ten and one-half (10 1/2) tons, dumpsters, scoop-mobiles five (5) cu. yds. and under or less than seven and one-half (7 1/2) tons, mixer trucks three (3) cu.yds. and under, air

compressors and welding machines, including those pulled by separate units, batch trucks - wet or dry - 2"34-E batches or less, truck driver helpers, warehousemen, mechanic's helpers, greasers and tiremen, all pick-up trucks and other vehicles. Drivers on dumpsters or similar dumpsters, mounted on a four (4) wheel truck rate two (2) cu.yds. or less and small pallet type fork-lift operator and drivers on pallet jacks or similar type equipment.

GROUP 2: Drivers on tandem axle eighteen (18) cu.yds. or twenty-four (24) tons gross, six (6) wheel trucks, Koehring or similar dumpsters, tract trucks, Euclids, hug bottom dumps, tournapulls, tournatrailers, tournarockers, or similar equipment when used for transportation purposes under nine (9) cu.yds. or less than thirteen and one-half (13 1/2) tons, tandems and semi-trailer service trucks, mixer trucks over three (3) cu.yds. and including six and one-half (6 1/2) cu.yds., fork lift, four (4) wheel A frame trucks when used for transportation purposes, four (4) wheel winch trucks, pavement breakers, batch trucks-wet or dry-over 2 up to and including 4-"34-E" batches, two (2) men oil distributors, fork-lift under four (4) ton and vacuum trucks.

GROUP 3: Koehring or similar dumpsters, tract trucks, sem-trailer water trucks, Euclids, hug bottom dumps, tournapulls, tournatrailers, tournarockers, tractor trailers, tandems Q frame winch trucks, hydrolift trucks or similar equipment when used for transportation purposes, mixer trucks over six and one-half (6 1/2) cu.yds. batch trucks wet or dry over 4-"34-E" batches single axle low boy trailers, and contractor's mechanics when working on equipment operated by employees within the bargaining unit; six (6) wheel pole trailers and one (1) man oil distributors, fork-lift over four (4) ton and mobile mixers

GROUP 4: Drivers on heavy equipment over sixteen (16) cu.yds. or twenty-four ton, such as Koehring or similar dumpsters, tract trucks, Euclids, hug bottom dumps, trounapulls, trounarockers or similar equipment when used for transportation purposes, pole trailers over six (6) wheels, water pulls, low-boy trailers tandem axles, quad axle or more no-weight limitation, diesel and /or heavy equipment mechanics when working on equipment operated by employees within the bargaining unit.

GROUP 5: Mechanic, with his own tools.

HARRISON COUNTY

| | Rates | Fringes |
|----------------|----------|---------|
| Truck drivers: | | |
| GROUP 1..... | \$ 23.43 | 19.15 |
| GROUP 2..... | \$ 23.89 | 19.15 |
| GROUP 3..... | \$ 24.11 | 19.15 |

GROUP 1 Pickup Trucks, Winch Trucks, Warehouseman, Mechanic, Street Sweepers, Single axle Trucks

GROUP 2 Tandem Trucks or Dump Trucks; Farm Tractor-Pulling Trailer; Bituminous Distributors, Pavement Breakers

GROUP 3 Mixer Trucks, all types; Lowboys, all types; Semi-trucks, all types; All Tri-axle Dump Trucks; Articulated End Dumps; End Dumps; Heavy Equipment Type Water Wagons; Hazardous Waste Warehouseman; Hazardous Waste Driver; and Drivers on equipment when not self-loaded or pusher loaded, such as Koehring or similar dumpsters, track trucks, Euclid bottom dump and hug bottom dump, Tournatrailers, Tournarockers or similar equipment

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which

these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the

Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"

Required Contract Provisions Federally-Assisted Construction Contracts

SECTION 1 General Information

BONDING REQUIREMENTS:

IC 36-1-12-4.5, IC 36-1-12-13.1, IC 36 1-12-14 e

The minimum requirements for contracts exceeding \$100,000 for construction shall be as follows:

1. A Bid Bond or a certified check shall be filed with each bid equivalent to 5% of the bid price as assurance that the bidder will, upon acceptance of their bid, execute such contractual documents as may be required within the time specified.
2. A Performance Bond for 100% of the contract price to assure fulfillment of the contractor's obligations under the contract.
3. A Payment Bond for 100% of the contract price to assure payment of all persons supplying labor and material in the execution of the work provided for in the contract.

NOTE: The Bid Bond must be submitted with the bid and the Performance Bond and Payment Bond must be provided to the project owner *before* construction begins on the project.

RETAINAGE: IC 36-1-12-14

Public work contracts in excess of \$100,000 require the retainage of 5% of the dollar value of all work satisfactorily completed by the contractor(s). The escrow agent shall be selected by mutual agreement between the board of the awarding agency and the contractor(s). The contractor shall be paid in full within sixty one (61) days after the date of substantial completion. If upon substantial completion of the public work there remain uncompleted minor items, an amount equal to two hundred percent (200%) of the value of each item as determined by the architect/engineer shall be withheld until the item is completed.

CHANGE ORDERS: IC 36-1-12-18

A change order may not be issued before commencement of the actual construction except in the case of an emergency. In such a case, the board of awarding agency must make a declaration and the board's minutes must show the nature of the emergency. The total of all change orders issued that increase the scope of the project may not exceed twenty percent (20%) of the amount of the original contract. A change order issued as a result of circumstances that could not have been reasonably foreseen does not increase the scope of the project. All change orders must be prepared by the project engineer or architect and approved and signed by the board of

the awarding agency and the contractor. All change orders must be directly related to the original public work project.

CONFLICT OF INTEREST: 24 CFR 570.611

In the procurement of supplies, equipment, construction and/or services by recipients and subrecipients, any conflict of interest is prohibited. No persons who exercise or have exercised any functions or responsibilities with respect to CDBG activities assisted under this part or who are in a position to participate in a decision making process or gain inside information with regard to such activities, may obtain a financial interest or benefit from a CDBG-assisted activity, or have a financial interest in any contract, subcontract, or agreement with respect to a CDBG-assisted activity, or with respect to the proceeds of the CDBG-assisted activity, either for themselves or those with whom they have business or immediate family ties, during their tenure or for one year thereafter.

CODE OF CONDUCT: 24 CFR 84.42

The recipient of CDBG grant funds shall maintain written standards of conduct governing the performance of employees engaged in the award and administration of contracts stating that no employee, officer, or agent shall participate in the selection, award, or administration of a contract supported by Federal funds if a real or apparent conflict of interest would be involved.

RECORD RETENTION: 24 CFR 85.42

Financial records, supporting documents, statistical records and all other records pertinent to a grant shall be retained for a period of five years. If any litigation, claim, negotiation, audit or other action is started before the expiration of the five-year period, the records shall be retained until all litigations, claims or audit findings involving the records have been resolved. The retention period starts from the date of the submission of the final expenditure report or, from the date of the submission of the annual financial status report covering the last expenditure of grant funds for that year.

ACCESS TO RECORDS: 24 CFR 85.42-e

The awarding agency and the Comptroller General of the United States, or any of their authorized representatives, shall have the right of access to any pertinent books, documents, papers or other records which are pertinent to the grant in order to make audits, examinations, excerpts and transcripts. The right of access in this section must not be limited to the required retention period but shall last as long as the records are retained.

Required Contract Provisions Federally-Assisted Construction Contracts

CONTRACT PROVISIONS:

In addition to provisions defining a sound and completed procurement contract, any recipient of federal funds shall include the following:

Contracts other than small purchases shall contain provisions or conditions which will allow for administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as may be appropriate.

All contracts in excess of \$25,000 shall contain suitable provisions for termination by the grantee including the manner by which it will be effected and the basis for settlement. In addition, such contract shall describe conditions under which the contract may be terminated for default as well as conditions where the contract may be terminated because of circumstances beyond the control of the contractor.

Contracts, subcontracts, and subgrants of amounts in excess of \$100,000 shall contain a provision which requires compliance with all applicable standards, orders, or requirements issued under Section 306 of the Clean Air Act (42 USC 1857 (h)), Section 508 of the Clean Water Act (33 USC 1368), Executive Order 11738, and Environmental Protection Agency regulations (40 CFR, Part 15), which prohibit the use under non-exempt federal contracts, grants or loans of facilities included on the EPA List of Violating Facilities. The provision shall require reporting of violations to the grantor agency and to the US EPA Administrator for Enforcement (EN-329).

These contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract.

Except as otherwise provided for in each section, the contractor shall insert in each subcontract all of the stipulations contained in these Required Contract Provisions, and further require their inclusion in any lower tier subcontract that may in turn be made. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with these Required Contract Provisions.

A breach of any of the stipulations contained in these Required Contract Provisions shall be sufficient grounds for termination of the contract.

A breach of the Required Contract Provisions may also be grounds for debarment as provided in 29 CFR 5.12.

CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING:

(Applicable to all Federal-aid construction contracts and to all related subcontracts which exceed \$100,000 – 49 CFR 20)

The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief that:

No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal 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 of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

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 Federal 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 Standard Form-LLL, "Disclosure Form to Report Lobbying", in accordance with its instructions.

This certification is a material representation of fact upon which reliance was placed with this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. 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.

The prospective participant also agrees by submitting his or her bid or proposal that he or she shall require that the language of this certification be included in all lower tier subcontracts, which exceed \$100,000, and that all such recipients shall certify and disclose accordingly.

Any and all contractors, subcontractors, independent contractors, suppliers, facilitators or any person participating in any program or activity receiving federal financial assistance shall:

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- a. Prohibit discrimination based on race, color or national origin under Title VI of the Civil Rights Act of 1964;
- b. Prohibit discrimination on the basis of sex under Title VII of the Civil Rights Act of 1964 and amended by the Equal Employment Opportunity Act of 1972;
- c. Prohibit discrimination on the basis of age under the Age Discrimination Act of 1975;
- d. Prohibit discrimination on the basis of disability under Section 504 of the Rehabilitation Act of 1973;
- e. Take affirmative action to employ and advance qualified disabled people under Section 503 of the Rehabilitation Act of 1973;
- f. Promote and insure equal opportunity for all persons, without regard to race, color, religion, sex, or national origin under Executive Order 11246 as Amended;
- g. Display posters which summarize the Federal laws prohibiting job discrimination based on race, color, sex, national origin, religion, age, equal pay and disability;
- h. Prohibit discrimination based on disability under the Americans with Disabilities Act of 1990;
- i. Assure that all buildings assigned for public use be designed, constructed and altered so as to be accessible to and usable by persons with physical disabilities under the Architectural Barriers Act of 1968; and
- j. Avoid maintaining or providing any segregated facilities.

Any and all contractors, subcontractors, independent contractors, suppliers, facilitators or any person participating in any program or activity receiving federal financial assistance shall:

Comply with the provisions for the elimination of Lead-Based paint hazards under 24 CFR Part 35;

Take all necessary precautions to guard against damages to property and injury to persons.

SECTION 2 Equal Employment Opportunity Regulations

NONDISCRIMINATION:

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$10,000 or more)

Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630 and 41 CFR 60) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The Equal Opportunity Construction Contractor Specifications set forth under 41 CFR 60-4.3 and the provisions of the American Disabilities Act of 1990 (42 U.S.C. 12101 *et seq.*) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO.

The contractor will work with the awarding agency and the Federal Government in carrying out EEO obligations and in their review of his/her activities under the contract.

The contractor will accept as his operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, preapprenticeship, and/or on-the-job training."

EEO OFFICER:

The contractor will designate and make known to the awarding agency an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active contractor program of EEO and who must be assigned adequate authority and responsibility to do so.

DISSEMINATION OF POLICY:

All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to

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provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO officer.

All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minority employees.

Notices and posters identifying the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

RECRUITMENT OF EMPLOYEES:

When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minority groups in the area from which the project work force would normally be derived.

The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minority group applicants. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority group applicants may be referred to the contractor for employment consideration.

In the event the contractor has a valid bargaining agreement providing for exclusive hall referrals, he is expected to observe the provisions of that agreement to the extent that the system permits the contractor's compliance with EEO contract provisions. (The DOL has held that where implementations of such agreements have the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Executive Order 11246, as amended.)

The contractor will encourage his present employees to refer minority group applicants for employment. Information and procedures with regard to referring minority group applicants will be discussed with employees.

SELECTION OF SUBCONTRACTORS, PROCUREMENT OF MATERIALS AND LEASING OF EQUIPMENT:

The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment.

The contractor shall notify all potential subcontractors and suppliers of his/her EEO obligations under this contract.

Disadvantaged business enterprises (DBE) as defined in 49 CFR 23, shall have equal opportunity to compete for and perform subcontracts which the contractor enters into pursuant to this contract. The contractor will use his best efforts to solicit bids from and to utilize DBE subcontractors or subcontractors with meaningful minority group and female representation among their employees.

The contractor will use his best efforts to ensure subcontractor compliance with their EEO obligations.

EEO RECORDS AND REPORTS:

The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives. The records kept by the contractor shall document the following:

The number of minority and non-minority group members and women employed in each work classification on the project;

The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women;

The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees; and

The progress and efforts being made in securing the services of DBE subcontractors or subcontractors with meaningful minority and female representation among their employees.

NONSEGREGATED FACILITIES:

Applicable to all Federal-aid construction contracts and to all related subcontracts of \$10,000 or more.

By the execution of this contract or subcontract, or the consummation of this material supply agreement or purchase order, all parties certify that the firm does not maintain or provide for its employees any segregated facilities at any of its

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establishments, and that the firm does not permit its employees to perform their services at any location under its control, where segregated facilities are maintained. The contractor agrees that a breach of this certification is a violation of the EEO provisions of this contract. The contractor further certifies that no employee will be denied access to adequate facilities on the basis of sex or disability.

As used in this certification, the term "segregated facilities" refers to facilities provided for employees which are segregated by explicit directive, or on the basis of race, color, religion, national origin, age or disability, because of habit, local custom, or otherwise. The only exception will be for the disabled when the demands for accessibility override, (e.g. disabled parking).

The contractor agrees that it has obtained or will obtain identical certification from proposed subcontractors or material suppliers prior to award of subcontracts or consummation of material supply agreements of \$10,000 or more and that it will retain such certifications in its files.

FALSIFICATION OF DOCUMENTS:

The falsification of any of the above certifications may subject the contractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 231.

The contractor or subcontractor shall make the records required available for inspection, copying, or transcription by authorized representatives of the awarding agency or the DOL, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the awarding agency, HUD or DOL, or all may, after written notice to the contractor, sponsor, applicant, or owner, take such actions as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds of debarment action pursuant to 29 CFR 5.12.

SECTION 3

The purpose of Section 3 requires that recipients of HUD funds and their contractors and subcontractors provide jobs and other economic opportunities to low-income persons. The CDBG project service area for Section 3 compliance will be the nonmetropolitan county.

Contractors and subcontractors participating in federally-assisted projects are required to track and report their activity relative to the hiring and training of low and moderate income persons and the use of local businesses owned by low-income persons. This information must be reported by all contractors and subcontractors, whose contract is \$100,000 or greater,

prior to project completion utilizing the "Section 3 Compliance form".

All Section 3 covered contracts shall include the following Section 3 clause:

"The work to be performed under this contract is subject to the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (Section 3). The parties to this contract agree to comply with this Section and certify that they are under no contractual or other impediment that would prevent them from complying with these regulations. The contractor agrees to notify each labor organization or representative workers with which the contractor has a collective bargaining agreement of the contractor's commitments under this Section 3 clause and include this clause in every subcontract subject to compliance with the Section 3 regulations. The contractor will certify that any vacant employment positions, including training positions, that are filled after the contractor is selected but before the contract is executed with persons other than those to whom the regulations of 24 CFR Part 135 require employment opportunities to be directed, were not filled to circumvent the contractor's obligations under this section of the Code of Federal Regulations. Noncompliance with HUD's regulations in this Part may result in sanctions, termination of this contract for default, and debarment or suspension from future HUD assisted contracts."

OFFICE OF FEDERAL CONTRACT COMPLIANCE (OFCCP)

For federally assisted construction contracts, the OFCCP administers and enforces Executive Order 11246, as amended. This Order prohibits discrimination and requires affirmative action to ensure equal employment opportunity without regard to race, color, sex, religion and/or national origin; and the implementing regulations at 41 CFR Parts 60-1 through 60-50. Generally, all contractors and subcontractors holding non-exempt federally assisted construction contracts and subcontracts exceeding \$10,000 must comply with Executive Order 11246.

A "Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity" (Executive Order 11246) is to be included in the bid solicitations for all federally assisted construction contracts and subcontracts in excess of \$10,000. The Notice, which is published at 41 CFR 60-4.2, informs the contractor/bidder of the affirmative action requirements imposed under Executive Order 11246, including the specified goals for minority and female participation.

Covered federally assisted construction contracts and subcontracts must incorporate the equal opportunity clause found at 41 CFR 60-1.4(b).

The equal opportunity clause may be expressly included in each contract or subcontract or incorporated by reference. Importantly, the equal opportunity clauses are deemed to be a part of every covered construction contract and subcontract

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even if they are not physically incorporated in the contract documents.

In addition to the equal opportunity clauses, federally assisted construction contracts and subcontracts in excess of \$10,000 must include the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" which are found at 41 CFR 60-4.3. The specifications describe the affirmative action obligations and set forth the specific affirmative action steps the construction contractor must implement in order to make a good faith effort to achieve the goals for minority and female participation that were listed in the bid solicitation.

Additional information regarding OFCCP Compliance may be found at www.dol.gov/esa/OFCCP or, at 1-800-397-6251. The Indiana office is located at 46 East Ohio Street, Suite 419, Indianapolis, IN 46204 and phone number is 317-226-5860.

SECTION 3 Federal Labor Standards Regulations

Any and all contractors, subcontractors, independent contractors, suppliers, facilitators or any person participating in any program or activity receiving federal financial assistance shall:

Comply with federal labor standards regulations as follows:

1. Davis-Bacon Act
2. Contract Work Hours and Safety Standards Act
3. Copeland Act (Anti-Kickback Act)
4. Fair Labor Standards Act

The U. S. Department of Labor has published rules and regulations corresponding to the above regulations at Title 29 CFR Parts 1, 3, 5, 6 and 7.

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION PRIMARY COVERED TRANSACTIONS:

(Applicable to all Federal-aid contracts 49 CFR 29)

By signing and submitting this proposal, the prospective primary participant is providing the certification set out below.

The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective primary participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.

The certification in this clause is a material representation of fact upon which reliance was placed when the department or agency determined to enter into this transaction. If it is later determined that the prospective primary participant knowingly rendered an erroneous certification, in addition to other

remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

The prospective primary participant shall provide immediate written notice to the department or agency to which this proposal is submitted if any time the prospective primary participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

The terms "covered transaction", "debarred", "suspended", "ineligible", "lower tier covered transaction", "participant", "person", "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the department or agency to which this proposal is submitted for assistance in obtaining a copy of those regulations.

The prospective primary participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

The prospective primary participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the non-procurement portion of the "Lists of Parties Excluded from Federal Procurement or Non-procurement Programs" (Non-procurement List) which is compiled by the General Services Administration.

Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

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

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available to the Federal Government, the department or agency may terminate this transaction for cause or default.

The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:

Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

Have not within a 3-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statement, or receiving stolen property.

Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in this certification; and

Have not within a 3-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION APPLICABLE TO ALL SUBCONTRACTS, PURCHASE ORDERS AND OTHER LOWER TIER TRANSACTIONS OF \$25,000 OR MORE

By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.

The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.

The terms "covered transaction," "debarred," "suspended," "ineligible," "primary covered transaction," "participant," "person," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contract the person to which this proposal is

submitted for assistance in obtaining a copy of those regulations.

The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Non-procurement List.

Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

If a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

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PAYMENT OF PREVAILING WAGES:

Applicable to all Federal-aid (CDBG) construction contracts exceeding \$2,000 and to all related subcontracts:

All mechanics and laborers employed or working upon the site of the work will be paid unconditionally and not less often than once a week and without subsequent deduction or rebate on any account except such payroll deductions as are permitted by regulations (29 CFR 3) issued by the Secretary of Labor under the Copeland Act (40 U.S.C. 276c) the full amounts of wages and bona fide fringe benefits or cash equivalents thereof due at time of payment. The payment shall be computed at wage rates not less than those contained in the wage determination of the Secretary of Labor, hereinafter called "the wage determination", which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor or its subcontractors and such laborers and mechanics. The wage determination shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. For the purpose of this Section, contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1 (b)(2) of the Davis-Bacon Act (40 U.S.C. 276a) on behalf of laborers or mechanics are considered wages paid. Regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill.

Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein, provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed.

All rulings and interpretations of the Davis-Bacon Act and related acts contained in 29 CFR 1, 3 and 5 are herein incorporated by reference in this contract.

PERSONNEL ACTIONS:

Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities

do not indicate discriminatory treatment of project site personnel.

The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with his obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of his avenues of appeal.

The contractor will assist in locating, qualifying, and increasing the skills of minority group and women employees, and applicants for employment.

CONFORMANCE RATES:

The awarding agency shall require that any class of laborers or mechanics employed under the contract which is not listed in the wage determination shall be classified in conformance with the wage decision.

An additional classification, wage rate and fringe benefits may be approved only when the following criteria have been met:

- (1) The work to be performed by the additional classification is not performed by any other classification in the wage determination;
- (2) The additional classification is utilized in the area by the construction industry;
- (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

If the contractor or subcontractor, laborers and mechanics, awarding agency and the contracting officer agree on the classification and conformance wage rate including the amount designated for fringe benefits where appropriate, the conformance rates shall be paid to all workers performing work in that classification from the first day on which work is performed in the classification.

In the event the contractor or subcontractors, laborers and mechanics, awarding agency and the contracting officer do not agree on the proposed classification and wage rate including the amount designated for fringe benefits where appropriate, the contracting officer (OCRA Labor Standards Compliance

Required Contract Provisions Federally-Assisted Construction Contracts

Officer) shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. Said Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting agency or will notify within the 30-day period that additional time is necessary. Any work performed during the waiting period will be paid at the base wage and fringe benefit amount conditionally assigned by the contracting officer until a conformance rate is assigned by the Wage and Hour Administrator.

PAYMENT OF FRINGE BENEFITS:

Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor or subcontractors, as appropriate, shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly case equivalent thereof. If the contractor or subcontractor does not make payments to a trustee or other third person, he/she may consider as a part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met.

APPRENTICE PARTICIPATION:

Apprentices will be permitted to work at less than the predetermined rate for the work they perform when they are employed pursuant to and individually registered in a bona fide apprenticeship program duly registered with the DOL, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau.

The allowable ratio of apprentices to journeyman-level employees on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any employee listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate listed in the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor or subcontractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman-level hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the

rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator for the Wage and Hour Division determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

In the event the Bureau of Apprenticeship and Training, or a State apprenticeship agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor or subcontractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the comparable work performed by regular employees until an acceptable program is approved.

OVERTIME REQUIREMENTS:

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers, mechanics, watchmen, or guards (including apprentices) shall require or permit any laborer, mechanic, watchman, guard or apprentice in any workweek in which he/she is employed on such work, to work in excess of 40 hours in such workweek unless such laborer, mechanic, watchman, guard or apprentice receives compensation at a rate not less than one-and-one-half times his/her basic rate of pay for all hours worked in excess of 40 hours in such workweek.

WITHHOLDING PAYMENT FOR UNPAID WAGES:

The awarding agency shall upon its own action or upon written request of an authorized representative of the DOL withhold, or cause to be withheld, from the contractor or subcontractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements which is held by the same prime contractor, as much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic employed or working on the site of the work, all or part of the wages required by the contract, the contracting agency may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

Required Contract Provisions Federally-Assisted Construction Contracts

VIOLATIONS AND LIABILITY FOR UNPAID WAGES AND LIQUIDATED DAMAGES:

In the event of any violation of the requirements set forth in this document, the contractor and any subcontractor responsible for the violation shall be liable to the affected employee for his/her unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States for liquidated damages.

STATEMENTS AND PAYROLLS:

Applicable to all Federally-assisted construction contracts exceeding \$2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural collectors, which are exempt.

The Contractor shall comply with the Copeland Regulations of the Secretary of Labor.

Payrolls and basic records relating thereto shall be maintained by the contractor and each subcontractor during the course of the work and preserved for a period of 3 years from the date of completion of the contract for all laborers, mechanics, apprentices, watchmen, helpers and guards working at the site of the work.

The payroll records shall contain the name and last four digits of the social security number of each such employee; his or her correct classification; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalent thereof the types described in Section 1(b)(2)(B) of the Davis Bacon Act); daily and weekly number of hours worked; deductions made; and actual wages paid. Whenever the Secretary of Labor has found that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b)(2)(B) of the Davis Bacon Act, the contractor and subcontractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, that the plan or program has been communicated in writing to the laborers or mechanics affected, and show the cost anticipated or the actual cost incurred in providing benefits. Contractors or subcontractors employing apprentices under approved programs shall maintain written evidence of the registration of apprentices and ratios and wage rates prescribed in the applicable programs.

Each contractor and subcontractor shall furnish, each week in which any contract work is performed, to the awarding agency or an agent thereof, a certified payroll report of wages paid each of its employees. The payroll submitted shall set out accurately and completely all of the information required to be maintained. This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal stock number 029-005-0014-1), U.S. Government

Printing Office, Washington D.C. 20402. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors.

Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his/her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

That the payroll for the payroll period contains the information required to be maintained and that such information is correct and complete;

That such laborer or mechanic employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR 3;

That each laborer or mechanic has been paid not less than the applicable wage rate and fringe benefits or cash equivalent for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance".

Required Contract Provisions Federally-Assisted Construction Contracts

SECTION 4 Health and Safety

SAFETY AND ACCIDENT PREVENTION:

In the performance of this contract the contractor shall comply with all applicable Federal, State and local laws governing safety, health and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the awarding agency may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3333).

Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333).

IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT:

(Applicable to all Federally assisted construction contracts and to all related subcontracts of \$100,000 or more.)

By submission of this bid or the execution of this contract, or subcontract, as appropriate, the bidder, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

That any facility that is or will be utilized in the performance of this contract, unless such contract is exempt under the Clean Air Act, as amended (42 U.S.C. 1857 et seq., as amended by Pub.L. 91-604), and under the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq., as amended by Pub.L. 92-500), Executive Order 11738, and regulations in implementation thereof (40 CFR 15) is not listed, on the date of contract award, on the U. S. Environmental Protection Agency (EPA) List of Violating Facilities pursuant to 40 CFR 15.20.

That the firm agrees to comply and remain in compliance with all the requirements of Section 114 of the Clean Air Act and Section 308 of the Federal Water Pollution Control Act and all regulations and guidelines listed thereunder.

That the firm shall promptly notify the awarding agency of the receipt of any communication from the Director, Office of Federal Activities, EPA, indicating that a facility that is or will be utilized for the contract is under consideration to be listed on the EPA List of Violating Facilities.

That the firm agrees to include or cause to be included the requirements of this Section in every nonexempt subcontract, and further agrees to take such action as the government may direct as a means of enforcing such requirements.

Equal Employment Opportunity is **THE LAW**

Private Employers, State and Local Governments, Educational Institutions, Employment Agencies and Labor Organizations

Applicants to and employees of most private employers, state and local governments, educational institutions, employment agencies and labor organizations are protected under Federal law from discrimination on the following bases:

RACE, COLOR, RELIGION, SEX, NATIONAL ORIGIN

Title VII of the Civil Rights Act of 1964, as amended, protects applicants and employees from discrimination in hiring, promotion, discharge, pay, fringe benefits, job training, classification, referral, and other aspects of employment, on the basis of race, color, religion, sex (including pregnancy), or national origin. Religious discrimination includes failing to reasonably accommodate an employee's religious practices where the accommodation does not impose undue hardship.

DISABILITY

Title I and Title V of the Americans with Disabilities Act of 1990, as amended, protect qualified individuals from discrimination on the basis of disability in hiring, promotion, discharge, pay, fringe benefits, job training, classification, referral, and other aspects of employment. Disability discrimination includes not making reasonable accommodation to the known physical or mental limitations of an otherwise qualified individual with a disability who is an applicant or employee, barring undue hardship.

AGE

The Age Discrimination in Employment Act of 1967, as amended, protects applicants and employees 40 years of age or older from discrimination based on age in hiring, promotion, discharge, pay, fringe benefits, job training, classification, referral, and other aspects of employment.

SEX (WAGES)

In addition to sex discrimination prohibited by Title VII of the Civil Rights Act, as amended, the Equal Pay Act of 1963, as amended, prohibits sex discrimination in the payment of wages to women and men performing substantially equal work, in jobs that require equal skill, effort, and responsibility, under similar working conditions, in the same establishment.

GENETICS

Title II of the Genetic Information Nondiscrimination Act of 2008 protects applicants and employees from discrimination based on genetic information in hiring, promotion, discharge, pay, fringe benefits, job training, classification, referral, and other aspects of employment. GINA also restricts employers' acquisition of genetic information and strictly limits disclosure of genetic information. Genetic information includes information about genetic tests of applicants, employees, or their family members; the manifestation of diseases or disorders in family members (family medical history); and requests for or receipt of genetic services by applicants, employees, or their family members.

RETALIATION

All of these Federal laws prohibit covered entities from retaliating against a person who files a charge of discrimination, participates in a discrimination proceeding, or otherwise opposes an unlawful employment practice.

WHAT TO DO IF YOU BELIEVE DISCRIMINATION HAS OCCURRED

There are strict time limits for filing charges of employment discrimination. To preserve the ability of EEOC to act on your behalf and to protect your right to file a private lawsuit, should you ultimately need to, you should contact EEOC promptly when discrimination is suspected:

The U.S. Equal Employment Opportunity Commission (EEOC), 1-800-669-4000 (toll-free) or 1-800-669-6820 (toll-free TTY number for individuals with hearing impairments). EEOC field office information is available at www.eeoc.gov or in most telephone directories in the U.S. Government or Federal Government section. Additional information about EEOC, including information about charge filing, is available at www.eeoc.gov.

Employers Holding Federal Contracts or Subcontracts

Applicants to and employees of companies with a Federal government contract or subcontract are protected under Federal law from discrimination on the following bases:

RACE, COLOR, RELIGION, SEX, NATIONAL ORIGIN

Executive Order 11246, as amended, prohibits job discrimination on the basis of race, color, religion, sex or national origin, and requires affirmative action to ensure equality of opportunity in all aspects of employment.

INDIVIDUALS WITH DISABILITIES

Section 503 of the Rehabilitation Act of 1973, as amended, protects qualified individuals from discrimination on the basis of disability in hiring, promotion, discharge, pay, fringe benefits, job training, classification, referral, and other aspects of employment. Disability discrimination includes not making reasonable accommodation to the known physical or mental limitations of an otherwise qualified individual with a disability who is an applicant or employee, barring undue hardship. Section 503 also requires that Federal contractors take affirmative action to employ and advance in employment qualified individuals with disabilities at all levels of employment, including the executive level.

DISABLED, RECENTLY SEPARATED, OTHER PROTECTED, AND ARMED FORCES SERVICE MEDAL VETERANS

The Vietnam Era Veterans' Readjustment Assistance Act of 1974, as amended, 38 U.S.C. 4212, prohibits job discrimination and requires affirmative action to employ and advance in employment disabled veterans, recently separated veterans (within

three years of discharge or release from active duty), other protected veterans (veterans who served during a war or in a campaign or expedition for which a campaign badge has been authorized), and Armed Forces service medal veterans (veterans who, while on active duty, participated in a U.S. military operation for which an Armed Forces service medal was awarded).

RETALIATION

Retaliation is prohibited against a person who files a complaint of discrimination, participates in an OFCCP proceeding, or otherwise opposes discrimination under these Federal laws.

Any person who believes a contractor has violated its nondiscrimination or affirmative action obligations under the authorities above should contact immediately:

The Office of Federal Contract Compliance Programs (OFCCP), U.S. Department of Labor, 200 Constitution Avenue, N.W., Washington, D.C. 20210, 1-800-397-6251 (toll-free) or (202) 693-1337 (TTY). OFCCP may also be contacted by e-mail at OFCCP-Public@dol.gov, or by calling an OFCCP regional or district office, listed in most telephone directories under U.S. Government, Department of Labor.

Programs or Activities Receiving Federal Financial Assistance

RACE, COLOR, NATIONAL ORIGIN, SEX

In addition to the protections of Title VII of the Civil Rights Act of 1964, as amended, Title VI of the Civil Rights Act of 1964, as amended, prohibits discrimination on the basis of race, color or national origin in programs or activities receiving Federal financial assistance. Employment discrimination is covered by Title VI if the primary objective of the financial assistance is provision of employment, or where employment discrimination causes or may cause discrimination in providing services under such programs. Title IX of the Education Amendments of 1972 prohibits employment discrimination on the basis of sex in educational programs or activities which receive Federal financial assistance.

INDIVIDUALS WITH DISABILITIES

Section 504 of the Rehabilitation Act of 1973, as amended, prohibits employment discrimination on the basis of disability in any program or activity which receives Federal financial assistance. Discrimination is prohibited in all aspects of employment against persons with disabilities who, with or without reasonable accommodation, can perform the essential functions of the job.

If you believe you have been discriminated against in a program of any institution which receives Federal financial assistance, you should immediately contact the Federal agency providing such assistance.

EMPLOYEE RIGHTS

EMPLOYEE POLYGRAPH PROTECTION ACT

THE UNITED STATES DEPARTMENT OF LABOR WAGE AND HOUR DIVISION

The Employee Polygraph Protection Act prohibits most private employers from using lie detector tests either for pre-employment screening or during the course of employment.

PROHIBITIONS

Employers are generally prohibited from requiring or requesting any employee or job applicant to take a lie detector test, and from discharging, disciplining, or discriminating against an employee or prospective employee for refusing to take a test or for exercising other rights under the Act.

EXEMPTIONS

Federal, State and local governments are not affected by the law. Also, the law does not apply to tests given by the Federal Government to certain private individuals engaged in national security-related activities.

The Act permits polygraph (a kind of lie detector) tests to be administered in the private sector, subject to restrictions, to certain prospective employees of security service firms (armored car, alarm, and guard), and of pharmaceutical manufacturers, distributors and dispensers.

The Act also permits polygraph testing, subject to restrictions, of certain employees of private firms who are reasonably suspected of involvement in a workplace incident (theft, embezzlement, etc.) that resulted in economic loss to the employer.

The law does not preempt any provision of any State or local law or any collective bargaining agreement which is more restrictive with respect to lie detector tests.

EXAMINEE RIGHTS

Where polygraph tests are permitted, they are subject to numerous strict standards concerning the conduct and length of the test. Examinees have a number of specific rights, including the right to a written notice before testing, the right to refuse or discontinue a test, and the right not to have test results disclosed to unauthorized persons.

ENFORCEMENT

The Secretary of Labor may bring court actions to restrain violations and assess civil penalties up to \$10,000 against violators. Employees or job applicants may also bring their own court actions.

THE LAW REQUIRES EMPLOYERS TO DISPLAY THIS POSTER WHERE EMPLOYEES AND JOB APPLICANTS CAN READILY SEE IT.



For additional information:

1-866-4-USWAGE

(1-866-487-9243)

TTY: 1-877-889-5627



WWW.WAGEHOUR.DOL.GOV

Scan your QR phone reader to learn more about the Employee Polygraph Protection Act.

U.S. Department of Labor | Wage and Hour Division

WHD 1462
Rev. Jan 2012

SAFETY AND HEALTH PROTECTION ON THE JOB

INTRODUCTION:

The intent of the Indiana Occupational Safety and Health Act of 1974, Indiana Code 22-8-1.1, is to assure, so far as possible, safe and healthful working conditions for the workers in the State.

The Indiana Department of Labor has primary responsibility for administering and enforcing the Act and the safety and health standards promulgated under its provisions.

Requirements of the Act include the following:

EMPLOYERS:

Each employer shall establish and maintain conditions of work which are reasonably safe and healthful for employees and free from recognized hazards that are causing or likely to cause death or serious physical harm to employees. The Act further requires that employers comply with the Occupational Safety and Health Standards, Rules, and Regulations.

EMPLOYEES:

All employees shall comply with Occupational Safety and Health Standards and all rules, regulations, and orders issued under the Act, which are applicable to their own actions and conduct.

INSPECTION:

The Act requires that an opportunity be provided for employees and their representatives to bring possible safety and health violations to the attention of the Department of Labor inspector in order to aid the inspection. This requirement may be fulfilled by allowing a representative of the employees and a representative of the employer to accompany the inspector during inspection. Where there is no employee representative, the inspector shall consult with a reasonable number of employees.

COMPLAINT:

Employees have the right to file a complaint with the Department of Labor. There shall be an inspection where reasonable grounds exist for the Department of Labor to believe there may be a hazard. Unless permission is given by the employees complaining to release their names, they will be withheld from the employer. Telephone Number (317) 232-2693.

The Act provides that no employer shall discharge, suspend, or otherwise discriminate in terms of conditions of employment against any employees for their failure or refusal to engage in unsafe practices or for filing a complaint, testifying, or otherwise acting to exercise their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with the Department of Labor within 30 days of the alleged discrimination. Please note that extensions of the 30-day filing requirement may be granted under certain special circumstances, such as where the employer has concealed or misled the employee regarding the grounds for discharge. However, a grievance-arbitration proceeding, which is pending, would not be considered justification for an extension of the 30-day filing period. The Commissioner of Labor shall investigate said complaint and upon finding discrimination in violation of the Act, shall order the employer to provide necessary relief to the employees. This relief may include rehiring, reinstatement to the job with back pay, and restoration of seniority.

All employees are also afforded protection from discrimination under Federal Occupational Safety and Health Act and may file a complaint with the U.S. Secretary of Labor within 30 days of the alleged discrimination.

VIOLATION NOTICE:

When an alleged violation of any provision of the Act has occurred, the Department of Labor shall promptly issue a written order to the employer, who shall be required to post it prominently at or near the place where the alleged violation occurred until it is made safe and required safeguards are provided or 3 days, whichever is longer.

PROPOSED PENALTIES:

The Act provides for CIVIL penalties of not more than \$7,000 for each serious violation and CIVIL penalties of up to \$7,000 for each non-serious violation. Any employer who fails to correct a violation within the prescribed abatement period may be assessed a CIVIL penalty of not more than \$7,000 for each day beyond the abatement date during which such violation continues. Also, any employer who knowingly or repeatedly violates the Act may be assessed CIVIL penalties of not more than \$70,000 for each violation. A minimum penalty of \$5,000 may be imposed for each knowing violation. A violation of posting requirements can bring a penalty of up to \$7,000.

VOLUNTARY ACTIVITY:

The Act encourages efforts by labor and management, before the Department of Labor inspections, to reduce injuries and illnesses arising out of employment.

The Act encourages employers and employees to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries.

Such cooperative action would initially focus on the identification and elimination of hazards that could cause death, injury, or illness to employees and supervisors.

The Act provides a consultation service to assist in voluntary compliance and give recommendations for the abatement of cited violations. This service is available upon a written request from the employer to INSafe. Telephone Number (317) 232-2688.

COVERAGE:

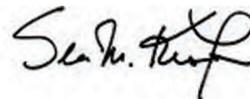
The Act does not cover those hired for domestic service in or about a private home and those covered by a federal agency. Those exempted from the Act's coverage include employees in maritime services, who are covered by the U.S. Department of Labor, and employees in atomic energy activities who are covered by the Atomic Energy Commission.

NOTE:

Under a plan approved March 6, 1974, by the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), the State of Indiana is providing job safety and health protection for workers throughout the State. OSHA will monitor the operation of this plan to assure that continued approval is merited. Any person may make a complaint regarding the State administration of this plan directly to the OSHA Regional Office, Regional Administrator, Region V, U.S. Department of Labor, Occupational Safety and Health Administration, 230 South Dearborn Street, Chicago, Illinois 60604, Telephone Number (312) 353-2220.

MORE INFORMATION:

INDIANA DEPARTMENT OF LABOR
402 West Washington Street, Room W195
Indianapolis, Indiana 46204
Telephone: (317) 232-2655
TT/Voice: (800) 743-3333
Fax: (317) 233-3790
Internet: <http://www.in.gov/dol>



Sean M. Keefer
Commissioner of Labor



EMPLOYERS: This poster must be displayed prominently in the workplace.

EMPLOYEE RIGHTS UNDER THE DAVIS-BACON ACT

FOR LABORERS AND MECHANICS EMPLOYED ON FEDERAL OR FEDERALLY ASSISTED CONSTRUCTION PROJECTS

THE UNITED STATES DEPARTMENT OF LABOR WAGE AND HOUR DIVISION

PREVAILING WAGES

You must be paid not less than the wage rate listed in the Davis-Bacon Wage Decision posted with this Notice for the work you perform.

OVERTIME

You must be paid not less than one and one-half times your basic rate of pay for all hours worked over 40 in a work week. There are few exceptions.

ENFORCEMENT

Contract payments can be withheld to ensure workers receive wages and overtime pay due, and liquidated damages may apply if overtime pay requirements are not met. Davis-Bacon contract clauses allow contract termination and debarment of contractors from future federal contracts for up to three years. A contractor who falsifies certified payroll records or induces wage kickbacks may be subject to civil or criminal prosecution, fines and/or imprisonment.

APPRENTICES

Apprentice rates apply only to apprentices properly registered under approved Federal or State apprenticeship programs.

PROPER PAY

If you do not receive proper pay, or require further information on the applicable wages, contact the Contracting Officer listed below:

or contact the U.S. Department of Labor's Wage and Hour Division.



For additional information:

1-866-4-USWAGE

(1-866-487-9243) TTY: 1-877-889-5627



WWW.WAGEHOUR.DOL.GOV



**EQUAL HOUSING
OPPORTUNITY**

**We Do Business in Accordance With the Federal Fair
Housing Law**

(The Fair Housing Amendments Act of 1988)

**It is Illegal to Discriminate Against Any Person
Because of Race, Color, Religion, Sex,
Handicap, Familial Status, or National Origin**

In the sale or rental of housing or
residential lots

In the provision of real estate
brokerage services

In advertising the sale or rental
of housing

In the appraisal of housing

In the financing of housing

Blockbusting is also illegal

**Anyone who feels he or she has been
discriminated against may file a complaint of
housing discrimination:**

1-800-669-9777 (Toll Free)

1-800-927-9275 (TTY)

www.hud.gov/fairhousing

**U.S. Department of Housing and
Urban Development
Assistant Secretary for Fair Housing and
Equal Opportunity
Washington, D.C. 20410**

Applicability

The Project or Program to which the construction work covered by this contract pertains is being assisted by the United States of America and the following Federal Labor Standards Provisions are included in this Contract pursuant to the provisions applicable to such Federal assistance.

A. 1. (i) Minimum Wages. All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under Section I(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of 29 CFR 5.5(a)(1)(iv); also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under 29 CFR 5.5(a)(1)(ii) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible, place where it can be easily seen by the workers.

(ii) (a) Any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. HUD shall approve an additional classification and wage rate and fringe benefits therefor only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(b) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and HUD or its designee agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by HUD or its designee to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, D.C. 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise HUD or its designee or will notify HUD or its designee within the 30-day period that additional time is necessary. (Approved by the Office of Management and Budget under OMB control number 1215-0140.)

(c) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and HUD or its designee do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), HUD or its designee shall refer the questions, including the views of all interested parties and the recommendation of HUD or its designee, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise HUD or its designee or will notify HUD or its designee within the 30-day period that additional time is necessary. (Approved by the Office of Management and Budget under OMB Control Number 1215-0140.)

(d) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (1)(ii)(b) or (c) of this paragraph, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part

of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program. (Approved by the Office of Management and Budget under OMB Control Number 1215-0140.)

2. Withholding. HUD or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee or helper, employed or working on the site of the work, all or part of the wages required by the contract, HUD or its designee may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased. HUD or its designee may, after written notice to the contractor, disburse such amounts withheld for and on account of the contractor or subcontractor to the respective employees to whom they are due. The Comptroller General shall make such disbursements in the case of direct Davis-Bacon Act contracts.

3. (i) Payrolls and basic records. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in Section 1(b)(2)(B) of the Davis-bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5 (a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been

communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs. (Approved by the Office of Management and Budget under OMB Control Numbers 1215-0140 and 1215-0017.)

(ii) (a) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to HUD or its designee if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant sponsor, or owner, as the case may be, for transmission to HUD or its designee. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i) except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to HUD or its designee if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant sponsor, or owner, as the case may be, for transmission to HUD or its designee, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this subparagraph for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to HUD or its designee. (Approved by the Office of Management and Budget under OMB Control Number 1215-0149.)

(b) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under 29 CFR 5.5 (a)(3)(ii), the appropriate information is being maintained under 29 CFR 5.5(a)(3)(i), and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR Part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(c) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph A.3.(ii)(b).

(d) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under subparagraph A.3.(i) available for inspection, copying, or transcription by authorized representatives of HUD or its designee or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, HUD or its designee may, after written notice to the contractor, sponsor, applicant or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and Trainees.

(i) **Apprentices.** Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who

is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) **Trainees.** Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by

the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under 29 CFR Part 5 shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR Part 3 which are incorporated by reference in this contract

6. Subcontracts. The contractor or subcontractor will insert in any subcontracts the clauses contained in subparagraphs 1 through 11 in this paragraph A and such other clauses as HUD or its designee may by appropriate instructions require, and a copy of the applicable prevailing wage decision, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in this paragraph.

7. Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act Requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this contract

9. Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and HUD or its designee, the U.S. Department of Labor, or the employees or their representatives.

10. (i) Certification of Eligibility. By entering into this contract the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1) or to be

awarded HUD contracts or participate in HUD programs pursuant to 24 CFR Part 24.

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1) or to be awarded HUD contracts or participate in HUD programs pursuant to 24 CFR Part 24.

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001. Additionally, U.S. Criminal Code, Section 1 01 0, Title 18, U.S.C., "Federal Housing Administration transactions", provides in part: "Whoever, for the purpose of . . . influencing in any way the action of such Administration..... makes, utters or publishes any statement knowing the same to be false..... shall be fined not more than \$5,000 or imprisoned not more than two years, or both."

11. Complaints, Proceedings, or Testimony by Employees. No laborer or mechanic to whom the wage, salary, or other labor standards provisions of this Contract are applicable shall be discharged or in any other manner discriminated against by the Contractor or any subcontractor because such employee has filed any complaint or instituted or caused to be instituted any proceeding or has testified or is about to testify in any proceeding under or relating to the labor standards applicable under this Contract to his employer.

B. Contract Work Hours and Safety Standards Act. The provisions of this paragraph B are applicable where the amount of the prime contract exceeds \$100,000. As used in this paragraph, the terms "laborers" and "mechanics" include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which the individual is employed on such work to work in excess of 40 hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in subparagraph (1) of this paragraph, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in subparagraph (1) of this paragraph, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages required by the clause set forth in subparagraph (1) of this paragraph.

(3) Withholding for unpaid wages and liquidated damages. HUD or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contract, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act which is held by the same prime contractor such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in subparagraph (2) of this paragraph.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in subparagraph (1) through (4) of this paragraph and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in subparagraphs (1) through (4) of this paragraph.

C. Health and Safety. The provisions of this paragraph C are applicable where the amount of the prime contract exceeds \$100,000.

(1) No laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health and safety as determined under construction safety and health standards promulgated by the Secretary of Labor by regulation.

(2) The Contractor shall comply with all regulations issued by the Secretary of Labor pursuant to Title 29 Part 1926 and failure to comply may result in imposition of sanctions pursuant to the Contract Work Hours and Safety Standards Act, (Public Law 91-54, 83 Stat 96). 40 USC 3701 et seq.

(3) The contractor shall include the provisions of this paragraph in every subcontract so that such provisions will be binding on each subcontractor. The contractor shall take such action with respect to any subcontractor as the Secretary of Housing and Urban Development or the Secretary of Labor shall direct as a means of enforcing such provisions.

How to Correctly Fill Out a WH-347 Payroll Form

The completion of the WH-347 Payroll Form is optional; contractors may utilize their own payroll system as long as it conforms to the WH-347 Payroll Form and contains all the necessary information. If you utilize WH-347 Payroll Form as a pdf, saving it electronically aids in making any needed corrections.

Check one of the boxes and list name of contractor or subcontractor

The last day of the payroll period.

Fill out completely with contractor or subcontractor address

U.S. Department of Labor
Employment Standards Administration
Wage and Hour Division

PAYROLL
(For Contractor's Optional Use; See instructions at www.dol.gov/esa/whd/forms/wh347instr.htm)
Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.

| | | | | | | | | | | | | | | | | |
|--|---|--|---------------------------------|--|-----|-----|-----------------------------|--------------------------------|---|----------------|------------------------|----------|---------|---------|---------|-------------------|
| NAME OF CONTRACTOR OR SUBCONTRACTOR <input type="checkbox"/> Contractor <input checked="" type="checkbox"/> Subcontractor Sample Construction Company | ADDRESS 385 West Drive, Madison WI 53703 | PROJECT AND LOCATION Robin Street Apartments, Delafield WI 53018 | PROJECT OR CONTRACT NO. 3000 | OMB No. 1215-0149 Expires: 12/31/2011 | | | | | | | | | | | | |
| PAYROLL NO. 8 | | FOR WEEK ENDING 04/24/2010 | | | | | | | | | | | | | | |
| (1) NAME AND INDIVIDUAL IDENTIFYING NUMBER (i.e. LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER) OF WORKER Alex Driver - ### | (2) NUMBER OF HOURS WORKED IN WEEK 2 | (3) WORK CLASSIFICATION Power Equipment Operator Bull Dozer Group 12 | (4) DAY AND DATE | | | | (5) TOTAL HOURS 2.00 | (6) RATE AT PAY \$62.83 | (7) GROSS AMOUNT EARNED \$1,422.84 | (8) DEDUCTIONS | (9) NET WAGES FOR WEEK | | | | | |
| | | | Sun | Mon | Tue | Wed | | | | | | Thur | Fri | Sat | FICA | WITHG HOLDING TAX |
| | | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | \$161.00 | \$185.15 | \$156.97 | \$50.31 | \$85.00 | \$24.43 | \$1,374.03 |

Payrolls must be numbered sequentially and should be based on the weeks worked under a contract.

Indicate the days and dates of the pay period. (should match week ending directly above)

The name and location of project.

The prime contractor should include the project number as listed in the loan

List each worker's name.

Only laborers and mechanics performing construction work under the contract should be listed.

Please note: Business Owners need only include their name, work classification including "owner" and the daily total hours worked.

Specify the job classification located in the contract wage decision and/or the corresponding job title.

List hourly wage rate and fringes paid in cash (not those paid to plans)

(For Contractor's Optional Use - See instructions at www.dol.gov/eis/whd/forms/wh347instr.htm)

Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.



Specify the net amount paid to the employee for the pay

Must accurately reflect overtime and straight time hours worked under the contract.

Specify the total overtime and straight time hours worked on the project.

Specify the gross earnings for the hours worked under the contract.

| NAME AND INDIVIDUAL IDENTIFYING NUMBER (6 or 9, LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER OF OWNER) | WORK CLASSIFICATION | (4) DAY AND DATE | | | | | | | TOTAL HOURS | RATE OF PAY | GROSS AMOUNT EARNED | (8) DEDUCTIONS | | | TOTAL DEDUCTIONS | NET WAGES PAID FOR WEEK |
|--|--|------------------|-----|-----|-----|-----|-----|-------|-------------|-------------|---------------------|----------------|----------|------------|------------------|-------------------------|
| | | Sun | Mon | Tue | Wed | Thu | Fri | Sat | | | | WTHH | FICA | WELFARE | | |
| Alex Driver - #### | Power Equipment Operator Bull Dozer Group 2 | | | | | | | 2.00 | \$62.83 | \$1,422.84 | \$161.00 | | | \$538.43 | \$1,374.03 | |
| Jason Worker - #### | General Laborer | | | | | | | 4.00 | \$45.20 | \$1,702.78 | \$136.06 | | | \$1,233.07 | | |
| Shawn Worker - #### | Carpenter | | | | | | | 1.50 | \$60.19 | \$1,064.72 | \$121.00 | \$128.35 | \$47.19 | \$1,406.18 | | |
| Roy Wrench - #### | Apprentice Carpenter 1st 6 mo. at 40% | | | | | | | 40.00 | \$32.72 | \$1,064.72 | \$85.18 | \$90.50 | \$26.62 | \$757.01 | | |
| Bart Turner - #### | Plumber | | | | | | | 20.00 | \$67.88 | \$1,004.80 | \$163.46 | \$118.51 | \$51.08 | \$1,563.04 | | |
| | Steamfitter | | | | | | | 20.00 | \$69.13 | \$1,038.40 | \$118.51 | \$51.08 | \$480.16 | \$1,563.04 | | |
| | Power Equipment Operator Rotary Drill Group 4 | | | | | | | 24.00 | \$32.97 | \$791.28 | \$118.51 | \$51.08 | \$415.93 | \$1,023.27 | | |

While completion of Form WH-347 is optional, it is mandatory for covered contractors and subcontractors performing work on Federally financed or assisted construction contracts to respond to (40 U.S.C. § 3145) contractors and subcontractors performing work on Federally financed or assisted construction contracts to furnish weekly a statement with respect to the wages paid each 28 C.F.R. § 5.5(a)(3)(ii) require contractors to submit weekly a copy of all payrolls to the Federal agency contracting for or financing the construction project, accompanied by a signed "Statement of Compliance" showing the proper Davis-Bacon prevailing wage rate for the work performed. DOL and federal contracting agencies receiving this information review the information for compliance with the Davis-Bacon Act.

Public Burden Statement

If part of a worker's weekly wage was earned on projects other than the project described on this payroll, enter the gross amount earned on this contract in the top half of column 7. Enter the gross amount earned during the week for all projects in the bottom half.

Alex Driver worked 29.5 hours on this contract and 12.5 hours on another contract. The gross wages earned on this project, \$1,422.84, is entered in the top half of column 7. The gross wages earned on all projects, \$2,012.46, is entered in the

| (1) NAME AND INDIVIDUAL IDENTIFYING NUMBER (e.g., LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER OF WORKER) | (2) JOB CLASSIFICATION | (3) WORK CLASSIFICATION | (4) DAY AND DATE | | | | | | | TOTAL HOURS | RATE OF PAY | GROSS AMOUNT EARNED | DEDUCTIONS | | | | | NET WAGES PAID FOR WEEK | |
|---|---------------------------|---|-----------------------|-----|-----|-----|-----|-----|-------|-------------|-------------|---------------------|------------|-------------------|-------------------------|------------|------------|-------------------------|------------------|
| | | | HOURS WORKED EACH DAY | | | | | | | | | | FICA | WITH- HOLDING TAX | State with- holding tax | Medicare | OTHER | | TOTAL DEDUCTIONS |
| | | | Sun | Mon | Tue | Wed | Thu | Fri | Sat | | | | | | | | | | |
| Alex Driver - #### | 2 | Power Equipment Bull Dozer Group 2 | | | | | | | 2.00 | \$62.83 | \$1,422.84 | \$61.00 | \$156.97 | \$50.31 | \$85.00 | \$638.43 | \$1,374.03 | | |
| Jason Worker - #### | 2 | General Laborer | | | | | | | 4.00 | \$40.70 | \$2,012.46 | \$35.06 | \$132.66 | \$42.52 | \$467.71 | \$1,233.07 | | | |
| Sharon Wood - #### | 3 | Carpenter | | | | | | | 1.50 | \$60.19 | \$1,700.78 | \$151.00 | \$154.77 | \$47.19 | \$481.31 | \$1,406.18 | | | |
| Reggie Tree - #### | 1 | Apprentice Carpenter 1st 6 mo. at 40% | | | | | | | 40.00 | \$32.72 | \$1,064.72 | \$85.18 | \$105.41 | \$90.50 | \$307.71 | \$757.01 | | | |
| Roy Wrench - #### | 5 | Plumber | | | | | | | 20.00 | \$67.88 | \$1,004.80 | \$163.46 | \$147.11 | \$118.51 | \$480.16 | \$1,563.04 | | | |
| Roy Wrench - #### | 5 | Steamfitter | | | | | | | 20.00 | \$69.13 | \$1,038.40 | \$115.41 | \$142.48 | \$35.98 | \$415.53 | \$1,023.27 | | | |
| Bart Turner - #### | 1 | Power Equipment Rotary Drill Group 4 | | | | | | | 24.00 | \$60.80 | \$719.28 | \$115.41 | \$142.48 | \$35.98 | \$415.53 | \$1,023.27 | | | |

If an employee performs multiple work classifications under the contract, use two or more lines to distinguish the different job classifications, hours worked, and hourly wage earned for each.

Combine the two classifications when recording the gross amount earned for this pay period, deductions, and net wages.

A registered apprentice performing work under a contract must be reported. The payroll must include the current pay scale & provide a copy of the apprenticeship agreement.

Provide explanation of "other" deductions on signatory page.



PAYROLL

Optional Use; See instructions at www.doi.gov/esa/whd/forms/wh347 to respond to the collection of information unless it displays a currently valid OMB control number.

ADDRESS 385 West Drive, Madison WI 53703

PROJECT OR CONTRACT NO. 3000

PROJECT AND LOCATION Robin Street Apartments, Delafield WI 53018

| (1) NAME AND INDIVIDUAL IDENTIFYING NUMBER (e.g., LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER OF WORKER) | (2) EMPLOYEE IDENTIFICATION NUMBER | (3) WORK CLASSIFICATION | (4) DAY AND DATE | | | | | | | (5) TOTAL HOURS | (6) RATE OF PAY | (7) GROSS AMOUNT EARNED | (8) DEDUCTIONS | | | (9) NET WAGES PAID FOR WEEK | |
|---|------------------------------------|---|------------------|-----|-----|-----|------|-----|-----|-----------------|-----------------|-------------------------|----------------|-------------------|----------|-----------------------------|------------|
| | | | Sun | Mon | Tue | Wed | Thur | Fri | Sat | | | | FICA | WITH- HOLDING TAX | Medicare | | OTHER |
| Alex Driver - ##### | 2 | Power Equipment Bull Dozer Group 2 | | | | | | | | 2.00 | \$62.83 | \$1,422.84 | \$161.00 | \$156.97 | \$50.31 | \$85.00 | \$1,274.03 |
| Jason Worker - ##### | 4 | General Laborer | | | | | | | | 4.00 | \$49.20 | \$2,012.46 | \$136.06 | \$132.66 | \$42.52 | \$467.71 | \$1,233.07 |
| Sharon Wood - ##### | 3 | Carpenter | | | | | | | | 1.50 | \$60.19 | \$1,700.78 | \$151.00 | \$128.35 | \$47.19 | \$481.31 | \$1,406.18 |
| Reggie Tree - ##### | 1 | Apprentice Carpenter 1st 6 mo. at 40% | | | | | | | | 40.00 | \$32.72 | \$1,887.49 | \$85.18 | \$90.50 | \$26.62 | \$307.71 | \$737.01 |
| Roy Wrench - ##### | 5 | Plumber | | | | | | | | 20.00 | \$67.88 | \$1,064.72 | \$163.46 | \$118.51 | \$51.08 | \$480.16 | \$1,563.04 |
| Roy Wrench - ##### | 5 | Steamfitter | | | | | | | | 20.00 | \$69.13 | \$1,038.40 | \$115.14 | \$122.33 | \$35.98 | \$415.93 | \$1,023.27 |
| Bart Turner - ##### | 1 | Power Equipment Rotary Drill Group 4 | | | | | | | | 24.00 | \$60.80 | \$2,043.20 | \$115.14 | \$142.48 | \$35.98 | \$415.93 | \$1,023.27 |

While completion of Form WH-347 is required for all contractors, the contractor is not required to file this form if the contractor is not a contractor under 40 U.S.C. § 3145, contract 29 C.F.R. § 5.5(g)(3)(i) or mechanic has been paid.

We estimate that it will take approximately 15 minutes to complete this form. If you have any comments regarding this form, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, ESA, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W., Washington, D.C. 20210.

Fringe benefits are not paid as cash to Bart Turner: explanation is included under "(c) exceptions" on signatory page.

STATEMENT OF COMPLIANCE

Date _____

I, _____, do hereby state:
(Name of signatory party) (Title)

(1) That I pay or supervise the payment of the persons employed by _____ on the
(Contractor or Subcontractor)
_____;
(Building or work)

_____ day of _____ and ending the _____ day of _____, all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said Contractor or Subcontractor from the full weekly wages earned by any person and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part 3 (29 CFR Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat., 948.63 Stat. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. 276c), and described below:

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, or if no such recognized agency exists in a State, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

In addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in Section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

Each laborer or mechanic listed in the above referenced payroll has been paid as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in Section 4(c) below.

(c) EXCEPTIONS

| EXCEPTION (CRAFT) | EXPLANATION |
|-------------------|-------------|
| | |
| | |
| | |

Remarks _____

Name and Title _____ Signature _____

The willful falsification of any of the above statements may subject the contractor or subcontractor to civil or criminal prosecution. See Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

How to Correctly Fill Out a WH-347 Payroll Form

The completion of the WH-347 Payroll Form is optional; contractors may utilize their own payroll system as long as it conforms to the WH-347 Payroll Form and contains all the necessary information. If you utilize WH-347 Payroll Form as a pdf, saving it electronically aids in making any needed corrections.

U.S. Department of Labor
Employment Standards Administration
Wage and Hour Division

WH-347
PAYROLL

(For Contractor's Optional Use; See instructions at www.dol.gov/esa/whd/forms/wh347instr.htm)
Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.

NAME OF CONTRACTOR OR SUBCONTRACTOR
Sample Construction Company

ADDRESS: 385 West Drive, Madison WI 53703

OMB No.: 1215-0149
Expires: 12/31/2011

PROJECT AND LOCATION: Robin Street Apartments, Delafield WI 53018

PROJECT OR CONTRACT NO.: 3000

PAYROLL NO.: 8

FOR WEEK ENDING: 04/24/2010

| NAME AND INDIVIDUAL IDENTIFYING NUMBER (i.e. LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER) OF WORKER | CLASSIFICATION | (4) DAY AND DATE | | | | | | | TOTAL HOURS | GROSS AMOUNT EARNED | WITHHOLDING TAX | FICA TAX | STATE WITHHOLDING TAX | MEDICARE | OTHER DEDUCTIONS | TOTAL DEDUCTIONS | NET WAGES FOR WEEK |
|--|--|------------------|-----|-----|-----|------|------|-------|-------------|---------------------|-----------------|----------|-----------------------|----------|------------------|------------------|--------------------|
| | | Sun | Mon | Tue | Wed | Thur | Frid | Sat | | | | | | | | | |
| Alex Driver - ### | Power Equipment Operator Bull Dozer Group 2 | | | | | | | 2.00 | \$62.83 | \$185.15 | \$161.00 | \$156.97 | \$50.31 | \$85.00 | \$24.43 | \$1,374.03 | |
| | | | | | | | | 27.50 | \$2,012.46 | | | | | | | | |

Check one of the boxes and list name of contractor or subcontractor

The last day of the payroll period.

Fill out completely with contractor or subcontractor address

Payrolls must be numbered sequentially and should be based on the weeks worked under a contract.

Type the word "Final" when the last payroll is submitted for the project.

Indicate the days and dates of the pay period. (should match week ending directly above)

The name and location of project.

The prime contractor should include the project number as listed in the loan

List each worker's name.

Only laborers and mechanics performing construction work under the contract should be listed.

Please note: Business Owners need only include their name, work classification including "owner" and the daily total hours worked.

Specify the job classification located in the contract wage decision and/or the corresponding job title.

List hourly wage rate and fringes paid in cash (not those paid to plans)

(For Contractor's Optional Use) See instructions at www.dol.gov/esa/whd/forms/wh347instr.htm

Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.



Specify the net amount paid to the employee for the pay

Specify the total overtime and straight time hours worked on the project.

Must accurately reflect overtime and straight time hours worked under the contract.

Specify the gross earnings for the hours worked under the contract.

| NAME AND INDIVIDUAL IDENTIFYING NUMBER (6 or 9, LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER OF OWNER) | WORK CLASSIFICATION | (4) DAY AND DATE | | | | | | | TOTAL HOURS | RATE OF PAY | GROSS AMOUNT EARNED | FICA | MEDICAID | DEDUCTIONS | TOTAL DEDUCTIONS | NET WAGES PAID FOR WEEK |
|--|--|------------------|-----|-----|-----|-----|-----|-------|-------------|-------------|---------------------|----------|----------|------------|------------------|-------------------------|
| | | Sun | Mon | Tue | Wed | Thu | Fri | Sat | | | | | | | | |
| Alex Driver - #### | Power Equipment Operator Bull Dozer Group 2 | | | | | | | 2.00 | \$62.83 | \$1,422.84 | \$161.00 | | | \$538.43 | \$1,374.03 | |
| Jason Worker - #### | General Laborer | | | | | | | 4.00 | \$45.25 | \$1,702.78 | \$136.06 | | | \$47.71 | \$1,233.07 | |
| Shawn Worker - #### | Carpenter | | | | | | | 1.50 | \$60.19 | \$1,064.72 | \$111.00 | \$54.27 | \$47.19 | \$47.19 | \$1,406.18 | |
| Roy Wrench - #### | Apprentice Carpenter 1st 6 mo. at 40% | | | | | | | 40.00 | \$32.72 | \$1,887.49 | \$85.18 | \$105.41 | \$90.50 | \$26.62 | \$307.71 | \$757.01 |
| Bart Turner - #### | Plumber | | | | | | | 20.00 | \$67.88 | \$1,064.72 | \$163.46 | \$147.11 | \$118.51 | \$51.08 | \$480.16 | \$1,563.04 |
| | Steamfitter | | | | | | | 24.00 | \$60.80 | \$719.28 | \$115.43 | \$142.48 | \$122.33 | \$35.98 | \$415.93 | \$1,023.27 |

While completion of Form WH-347 is optional, it is mandatory for covered contractors and subcontractors performing work on Federally financed or assisted construction contracts to respond to (40 U.S.C. § 3145) contractors and subcontractors performing work on Federally financed or assisted construction contracts to furnish weekly a statement with respect to the wages paid each 28 C.F.R. § 5.5(a)(3)(ii) require contractors to submit weekly a copy of all payrolls to the Federal agency contracting for or financing the construction project, accompanied by a signed "Statement of Compliance" showing the proper Davis-Bacon prevailing wage rate for the work performed. DOL and federal contracting agencies receiving this information review the information for compliance with the Davis-Bacon Act.

Public Burden Statement

If part of a worker's weekly wage was earned on projects other than the project described on this payroll, enter the gross amount earned on this contract in the top half of column 7. Enter the gross amount earned during the week for all projects in the bottom half.

Alex Driver worked 29.5 hours on this contract and 12.5 hours on another contract. The gross wages earned on this project, \$1,422.84, is entered in the top half of column 7. The gross wages earned on all projects, \$2,012.46, is entered in the

| (1) NAME AND INDIVIDUAL IDENTIFYING NUMBER (e.g., LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER OF WORKER) | (2) JOB CLASSIFICATION | (3) WORK CLASSIFICATION | (4) DAY AND DATE | | | | | | | TOTAL HOURS | RATE OF PAY | GROSS AMOUNT EARNED | DEDUCTIONS | | | | NET WAGES PAID FOR WEEK | | |
|---|---------------------------|---|------------------|-----|-----|-----|-----|-----|-----|-------------|-------------|---------------------|------------|-------------------|-------------------------|----------|-------------------------|------------|------------------|
| | | | HOURS WORKED | | | | | | | | | | FICA | WITH- HOLDING TAX | State with- holding tax | Medicare | | OTHER | TOTAL DEDUCTIONS |
| | | | Sun | Mon | Tue | Wed | Thu | Fri | Sat | | | | | | | | | | |
| Alex Driver - #### | 2 | Power Equipment Bull Dozer Group 2 | | | | | | | | 2.00 | \$62.83 | \$1,422.84 | \$61.00 | \$156.97 | \$50.31 | \$85.00 | \$638.43 | \$1,374.03 | |
| Jason Worker - #### | 2 | General Laborer | | | | | | | | 4.00 | \$40.70 | \$2,012.46 | \$35.06 | \$132.66 | \$42.52 | | \$467.71 | \$1,233.07 | |
| Sharon Wood - #### | 3 | Carpenter | | | | | | | | 1.50 | \$60.19 | \$1,700.78 | \$151.00 | \$154.77 | \$47.19 | | \$481.31 | \$1,406.18 | |
| Reggie Tree - #### | 1 | Apprentice Carpenter 1st 6 mo. at 40% | | | | | | | | 40.00 | \$32.72 | \$1,064.72 | \$85.18 | \$105.41 | \$90.50 | | \$307.71 | \$757.01 | |
| Roy Wrench - #### | 5 | Plumber | | | | | | | | 20.00 | \$67.88 | \$1,004.80 | | | | | | | |
| Roy Wrench - #### | 5 | Steamfitter | | | | | | | | 20.00 | \$69.13 | \$1,038.40 | \$163.46 | \$147.11 | \$118.51 | \$51.08 | \$480.16 | \$1,563.04 | |
| Bart Turner - #### | 1 | Power Equipment Rotary Drill Group 4 | | | | | | | | 24.00 | \$60.80 | \$2,043.20 | \$15.00 | \$142.48 | \$35.98 | | \$415.53 | \$1,023.27 | |

If an employee performs multiple work classifications under the contract, use two or more lines to distinguish the different job classifications, hours worked, and hourly wage earned for each.

Combine the two classifications when recording the gross amount earned for this pay period, deductions, and net wages.

A registered apprentice performing work under a contract must be reported. The payroll must include the current pay scale & provide a copy of the apprenticeship agreement.

Provide explanation of "other" deductions on signatory page.



PAYROLL

Optional Use; See instructions at www.dol.gov/esa/whd/forms/wh347 to respond to the collection of information unless it displays a currently valid OMB control number.

ADDRESS 385 West Drive, Madison WI 53703

PROJECT OR CONTRACT NO. 3000

PROJECT AND LOCATION Robin Street Apartments, Delafield WI 53018

| (1) NAME AND INDIVIDUAL IDENTIFYING NUMBER (e.g., LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER OF WORKER) | (2) EMPLOYEE'S WORK CLASSIFICATION | (4) DAY AND DATE | | | | | | | (5) TOTAL HOURS | (6) RATE OF PAY | (7) GROSS AMOUNT EARNED | (8) DEDUCTIONS | | | (9) NET WAGES PAID FOR WEEK |
|--|---|------------------|-----|-----|-----|------|-----|-------|--------------------|--------------------|----------------------------|----------------|-------------------|----------|--------------------------------|
| | | Sun | Mon | Tue | Wed | Thur | Fri | Sat | | | | FICA | WITH- HOLDING TAX | Medicare | |
| Alex Driver - ##### | Power Equipment Bull Dozer Group 2 | | | | | | | 2.00 | \$62.83 | \$1,422.84 | \$161.00 | \$156.97 | \$50.31 | \$85.00 | \$1,274.03 |
| Jason Worker - ##### | General Laborer | | | | | | | 27.50 | \$132.83 | \$2,012.46 | \$136.06 | \$132.66 | \$42.52 | \$467.71 | \$1,233.07 |
| Sharon Wood - ##### | Carpenter | | | | | | | 4.00 | \$49.20 | \$1,700.78 | \$151.00 | \$128.35 | \$47.19 | \$481.31 | \$1,406.18 |
| Reggie Tree - ##### | Apprentice Carpenter 1st 6 mo. at 40% | | | | | | | 1.50 | \$60.19 | \$1,887.49 | \$85.18 | \$90.50 | \$26.62 | \$307.71 | \$737.01 |
| Roy Wrench - ##### | Plumber | | | | | | | 40.00 | \$32.72 | \$1,064.72 | \$163.46 | \$118.51 | \$51.08 | \$480.16 | \$1,563.04 |
| Roy Wrench - ##### | Steamfitter | | | | | | | 20.00 | \$67.88 | \$1,004.80 | \$115.14 | \$122.33 | \$35.98 | \$415.93 | \$1,023.27 |
| Bart Turner - ##### | Power Equipment Rotary Drill Group 4 | | | | | | | 20.00 | \$34.41 | \$2,043.20 | \$115.14 | \$142.48 | \$35.98 | \$415.93 | \$1,023.27 |
| | | | | | | | | 24.00 | \$29.97 | \$1,439.20 | | | | | |

While completion of Form WH-347 is required, the contractor is not required to file this form with the Department of Labor, Division 108, unless it is a contractor for a project financed or assisted by the Federal Government. The contractor is required to file this form with the Department of Labor, Division 108, if it is a contractor for a project financed or assisted by the Federal Government. The contractor is required to file this form with the Department of Labor, Division 108, if it is a contractor for a project financed or assisted by the Federal Government. The contractor is required to file this form with the Department of Labor, Division 108, if it is a contractor for a project financed or assisted by the Federal Government.

Burden Statement
We estimate that it will take approximately 15 minutes to search existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information, if you have any comments regarding this burden estimate or any aspect of this collection of information, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, ESA, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W., Washington, D.C. 20210

Fringe benefits are not paid as cash to Bart Turner: explanation is included under "(c) exceptions" on signatory page.

SECTION 01011 - SUMMARY OF WORK - SINGLE PRIME CONTRACTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of each prime Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 PROJECT IDENTIFICATION

- A. The Project consists of HVAC upgrades / replacements for Vaile Elementary School per Contract Documents:

HVAC Upgrades / Replacements

Vaile Elementary School
300 South 14th Street

Westview Elementary School
1707 Southwest A Street

Charles Elementary School
2400 Reeveston Road

RICHMOND, IN
PROJECT 2115-1

For: The Richmond Community School Corporation, 300 Hub Etchison Parkway, Richmond, Indiana, as shown on contract documents prepared by Maze Design, Inc. Dated 10/29/2021.

- B. Single Prime Contracts, Represents a contract that combines all construction activities performed on the project under one Single Prime Contract.

1.3 WORK SEQUENCE

- A. Education takes highest priority, scheduling will be established to minimize any interruption in the educational process.

The Owner will work closely with the Contractor to move the project as expedient as possible.

Preliminary Construction Schedule:

1. Basement floor sawing and floor concrete removal at Vaile and Charles schools shall be completed over Christmas Break, December 20, 2021 through January 4, 2022, or Spring Break, March 19 through March 27, 2022. The Owner will set the VAV AHU fans to slow speed and the Contractor shall tape or provide sealed covers on all joints , penetrations, and access doors door on negative pressure ducts and AHU sections in the basement. The Vaile Gymnasium AHU will be turned off by the Owner for 2 days for floor cutting and removal, and the Owner will provide any necessary temporary heat in the Gymnasium. At Vaile Elementary School, at the Contractor's option, the VAV AHU may be turned off for up to 3 days and low sections of ductwork may be temporarily removed in order to facilitate floor cutting and removal under low ducts. Temporarily removed ducts shall be stored in a clean location, remaining duct openings shall be covered and sealed closed, and the Contractor shall provide temporary heat in served areas to prevent room temperatures from falling below 55 degrees.
 2. All under floor drainage systems, floor patching, perimeter wall sealing, and door and frame modifications work at Vaile and Charles schools shall occur in January and February, 2022.
 3. All electrical wiring work except for final terminations shall be completed before June 1, 2022 at all three schools.
 4. For all three schools, all work required for air handler replacement including pipe and duct replacement work shall occur after May 26, 2022. All replacement work shall be in place and air handling systems and their controls shall be fully operational before July 22, 2022.
 5. All awarded duct cleaning work at all schools shall be accomplished during non-school hours. Acceptable work times include Christmas Break, Spring Break, any time after May 26, all weekends and school holidays, and shift work between 3:00 PM and 6:00 AM on school in-session days.
 6. All awarded boiler replacement work shall occur after April 15 and before the substantial completion date.
- Final construction schedule shall be prepared by the successfully contractor and submitted for engineer and owner review.
 - Substantial completion off all work including boilers on or before July 22nd 2022.
 - Final punch list items must be completed on or before August 5th 2022.

1.4 CONTRACTORS USE OF PREMISES

- A. General: The Contractor shall limit their use of the premises to construction activities in areas indicated. All dumpster

locations must be approved by owner. Repair of any damage to lawn, walks drives and other improvements shall be repaired by contractor.

- (1) Keep driveways and entrances serving the premises clear and available to the Owner and the Owner's employees at all times. Coordinate areas available for parking or storage of materials with Owner's representative. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

1.5 OWNER OCCUPANCY

- A. Full Owner Occupancy: The Owner will occupy the site and existing building for School during the entire construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with the Owner's operations. Contractor shall provide temporary self-contained toilets for employees.

1.6 PROVISIONS FOR CONTRACTORS EMPLOYEES

- a. It is required that all construction employees comply with the following rules during school hours and school activities. Said rules shall be posted at the job site.
 - 1.No employees are to eat in the occupied school premises.
 - 2.Construction employees are not to be within areas used by students during school hours without express approval by the Principal.
 - 3.There is to be no smoking on school property.
 - 4.No coffee breaks, loafing, etc., will be tolerated in areas occupied by school.
 - 5.All construction personnel will conduct themselves in an unimpeachable manner while on the construction site, including proper language, etc.
 - 6.All requirements of Occupational Safety and Health Act will be followed implicitly.
 - 6.The contractor shall have all employees complete and submit a background check prior to working on site. Verify type with Owner.

END OF SECTION 01011

SECTION 01020 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements governing handling and processing allowances.
- B. Types of allowances required include the following:
 - 1. Lump sum allowances.
 - 2. Contingency allowances.
- C. Procedures for submitting and handling Change Orders are included in Section "Change Order Procedures."

1.3 SELECTION AND PURCHASE

- A. At the earliest feasible date after Contract award, advise the Engineer of the date when the final selection and purchase of each product or system described by an allowance must be completed in order to avoid delay in performance of the Work.
 - 1. When requested by the Engineer, obtain proposals for each allowance for use in making final selections; include recommendations that are relevant to performance of the Work.
 - 2. Purchase products and systems as selected by the Engineer from the designated supplier.

1.4 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- B. Submit invoices or delivery slips to indicate actual quantities of materials delivered to the site for use in fulfillment of each allowance.

1.5 CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed for the Owner's purposes, and only by Change Orders which designate amounts to be charged to the allowance.
 - 1. The Contractor's related costs for products or equipment ordered by the Owner under the contingency allowance, including delivery, installation, taxes, insurance, equipment rental, and similar costs are not part of the Contract Sum.
 - 2. Change Orders authorizing use of funds from the contingency allowance will include the Contractor's related costs and reasonable overhead and profit margins.
 - 3. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.
 - 4. Contractor mark-up on allowance items purchased shall be limited to 5% of the purchase / sub-contractors cost.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect products covered by an allowance promptly upon delivery for damage or defects.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related construction activities.

3.3 SCHEDULE OF ALLOWANCES

Allowance No. 1 General: General Contractor shall include a Contingency Allowance of \$50,000.00 for use upon the Owner's instructions.

END OF SECTION 01020

SECTION 01027 - APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

- A. Prime Contractor shall prepare its Schedule of Values for its Work.
 - 1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
 - a. Contractor's construction schedule.
 - b. Application for Payment form.
 - 2. Submit the Schedule of Values to the Engineer at the earliest feasible date, but in no case later than 7 days before the date scheduled for submittal of the initial Application for Payment.
- B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
 - 1. Schedule of Value Form: Use form included at the end of this section.
 - 2. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
 - 3. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.
 - 4. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide

separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

5. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.

- a. At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.

6. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT:

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Engineer and paid for by the Owner.
 1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.
- B. Payment Application Times: Each progress payment date is the 6th day of the month. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement. Owner shall have 31 days for payment to be submitted to contractor.
- C. Payment Application Forms: Use AIA Document G 702 and Continuation Sheets G 703, as the form for Application for Payment. Use original documents; copies will not be accepted.
- D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.
 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
 2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the

construction period covered by the application.

- E. Transmittal: Submit four executed copies of each Application for Payment to the Engineer by means ensuring receipt within 24 hours; all copies shall be complete, including waivers of lien and similar attachments, when required.
1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Engineer.
- F. Waivers of Mechanics Lien: With each Application for Payment submit waivers of mechanics liens from subcontractors or sub- subcontractors and suppliers for the construction period covered by the previous application.
1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
 2. When an application shows completion of an item, submit final or full waivers.
 3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to Owner.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include but are not limited to the following:
1. Schedule of Values.
 2. Contractor's Construction Schedule (preliminary if not final).
 3. Copies of building permits
 4. Certificates of insurance and insurance policies.
- H. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work. Administrative actions and submittals that shall precede or coincide with this application include but are not limited to the following:
1. Occupancy permits and similar approvals.
 2. Warranties (guarantees) and maintenance agreements.
 3. Test/adjust/balance records.
 4. Maintenance instructions.
 5. Start-up performance reports.
 6. Change-over information related to Owner's occupancy, use, operation and maintenance.

7. Final cleaning.
 8. List of incomplete Work, recognized as exceptions to Engineer's Certificate of Substantial Completion.
- I. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include but are not limited to the following:
1. Completion of Project closeout requirements.
 2. Completion of items specified for completion after Substantial Completion.
 3. Assurance that unsettled claims will be settled.
 4. Assurance that Work not complete and accepted will be completed without undue delay.
 5. Transmittal of required Project construction records to Owner.
 6. Removal of temporary facilities and services.
 7. Removal of surplus materials, rubbish and similar elements.
 8. Change of door locks to Owner's access.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01027

SECTION 01030 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for Alternates.
- B. Definition: An Alternate is an amount proposed by Bidders and stated on the Bid Form for certain construction activities defined in the Bidding Requirements that may be added to or deducted from Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems or installation methods described in Contract Documents.
- C. Coordination: Coordinate related Work and modify or adjust adjacent Work as necessary to ensure that Work affected by each accepted Alternate is complete and fully integrated into the project. Costs for related coordination, modification or adjustment shall be included in alternate bids.
- D. Notification: Immediately following the award of the Contract, prepare and distribute to each party involved, notification of the status of each Alternate. Indicate whether Alternates have been accepted, rejected or deferred for consideration at a later date. Include a complete description of negotiated modifications to Alternates.
- E. Schedule: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods necessary to achieve the Work described under each Alternate.
 - 1. Include as part of each Alternate, miscellaneous devices, accessory objects and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

Alternate #1 - Replace Boilers Vaile

State the Lump Sum Price to be added to the base bid per alternate bid #1 per design plans and specifications.

Alternate #2 - Ductwork Cleaning Vaile

State the Lump Sum Price to be added to the base bid per alternate bid #2 per design plans and specifications.

Alternate #3 - Replace Boilers Charles

State the Lump Sum Price to be added to the base bid per alternate bid #3 per design plans and specifications.

Alternate #4 - Ductwork Cleaning Charles

State the Lump Sum Price to be added to the base bid per alternate bid #4 per design plans and specifications.

Alternate #5 - Ductwork Cleaning Westview

State the Lump Sum Price to be added to the base bid per alternate bid #5 per design plans and specifications.

END OF SECTION 01030

SECTION 01035 - MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.
 - 1. Single Prime Contracts: Provisions of this Section apply to the Work of prime contractor.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 1 Section "Allowances" for procedural requirements governing the handling and processing of allowances.
 - 2. Division 1 Section "Submittals" for requirements for the Contractor's Construction Schedule.
 - 3. Division 1 Section "Application for Payment" for administrative procedures governing applications for payment.

1.3 MINOR CHANGES IN THE WORK

- A. Supplemental instructions authorizing minor changes in the Work, not involving an adjustment to the Contract Sum or Contract Time, will be issued by the Engineer on AIA form G710, Architect's Supplemental Instructions.

1.4 CHANGE ORDER PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time will be issued by the Engineer, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
 - 1. Proposal requests issued by the Engineer are for

information only. Do not consider them an instruction either to stop work in progress, or to execute the proposed change.

2. Unless otherwise indicated in the proposal request, within 20 days of receipt of the proposal request, submit to the Engineer for the Owner's review an estimate of cost necessary to execute the proposed change.
 - a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.
- B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Engineer.
 1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
 2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 4. Comply with requirements in Section "Product Substitutions" if the proposed change in the Work requires the substitution of one product or system for a product or system specified.
- C. Proposal Request Form: Use AIA Document G 709 for Change Order Proposal Requests.

1.5 ALLOWANCES

- A. Allowance Adjustment: Base each Change Order Proposal Request for an allowance cost adjustment solely on the difference between the actual purchase amount and the allowance, multiplied by the final measurement of work-in-place, with reasonable allowances, where applicable, for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in the purchase amount only where indicated as part of the allowance.
 2. When requested, prepare explanations and documentation to substantiate the margins claimed.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit, within 20 days of receipt of the change order or construction change directive authorizing work to proceed. Claims submitted later than 20 days will be rejected.
1. The Change Order cost amount shall not include the Contractor's or Subcontractor's indirect expense except when it is clearly demonstrated that either the nature or scope of work required was changed from that which could have been foreseen from the description of the allowance and other information in Contract Documents.
 2. No change to the Contractor's indirect expense is permitted for selection of higher or lower priced materials or systems of the same scope and nature as originally indicated.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Engineer may issue a Construction Change Directive on AIA Form G714, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.7 CHANGE ORDER PROCEDURES

- A. Upon the Owner's approval of a Change Order Proposal Request, the Engineer will issue a Change Order for signatures of the Owner and Contractor on AIA Form G701, as provided in the Conditions of the Contract.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01035

SECTION 01041 - PROJECT COORDINATION -PRIME CONTRACT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies minimum administrative and supervisory requirements necessary for coordination on the Project to be fulfilled by the single prime Contractor.
- B. Field engineering is included in Section "Field Engineering".
- C. Progress meetings, coordination meetings and pre-installation conferences are included in Section "Project Meetings".
- D. Requirement for the Contractor's Construction Schedule is included in Section "Submittals."

1.3 COORDINATION

- A. Coordination: The Prime Contractor shall be responsible for overall coordination and shall coordinate Subcontractor's construction activities with those of other Subcontractors and other entities involved to assure efficient and orderly installation of each part of the Work.

1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, Prime contractor shall schedule the construction activities in the sequence required to obtain the best results.
2. Where availability of space is limited, Prime contractor shall coordinate installation of different components with other Subcontractors to assure maximum accessibility for required maintenance, service, and repair.
3. Prime contractor shall make adequate provisions to accommodate items scheduled for later installation.

- B. Where necessary, prepare memoranda for distribution to each

party involved outlining special procedures required for coordination. Include items such as required notices, reports, and attendance at meetings.

1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.
- C. Administrative Procedures: Prime contractor shall coordinate scheduling and timing of its administrative procedures with other construction activities and activities of other Subcontractors to avoid conflicts and ensure orderly progress of the Work.
- D. Conservation: Prime contractor shall coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.4 SUBMITTALS

- A. Coordination Drawings: Prepare and submit Coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.
1. Show the interrelationship of components shown on separate Shop Drawings.
 2. Indicate required installation sequences.
 3. Comply with requirements contained in Section "Submittals".
 4. Preparation Responsibility: Preparation of Coordination Drawings is the responsibility of the prime Contractor.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: The prime contractor shall require the installer of each major component to

inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

- B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
 - 1. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject incorrect, damaged and defective items.
 - 2. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.
- C. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Engineer for final decision.
- D. Recheck measurements and dimensions, before starting each installation.
- E. Install each component during weather conditions and project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- F. Enclosure of the Work: Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.
- G. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Engineer for final decision.

3.2 CLEANING AND PROTECTION

- A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure freedom from damage or deterioration at Substantial Completion.
- B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

- C. Limiting Exposures: Prime contractor shall supervise its construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to the following:
1. Excessive static or dynamic loading.
 2. Excessive internal or external pressures.
 3. Excessively high or low temperatures.
 4. Thermal shock.
 5. Excessively high or low humidity.
 6. Air contamination or pollution.
 7. Water or ice.
 8. Solvents.
 9. Chemicals.
 10. Light.
 11. Radiation.
 12. Puncture.
 13. Abrasion.
 14. Heavy traffic.
 15. Soiling, staining and corrosion.
 16. Bacteria.
 17. Rodent and insect infestation.
 18. Combustion.
 19. Electrical current.
 20. High speed operation,
 21. Improper lubrication,
 22. Unusual wear or other misuse.
 23. Contact between incompatible materials.
 24. Destructive testing.
 25. Misalignment.
 26. Excessive weathering.
 27. Unprotected storage.
 28. Improper shipping or handling.
 29. Theft.
 30. Vandalism.

END OF SECTION 01041

SECTION 01045 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for cutting and patching.
- B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - 1. Requirements of this Section apply to mechanical and electrical installations. Refer to Division-15 and Division-16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.
- C. Demolition of selected portions of the building for alterations is included in Section "Selective Demolition."

1.3 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Engineer's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Use materials that match existing adjacent materials to the fullest extent possible with regard to visual effect. Notify Engineer of existing materials which cannot be matched prior to proceeding. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
 - 1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

- B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.
1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
 3. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
 4. Comply with requirements of applicable Sections of Division-2 where cutting and patching requires excavating and backfilling.
 5. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
 2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
 - a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch, after the patched area has received primer and second coat.
 4. Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.4 CLEANING

- A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION 01045

SECTION 01095 - REFERENCE STANDARDS AND DEFINITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. Indicated: The term indicated refers to graphic representations, notes, or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as shown, noted, scheduled, and specified are used to help the reader locate the reference. There is no limitation on location.
- C. Directed: Terms such as directed, requested, authorized, selected, approved, required, and permitted mean directed by the Engineer, requested by the Engineer, and similar phrases.
- D. Approved: The term approved, when used in conjunction with the Engineer's action on the Contractor's submittals, applications, and requests, is limited to the Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- E. Regulations: The term regulations includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. Furnish: The term furnish means supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. Install: The term install describes operations at the Project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

- H. Provide: The term provide means to furnish and install, complete and ready for the intended use.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 16-Division format and MASTERFORMAT numbering system.
- B. Specification Content: This Specification uses certain conventions regarding the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:
 - 1. Abbreviated Language: Language used in Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words that are implied, but not stated, shall be interpolated as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

1.4 INDUSTRY STANDARDS

- A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with the standards in effect as of the date of the Contract Documents.
- C. Conflicting Requirements: Where compliance with two or more standards is specified and where the standards may establish different or conflicting requirements for minimum quantities or quality levels, refer requirements that are different but apparently equal and other uncertainties to the Engineer for a decision before proceeding.
 - 1. Minimum Quantity or Quality Levels: The quantity or

quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the Engineer for a decision before proceeding.

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

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

- E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-generating organization, authority having jurisdiction, or other entity applicable to the context of the Text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

1.5 SUBMITTALS

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01095

SECTION 01200 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings.
- B. Construction schedules are specified in other Division-1 Sections.

1.3 PRE-CONSTRUCTION CONFERENCE

- A. Contractor to schedule a pre-construction conference and organizational meeting at the Project site or other convenient location no later than 10 days after execution of the Agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.
- B. Attendees: The Owner, Engineer and their consultants, all Sub Contractors and their superintendents, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.
- C. Agenda: Discuss items of significance that could affect progress including such topics as:
 - 1. Tentative construction schedule.
 - 2. Critical Work sequencing.
 - 3. Designation of responsible personnel.
 - 4. Procedures for processing field decisions and Change Orders.
 - 5. Procedures for processing Applications for Payment.
 - 6. Distribution of Contract Documents.
 - 7. Submittal of Shop Drawings, Product Data and Samples.
 - 8. Preparation of record documents.
 - 9. Use of the premises.
 - 10. Office, Work and storage areas.

11. Equipment deliveries and priorities.
12. Safety procedures.
13. First aid.
14. Security.
15. Housekeeping.
16. Working hours.

1.4 PRE-INSTALLATION CONFERENCES

- A. Conduct a pre-installation conference at the site as required:

1.5 COORDINATION MEETINGS

- A. Conduct Project coordination meetings at regularly scheduled times convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.
- B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.
- C. Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.6 PROGRESS MEETINGS

- A. Conduct weekly progress meetings at the Project site. Notify the Owner and Engineer of scheduled meeting times. Coordinate dates of meetings with preparation of the payment request. The Contractor for General Construction is responsible for coordinating the meetings and taking minutes.
- B. Attendees: In addition to representatives of the Owner and Engineer, each contractor, each major subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.
- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.

1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 2. Review the present and future needs of each entity present, including such items as:
 - a. Interface requirements.
 - b. Time.
 - c. Sequences.
 - d. Deliveries.
 - e. Off-site fabrication problems.
 - f. Access.
 - g. Site utilization.
 - h. Temporary facilities and services.
 - i. Hours of Work.
 - j. Hazards and risks.
 - k. Housekeeping.
 - l. Quality and Work standards.
 - m. Change Orders.
 - n. Documentation of information for payment requests.
- D. Reporting: No later than 5 days after each progress meeting date, the Contractor for General Construction will have distributed copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
1. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01200

SECTION 01300 - SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including;

- 1. Contractor's construction schedule.
- 2. Submittal schedule.
- 3. Daily construction reports.
- 4. Shop Drawings.
- 5. Product Data.
- 6. Samples.

- B. Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:

- 1. Permits.
- 2. Applications for payment.
- 3. Performance and payment bonds.
- 4. Insurance certificates.
- 5. List of Subcontractors.

- C. The Schedule of Values submittal is included in Section "Applications for Payment."

- D. Inspection and test reports are included in Section "Quality Control Services."

1.3 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

- 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related

activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
 - a. Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals.
 - b. If an intermediate submittal is necessary, process the same as the initial submittal.
 - c. Allow two weeks for reprocessing each submittal.
 - d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.
- B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
1. Provide a space approximately 4" x 5" on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
 2. Include the following information on the label for processing and recording action taken.
 - a. Project name.
 - b. Date.
 - c. Name and address of Engineer.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Number and title of appropriate Specification Section.
 - i. Drawing number and detail references, as appropriate.
- C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Engineer using a transmittal form. Submittals

received from sources other than the Contractor will be returned without action.

- D. All submittals shall be submitted to the Engineer by Email in PDF Format. Material Samples shall be submitted and delivered to the Engineers office as specified.

1. On the transmittal Record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. See Section 01315 for required CPM Schedule.

1.5 SUBMITTAL SCHEDULE

- A. After development and acceptance of the Contractor's construction schedule, prepare a complete schedule of submittals. Submit the schedule no later than 10 days after the date required for establishment of the Contractor's construction schedule.

1. Coordinate submittal schedule with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.
2. Prepare the schedule in chronological order; include submittals required during the first 90 days of construction. Provide the following information:
 - a. Scheduled date for the first submittal.
 - b. Related Section number.
 - c. Submittal category.
 - d. Name of subcontractor.
 - e. Description of the part of the Work covered.
 - f. Scheduled date for Engineer's final release or approval.

- B. Distribution: Following response to initial submittal, print and distribute copies to the Engineer, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in

construction activities.

- C. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.6 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report, recording the following information concerning events at the site; and submit one copy to the Engineer at weekly intervals:
 - 1. List of subcontractors at the site.
 - 2. Approximate count of personnel at the site.
 - 3. High and low temperatures, general weather conditions.
 - 4. Accidents and unusual events.
 - 5. Meetings and significant decisions.
 - 6. Stoppages, delays, shortages, losses.
 - 7. Meter readings and similar recordings.
 - 8. Emergency procedures.
 - 9. Orders and requests of governing authorities.
 - 10. Change Orders received, implemented.
 - 11. Services connected, disconnected.
 - 12. Equipment or system tests and start-ups.
 - 13. Partial Completions, occupancies.
 - 14. Substantial Completions authorized.

1.7 SHOP DRAWINGS

- A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.
- B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
 - 1. Dimensions.
 - 2. Identification of products and materials included.
 - 3. Compliance with specified standards.
 - 4. Notation of coordination requirements.
 - 5. Notation of dimensions established by field measurement.
 - 6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 36" x 48".
 - 7. Initial Submittal and Resubmittals: Submit one correctable translucent reproducible and one blue- or black-line print if possible, or seven blue or black-

line prints for the Engineer's review; the reproducible print will be returned.

8. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.
- C. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.
1. Preparation of coordination Drawings is specified in section "Project Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.
 2. Submit coordination Drawings for integration of different construction elements. Show sequences and relationships of separate components to avoid conflicts in use of space.

1.8 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."
1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with recognized trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
 - f. Notation of coordination requirements.
 2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
 3. Preliminary Submittal: Submit a preliminary single-copy of Product Data where selection of options is required.

4. Submittals:
 - a. Submit 7 copies of each required submittal.
 - b. All submittals shall also be submitted to the Engineer by Email in PDF Format. Material Samples shall be submitted and delivered to the Engineers office as specified.
 - c. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - a. Do not proceed with installation until an approved copy of Product Data is in the installer's possession.
 - b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.9 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern.
 1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Engineer's Sample. Include the following:
 - a. Generic description of the Sample.
 - b. Sample source.
 - c. Product name or name of manufacturer.
 - d. Compliance with recognized standards.
 - e. Availability and delivery time.
 2. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - a. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the

- variations.
- b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
 - c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.
3. Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
 - a. Preliminary submittals will be reviewed and retained by the Engineer. The Engineer will return written response of selections and other actions.
 4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets; one will be returned marked with the action taken.
 5. Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of construction.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.
- B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
1. Field Samples specified in individual Sections are special types of Samples. Field Samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the Work will be judged.
 - a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.10 ENGINEER'S ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer will review each submittal, mark to indicate action taken, and return promptly.
1. Compliance with specified characteristics is the Contractor's responsibility.
- B. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:
1. Final Unrestricted Release: Where submittals are marked "No Exceptions Taken," that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
 2. Final-But-Restricted Release: When submittals are marked "Make Corrections Noted," that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
 3. Returned for Resubmittal: When submittal is marked "Amend & Resubmit or Rejected - See Remarks," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
 - a. Do not permit submittals marked "Not Approved, Revise and Resubmit" to be used at the Project site, or elsewhere where Work is in progress.
 4. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked "Action Not Required".

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

END OF SECTION 01300

SECTION 01501 - TEMPORARY FACILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of each prime Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.
- B. Temporary utilities required include but are not limited to:
 - 1. Temporary electric power and light.
- C. Temporary construction and support facilities required include but are not limited to:
 - 1. Temporary heat.
 - 2. Field offices and storage sheds.
 - 3. Sanitary facilities, including drinking water.
 - 4. Temporary enclosures.
 - 5. Temporary project identification signs and bulletin boards.
 - 6. Waste disposal services.
 - 7. Rodent and pest control.
 - 8. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities required include but are not limited to:
 - 1. Temporary fire protection.
 - 2. Barricades, warning signs, lights.
 - 3. Environmental protection.

1.3 DIVISION OF RESPONSIBILITIES

- A. General: Prime contractor is responsible for all temporary facilities or to assign responsibility to subcontractors prior to bid.
- B. Contractor is responsible for:

1. Installation, operation, maintenance and removal of each temporary service or facility usually considered as its own normal construction activity, as well as the costs and use charges associated with each such service or facility.
 2. Plug-in electric power cords and extension cords, and supplementary plug-in task lighting and special lighting necessary exclusively for its own activities.
 3. Its own field office, complete with necessary furniture, utilities and telephone service.
 4. Its own storage and fabrication sheds.
 5. Temporary heat, ventilation, humidity control and enclosure of the building where these utilities are necessary for its construction activity, but where these utilities have not yet been installed by the responsible prime Contractor.
 6. All of their own hoisting requirements, including hoisting material or equipment into spaces below grade, and hoisting requirements outside the building enclosure.
 7. Collection and disposal of its own hazardous, dangerous, unsanitary or other harmful waste material.
 8. Secure lockup of its own tools, materials and equipment.
 9. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.
 10. Temporary telephone service.
- C. Contractor is responsible for:
1. Temporary toilets, including disposable supplies.
 2. Temporary wash facilities, including disposable supplies.
 3. Containerized bottled-water type drinking water units.
 4. Temporary enclosure of the building.
 5. Project identification and temporary signs.
 6. General collection and disposal of wastes.
 7. Rodent and pest control.
 8. Barricades, warning signs and lights.
 9. Security enclosure and lockup.
 10. Environmental protection.
 11. Temporary heat, upon enclosure of the building.
 12. Temporary ventilation, upon enclosure of the building.
- D. The Contractor is responsible for:
1. Piped temporary water service.
- E. The Electrical Subcontractor is responsible for:
1. Temporary electric power service and distribution.
 2. Temporary lighting.

1.4 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to the Owner or Engineer; Prime Contractor's cost or use charges for temporary services or facilities will not be accepted as a basis of claim for an adjustment in the Contract Sum or Contract Time.
- B. Water Service: The Owner shall pay water service use charges.
- C. Electric Power Service: The Owner shall pay electric power service use charges.
- D. Except for those mentioned above the cost of providing and using any additional temporary services and facilities, including use charges, is solely to be borne by the Contractor for General Construction and shall be totally included in the Contract Sum.
- E. Other entities using temporary services and facilities include, but are not limited to:
 - 1. Other Subcontractors.
 - 2. The Owner's work forces.
 - 3. Occupants of the Project.
 - 4. The Engineer.
 - 5. Testing agencies.
 - 6. Personnel of government agencies.

1.5 SUBMITTALS

- A. Temporary Utilities: contractor shall submit reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.

1.6 QUALITY ASSURANCE

- A. Regulations: contractor shall comply with industry standards and with applicable laws and regulations of authorities having jurisdiction, including but not limited to:
 - 1. Building code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police, Fire Department and Rescue Squad rules.
 - 5. Environmental protection regulations.
- B. Standards: contractor shall comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for

Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities."

1. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", prepared jointly by AGC and ASC for industry recommendations.
 2. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with the normal application of trade regulations and union jurisdictions.
 3. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.7 PROJECT CONDITIONS

- A. Temporary Utilities: At the earliest feasible time, when acceptable to the Owner, change over from use of the temporary service to use of the permanent service.
1. Temporary use of permanent facilities: The Installer of each permanent service or facility shall assume responsibility for its operation, maintenance and protection during its use as a construction service or facility prior to the Owner's acceptance, regardless of previously assigned responsibilities.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous, dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

1.8 PROVISIONS FOR CONTRACTORS EMPLOYEES

- A. It is required that all construction employees comply with The following rules.
1. Construction employees are to use their own toilet facilities.
 2. There is to be no smoking on the property.
 3. Areas inside and out including streets and sidewalks surrounding construction, in which construction personnel are working or otherwise using, shall be policed daily to keep same free from debris, dust, mud,

- etc.
4. All construction personnel will conduct themselves in an unimpeachable manner while on the construction site, including proper language, etc.
 5. All requirements of Occupational Safety and Health Act will be followed implicitly.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: contractor shall provide new materials; if acceptable to the Engineer, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.
- B. Lumber and Plywood: Comply with requirements in Division-6 Section "Rough Carpentry."
 1. For signs and directory boards, provide exterior type, Grade B-B High Density Concrete Form Overlay Plywood conforming to PS-1, of sizes and thickness indicated.
 2. For fences and vision barriers, provide exterior type, minimum 3/8" thick plywood.
 3. For safety barriers, similar uses, provide minimum 5/8" thick exterior plywood.
- C. Water: Provide potable water approved by local health authorities.
- D. Open-Mesh Fencing: Provide 11-gage, galvanized 2-inch, chain link fabric fencing 6 feet high with galvanized barbed wire top strand and galvanized steel pipe posts, 1-1/2" I.D. for line posts, and 2-1/2" I.D. for corner posts.

2.2 EQUIPMENT

- A. General: contractor shall provide new equipment; if acceptable to the Engineer, undamaged, previously used equipment in serviceable condition may be used. Provide equipment suitable for the use intended.
- B. Water Hoses: Provide 3/4" heavy-duty, abrasion-resistant, flexible rubber hoses 100 ft. long, with pressure rating greater than the maximum pressure of the water distribution system; provide adjustable shut-off nozzles at hose discharge.
- C. Electrical Outlets: Provide properly configured NEMA polarized outlets to prevent insertion of 125 volt AC plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset

- button and pilot light, for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords, no less than 50 feet long; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.
 - E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
 - F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.
 - G. Temporary Offices: Contractor shall provide its own prefabricated or mobile units with lockable entrances, operable windows and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.
 - H. Temporary Toilet Units: Provide self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.
 - I. First Aid Supplies: Comply with regulations of authorities having jurisdiction.
 - J. Fire Extinguishers: Provide hand-carried, portable, UL-rated, class A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended types for the exposures.
 - 1. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use qualified personnel for installation of temporary

facilities. Locate facilities where they serve the project adequately and result in minimum interference with performance of construction activities. Relocate and modify facilities as required.

- B. contractor shall provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed, or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.
 - 1. Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary services.
 - 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.

- C. Temporary Electric Power Service:
The Electrical Contractor will have the responsibility of installing all temporary wiring, panels, and devices for this system in compliance with all applicable safety regulations, and the National Electric Code.
 - 1. Receptacles for power supply shall be provided within 100 feet of any point of the new building. Each Contractor or Trade in need thereof shall furnish any necessary extension cords to reach from the nearest outlet/s to his construction activity.
 - 2. Adequate temporary lighting shall be continuously provided in all work areas for all contractors on the Project when conditions of enclosure merit this illumination.
 - 3. The Electrical Contractor shall also provide, as needed: Area floor lights, guard lights at barricades, lighted drives and walks at all locations of hazard to the public and the construction personnel.
 - 4. The Electrical Contractor shall be ultimately responsible for removal of all other temporary electric power system wiring and equipment related thereto at such time when turnover to permanent system is available.

3.3 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities in locations as directed by Owner and Engineer.
 - 1. Maintain temporary construction and support facilities until near Substantial Completion. Remove prior to Substantial Completion.
- B. Provide noncombustible construction for offices, shops and sheds located within the construction area, or within 30 feet of building lines. Comply with requirements of NFPA 241.
- C. Temporary Heat: Provide temporary heat during heating down time and for construction activities, for curing or drying of completed installations, or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
- D. Heating Facilities: Except where use of the permanent system is authorized, provide properly vented self-contained LP gas or fuel oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, or open burning or salamander type heating units is prohibited.
- E. Field Offices:

The Contractor shall provide an insulated, weathertight temporary office of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings.

 - 1. The Contractor for General Construction shall provide, either as a part of its field office, or as a separate facility, a conference area for project meetings. Furnish the room with a conference table, 8 folding chairs and a tackboard.
- F. Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.

1. The Contractor shall provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.
- G. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.
- H. Drinking Water Facilities: The Contractor for General Construction shall provide containerized tap-dispenser bottled-water type drinking water units, including paper supply.
- I. Temporary Enclosures: Provide temporary enclosure for protection of construction in progress and completed, from exposure, foul weather, other construction operations and similar activities.
1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
 2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials.
 3. Close openings through floor or roof decks and horizontal surfaces with load-bearing wood-framed construction.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. General: Do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer as requested by the Engineer.
- B. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."
1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.

2. Store combustible materials in containers in fire-safe locations.
 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
 4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.
- C. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public, of the hazard being protected against. Where appropriate and needed provide lighting, including flashing red or amber lights.
- D. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security.
1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

END OF SECTION 01501

SECTION 01600 - MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements governing each Prime Contractor's selection of products for use in the Project.
- B. Standards: Refer to Section "Definitions and Standards" for applicability of industry standards to products specified.
- C. Administrative procedures for handling requests for substitutions made after award of the Contract are included under Section "Product Substitutions."

1.3 DEFINITIONS

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms such are self-explanatory and have well recognized meanings in the construction industry.
 - 1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - a. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
 - 2. "Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
 - 3. "Equipment" is a product with operational parts, whether

motorized or manually operated, that requires service connections such as wiring or piping.

1.4 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.
- B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
 - 1. Each prime Contractor is responsible for providing products and construction methods that are compatible with products and construction methods of other prime or separate Contractors.
 - 2. If a dispute arises between prime Contractors over concurrently selectable, but incompatible products, the Engineer will determine which products shall be retained and which are incompatible and must be replaced.
- C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.
 - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.

1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
3. Deliver products to the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
4. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.
5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
6. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
 1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
- B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:
 1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.
 2. Semiproprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.
 - a. Where products or manufacturers are specified by name, accompanied by the term "or equal," or "or approved equal" comply with the Contract Document

provisions concerning "substitutions" to obtain approval for use of an unnamed product.

3. Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
4. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
5. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.
 - a. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
6. Compliance with Standards, Codes and Regulations: Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.
7. Visual Matching: Where Specifications require matching an established Sample, the Engineer's decision will be final on whether a proposed product matches satisfactorily.
 - a. Where no product available within the specified category matches satisfactorily and also complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category, or for noncompliance with specified requirements.
8. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Engineer will select the color, pattern and texture from the product line selected.

9. Allowances: Refer to individual Specification Sections and "Allowance" provisions in Division-1 for allowances that control product selection, and for procedures required for processing such selections.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS:

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
 1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01600

SECTION 01631 - PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.
 - 1. Single Prime Contracts: Provisions of this Section apply to the construction activities of prime Contractor.
- B. Standards: Refer to Section "Definitions and Standards" for applicability of industry standards to products specified.
- C. Procedural requirements governing the Contractor's selection of products and product options are included under Section "Materials and Equipment."

1.3 DEFINITIONS

- A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.
- B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions." The following are not considered substitutions:
 - 1. Substitutions requested by Bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
 - 2. Revisions to Contract Documents requested by the Owner or Engineer.
 - 3. Specified options of products and construction methods included in Contract Documents.
 - 4. The Contractor's determination of and compliance with

governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

- A. Substitution Request Submittal: Requests for substitution will be considered if received the first application for payment. Requests received after this time may be considered or rejected at the discretion of the Engineer.
1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.
 2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
 - a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
 - b. Samples, where applicable or requested.
 - c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
 - d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, that will become necessary to accommodate the proposed substitution.
 - e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
 - f. Cost information, including a proposal of the net change, if any in the Contract Sum.
 - g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time, that may subsequently become necessary because of the failure of the substitution to perform adequately.
 3. Engineer's Action: Within one week of receipt of the

request for substitution, the Engineer will request additional information or documentation necessary for evaluation of the request. Within 2 weeks of receipt of the request, or one week of receipt of the additional information or documentation, whichever is later, the Engineer will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance will be in the form of a Change Order.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Conditions: The Contractor's substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements.
1. Extensive revisions to Contract Documents are not required.
 2. Proposed changes are in keeping with the general intent of Contract Documents.
 3. The request is timely, fully documented and properly submitted.
 4. The request is directly related to an "or equal" clause or similar language in the Contract Documents.
 5. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
 6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 7. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.
 8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
 9. The specified product or method of construction cannot

be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.

10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.
 11. Where a proposed substitution involves more than one prime Contractor, each Contractor shall cooperate with the other Contractors involved to coordinate the Work, provide uniformity and consistency, and to assure compatibility of products.
- B. The Contractor's submittal and Engineer's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01631

SECTION 01700 - PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
 - 1. Inspection procedures.
 - 2. Submittal of warranties.
 - 3. Final cleaning.
- B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions-2 through -16.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
 - 1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
 - 2. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
- B. Inspection Procedures: On receipt of a request for inspection, the Engineer will either proceed with inspection

or advise the Contractor of unfilled requirements. The Engineer will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Engineer will repeat inspection when assured that the Work has been substantially completed.
2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
3. Submit a certified copy of the Engineer's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Engineer.

B. Reinspection Procedure: The Engineer will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Engineer.

1. Upon completion of reinspection, the Engineer will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
2. If necessary, reinspection will be repeated.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do

not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION 01700

SECTION 01720 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for Project Record Documents.
- B. Project Record Documents required include:
 - 1. Marked-up copies of Contract Drawings.
 - 2. Marked-up copies of Shop Drawings.
 - 3. Maintenance Manuals.
 - 4. Scan PDF set of As-Built Record Drawings
- C. Specific record copy requirements that expand requirements of this Section are included in the individual Sections.
- D. General project closeout requirements are included in Section "Project Closeout."
- E. General requirements for submittal of Project Record Documents are included in Section "Submittals."
- F. Contractor is responsible for obtaining, maintaining, and recording Project Record Document information for its own part of the Work. The Contractor for General Construction is responsible for coordination of Project Record Document information, where information from more than one prime Contractor is indicated to be integrated to form one combined record of the Work.

1.3 RECORD DOCUMENTS

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

1.4 RECORD DRAWINGS

- A. Mark-up Procedure: During the construction period, maintain a set of blue- or black-line white-prints of Contract Drawings and Shop Drawings for Project Record Document purposes.
1. Mark these Drawings to indicate the actual installation where the installation varies appreciably from the installation shown originally. Give particular attention to information on concealed elements which would be difficult to identify or measure and record later. Items required to be marked include but are not limited to:
 - a. Dimensional changes to the Drawings.
 - b. Revisions to details shown on the Drawings.
 - c. Depths of foundations below the first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order.
 - k. Details not on original Contract Drawings.
 2. Mark completely and accurately record prints of Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions. Where Shop Drawings are marked, show cross-reference on Contract Drawings location.
 3. Mark record sets with red erasable colored pencil; use other colors to distinguish between changes for different categories of the Work at the same location.
 4. Mark important additional information which was either shown schematically or omitted from original Drawings.
 5. Note construction change directive numbers, alternate numbers, Change Order numbers and similar identification.
 6. Submit the marked-up record set to the Engineer for Owner's records.
 7. Submit CD containing electronic PDF as-built record prints at original full scale size.

1.5 MAINTENANCE MANUAL SUBMITTAL

- A. When each construction activity that requires submittal of maintenance manuals is nominally complete, but before Substantial Completion, submit 3 copies of maintenance manuals specified.

1. Organize operating and maintenance manuals into suitable sets of manageable size.
2. Bind data into individual binders for each manual, properly identified on front and spine. For large manuals, provide an index sheet and thumb tabs for separate information categories.
3. Provide vinyl-covered, heavy-duty back cover mounted 3-ring slant type binders, 1" to 2" thick as required to contain information, sized for 8-1/2" x 11" paper with inside pockets or pocket folders for folded sheets.
4. In each maintenance manual include information specified in individual Specification Sections and the following:
 - a. Emergency instructions.
 - b. Spare parts list.
 - c. Copies of specific warranties.
 - d. Wiring diagrams.
 - e. Recommended maintenance procedures and turn-around times.
 - f. Inspection and system-test procedures.
 - g. Copies of applicable Shop Drawings and Product Data.
 - h. Listing of required maintenance materials and services.
 - i. Names and addresses of sources of maintenance materials.
 - j. Maintenance Drawings and diagrams.
 - k. Precautions against improper maintenance and exposure.
5. Manuals for mechanical and electrical equipment items shall include the following additional information:
 - a. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 - b. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operation instructions.
 - c. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - d. Servicing instructions and lubrication charts and schedules.

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION

3.1 RECORDING

- A. Post changes and modifications to the Documents as they occur. Do not wait until the end of the Project. The Engineer may periodically review record documents to assure compliance with this requirement.

END OF SECTION 01720

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.2 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI A10.6 and NFPA 241.

1.3 PROJECT 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. Hazardous Materials: It is unknown whether hazardous materials will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.
- D. Storage or sale of removed items or materials on-site is not permitted.

1.4 WARRANTY

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- B. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Owner.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems and protect them against damage during selective demolition operations.

3.3 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing items 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. Dispose of demolished items and materials promptly.
- B. Existing Items to Remain: Protect existing finishes indicated to remain against damage and soiling during selective demolition.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.5 CLEANING

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

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture.

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. ACI Publications: Comply with the following unless otherwise indicated.
 - 1. ACI 301, "Specification for Structural 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. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I, Gray.
 - a. Fly Ash: ASTM C 618, Class C or F.

- B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size: 1 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

- A. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

2.6 RELATED MATERIALS

- A. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.7 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Use pozzolan as needed to reduce the total amount of portland cement. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

2.8 CONCRETE MIXTURES

- A. Interior Slabs on Grade, and all other interior concrete unless otherwise identified: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 3500 psi at 28 days.
 - 2. Minimum Cementitious Materials Content: 520 lb/cu. yd. maximum aggregate size 1", 540 lb/cu. yd..
 - 3. Maximum Water-Cementitious Materials Ratio: 0.45.
 - 4. Slump Limit: 4 inches, plus or minus 1 inch.
 - 5. Air Content: 3 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

6. Interior Slab on Grade Slump: 6 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture, plus or minus 1 inch.

2.9 FABRICATING REINFORCEMENT

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

2.10 CONCRETE MIXING

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

PART 3 - EXECUTION

3.1 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

3.2 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement.
- C. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 - 5.

3.3 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighen until surface is free of trowel marks and uniform in texture and appearance.

3.4 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1.

END OF SECTION 033000

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

- A. Masonry work shall comply with requirements ACI 530.1/ASCE6/TMS 602.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
- B. Mix Designs: For each type of mortar.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

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. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONCRETE MASONRY UNITS (CMUs)

- A. Shapes: Provide shapes indicated and as follows:
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide bullnose units for outside corners, unless otherwise indicated.
- B. Concrete Masonry Units: ASTM C 90, Type I or II.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa).
 - 2. Weight Classification: Lightweight or Normal weight, unless otherwise indicated.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.3 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
- D. Masonry Cement: ASTM C 91.

1. Products:

- a. Capital Materials Corporation; Flamingo Color Masonry Cement.
- b. Essroc, Italcementi Group; Brixment.
- c. Holcim (US) Inc.; Rainbow Mortamix Custom Masonry Cement.
- d. Lafarge North America Inc.; Lafarge Masonry Cement.
- e. Lehigh Cement Company; Lehigh Masonry Cement.
- f. National Cement Company, Inc.; Coosa Masonry Cement.

- E. Mortar Cement: ASTM C 1329.

1. Products:

- a. Lafarge North America Inc.; Lafarge Mortar Cement.
- b. Spec Mix Mortar; Spec Mix
- c. Cemex PCL

- F. Aggregate for Mortar: ASTM C 144.

- 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
- 2. For joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.

- G. Water: Potable.

2.4 TIES AND ANCHORS

- A. Materials: Provide ties and anchors as specified below, unless otherwise indicated.

- 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
- 2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
- 3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.5 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers:

- a. Diedrich Technologies, Inc.
- b. EaCo Chem, Inc.
- c. ProSoCo, Inc.

2.6 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification and Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.
 - 1. For interior non-load-bearing partitions, Type O or Type N with minimum compressive strength of 750 psi in 28 days.
- C. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.
 - 3. Grout shall achieve 3,000 psi minimum compressive strength in 28 days.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.2 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Lay exposed masonry in running bond.
- C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar.

3.3 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry units as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.

2. With entire units, including areas under cells, fully bedded in mortar at starting course.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

3.4 MASONRY WASTE DISPOSAL

- A. Excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION 042000

SECTION 09900 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.
 - 1. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections.
- B. Paint exposed surfaces whether or not colors are designated in "schedules," except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Engineer will select from standard colors or finishes available.
- C. Painting of exposed bare and covered pipes and conduits (including color coding) installed by the Mechanical Contractor is by the Mechanical Contractor.
- D. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels.
- E. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
 - 2. Division 8 Section "Steel Doors and Frames" for shop priming steel doors and frames.
 - 3. Divisions 15 and 16: Painting mechanical and electrical work is specified in Divisions 15 and 16, respectively.

1.3 DEFINITIONS

- A. "Paint" includes coating systems materials, primers,

emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's technical information, label analysis, and application instructions for each material proposed for use.
 - 1. List each material and cross-reference the specific coating and finish system and application. Identify each material by the manufacturer's catalog number and general classification.
- B. Samples for initial color selection in the form of manufacturer's color charts.
 - 1. After color selection, the Engineer will furnish color chips for surfaces to be coated.

1.5 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.
- B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify the Engineer of problems anticipated using the materials specified.
- C. Material Quality: Provide the manufacturer's best quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary names used to designate colors or materials are not intended to imply that products named are required or to exclude equal products of other manufacturers.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 - 1. Product name or title of material.

2. Product description (generic classification or binder type).
 3. Federal Specification number, if applicable.
 4. Manufacturer's stock number and date of manufacture.
 5. Contents by volume, for pigment and vehicle constituents.
 6. Thinning instructions.
 7. Application instructions.
 8. Color name and number.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 JOB CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F (10 deg C) and 90 deg F (32 deg C).
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 deg F (7 deg C) and 95 deg F (35 deg C).
- C. Do not apply paint in snow, rain, fog, or mist, when the relative humidity exceeds 85 percent, at temperatures less than 5 deg F (3 deg C) above the dew point, or to damp or wet surfaces.
 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 1. PPG Industries, Pittsburgh Paints (Pittsburgh).
 2. Pratt and Lambert (P & L).
 3. The Sherwin-Williams Company (S-W).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin paint application until unsatisfactory conditions have been corrected.
 - 1. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

3.2 PREPARATION

- A. General Procedures: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.
 - 1. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to cleaning. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- B. Surface Preparation: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions for each particular substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers or remove and reprime. Notify Engineer in writing of problems anticipated with using the specified finish-coat material with substrates primed by others.
 - 2. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - 3. Ferrous Metals: Clean nongalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures

Painting Council.

- a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.
- C. Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturer's directions.
1. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
 3. Use only thinners approved by the paint manufacturer, and only within recommended limits.
- C. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 1. Paint colors, surface treatments, and finishes are indicated in "schedules."
 2. Provide finish coats that are compatible with primers used.
 3. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.
 4. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat

- surfaces.
5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.
 6. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.
 7. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.
 8. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
- C. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
- D. Minimum Coating Thickness: Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer.
- E. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- F. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.
- G. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surface imperfections.
- H. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections

will not be acceptable.

- I. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.
 - 1. Provide egg shell finish for final coats.
- J. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

3.4 CLEANING

- A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
- B. Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

- A. Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Engineer.
- B. Provide "wet paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.
 - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.7 PAINT SCHEDULE:

A. METAL DOORS AND FRAMES:

Primer: B66W01310 - PI PROCRYL PR OF W
- Location: Metal Doors and Frames
Coat 1: B53W02151 - PI WB ALK UR SG EW
- Location: Metal Doors and Frames
Coat 2: B53W02151 - PI WB ALK UR SG EW
- Location: Metal Doors and Frames

B. Steel/Ferrous Metal

Primer: B66W01310 - PI PROCRYL PR OF W

- Location: Steel Piping

Finish: B66W01151 - Pro Industrial DTM Acrylic Semi-Gloss Extra White

C. Galvanized Metal

Primer: B66W01310 - PI PROCRYL PR OF W

- Location: Galvanized Piping

Finish: B66W01151 - Pro Industrial DTM Acrylic Semi-Gloss Extra White

D. Piping Insulation

Primer: B51W00620 - PrepRite® ProBlock® Interior/Exterior Latex Primer/Sealer White

- Location: Piping Insulation

Finish: B66W01151 - Pro Industrial DTM Acrylic Semi-Gloss Extra White

END OF SECTION 09900

SECTION 200500 – COMMON WORK REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Refer to Alternates Section for Alternates that may affect the Work of this Section.
- B. The requirements of this Section shall apply to all Work for all Sections listed under Divisions 22, 23, and 26.
- C. The Drawings show where pipes, ducts, raceways, equipment, fixtures, and accessories must be installed in order to harmonize with the building and installations of the various trades. Drawings shall be carefully checked during the course of bidding and construction. Drawing dimensions shall be used to determine exact locations and as a check with other contractors to avoid interferences with their work. Where component locations are not dimensioned, take necessary field measurements before installing work to insure fit and required clearances. The Engineer reserves the right to make minor location changes for any work at no additional cost if sufficiently in advance to avoid extra work or delay progress on the Project.
- D. Refer to applicable drawings describing portions of the Work where other trades are involved on the Project so that added field work and delays resulting from conflicts are avoided. Components that are prefabricated before coordinating with the other trades will have to be refabricated at no additional cost if conflicts are encountered.

1.2 GENERAL REQUIREMENTS

- A. The Contractor shall provide the labor, materials, equipment, accessories, and perform the operations in connection with the construction and installation of the work.
- B. The Contractor must present to the Owner through the Engineer, properly signed certificates of final inspection by the governing authorities when they become due and shall not cover up Work until approved by those authorities.
- C. No outages, either full or partial, shall be permitted for any systems serving any portion of any existing building without prior written approval from the Owner. Such systems include but are not limited to gas, water, electric, drainage, telephone, and fire alarm. Unintentional cutting or interruption of water lines, electric conduit, or similar service lines in the course of Work performed under this Section shall be immediately repaired by the contractor at no additional cost.
- D. Materials or labor obviously required to fully complete the Work and make it operational, or to meet manufacturer's recommendations, shall be included even though each item necessarily involved may not be specifically mentioned or shown. Such Work and materials shall be furnished and shall be of the same grade or quality as the related parts specified and shown.
- E. Should there be a conflict between the plans and specifications, the greater quantity and better quality shall be provided.
- F. Installation of all electrical wiring and of all UL listed products shall comply with all applicable requirements of the National Electrical Code.
- G. Do not make field modifications to manufactured units.

1.3 QUALITY ASSURANCE

- A. Instruments used by the Contractor shall be accurately calibrated and maintained in good working condition.
- B. Materials used in this Contract shall be those specified herein unless proposals for the use of alternate materials have been submitted and accepted in writing. Materials shall be strictly first grade of their kind

and shall be new and in first-class condition when installed. Damaged materials will be rejected and shall be replaced by new materials.

- C. No materials or equipment may be installed which do not meet the approval of the authorities having jurisdiction.
- D. All products having connections to electrical wiring at any voltage shall be UL listed and labeled.
- E. Qualify welding processes and operators for structural steel according to AWS D1.1 "Structural Welding Code – Steel."
- F. Qualify welding and brazing processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."

1.4 PROJECT CONDITIONS

- A. Certain areas will be designated for the storage of materials and equipment. Cooperation with the Owner in minimizing interference with the Owner's operations is mandatory.
 - 1. Store materials inside and protected from weather.
 - 2. Follow manufacturer's instructions for receiving, inspecting, handling, storage, and protection of products prior to installation.
- B. Equipment Clearances and Requirements:
 - 1. For many items of equipment described in these Specifications, several manufacturers are listed. Unless otherwise indicated, the first named in each instance is the Basis of Design manufacturer on which the layout was based and on which clearances, services required for electrical, mechanical, and plumbing characteristics have been shown. Additional manufacturers listed are considered acceptable.
 - 2. Due to the possibility of restrictions imposed by space limitations, the responsibility for resolving conflicts resulting from the use of equipment other than Basis of Design shall rest with the Contractor furnishing the equipment. Submission of other named manufacturer's equipment for approval shall be considered as a certification that clearances for access, service, maintenance, and utilities connections have been checked by the Contractor and found adequate.
 - 3. Alternate equipment or the equipment of other acceptable manufacturers named in these documents shall meet all Specifications. If any equipment which the bidder proposes to furnish, deviates from the Basis of Design product regarding dimensions, weight, electric service, power wiring, control wiring, plumbing, piping, sound generation, vibration, or any other property, it shall be the responsibility of the contractor furnishing the item to pay all additional costs or charges resulting from use of the alternate equipment.
- C. Piping, ductwork, raceways, systems, and equipment shall be offset, lowered or raised, as required, or as directed at the site if necessary to accommodate field conditions, but only after receiving written authorization from the Engineer to do so.

1.5 SUBSTITUTES

- A. Where equipment, fixtures, or materials are specified by brand and model, substitutes will be approved only if every component of the proposed substitute meets or exceeds the quality of the components of the specified equipment, fixtures, or materials.
- B. Equipment pads, connections, capacities of inter-related equipment, etc. have been designed based on specific brands and models named. Where substitutes are approved the contractor shall bear the cost of any and all changes made necessary by the use of such substitute equipment.
- C. Equipment, fixtures, and materials named by brand and model are named in the interest of obtaining complete, integrated working systems. Substitutes will be considered as required to avoid limiting competition.

- D. The naming of products and materials incorporates the printed specifications and drawings of the manufacturer's products listed and these shall be considered a part of the specifications as though repeated therein.

1.6 DEFINITIONS

- A. General: Basic Contract definitions are included in the General Conditions and in Division 1. Where these sections do not define the following terms, the definition given below applies.
 - 1. Indicated: The term indicated refers to graphic representations, notes, or schedules on the Drawings, and to paragraphs or schedules in the Specifications, and to similar requirements anywhere in the Contract Documents. Terms such as shown, noted, scheduled, and specified are used to help the reader locate the reference.
 - 2. Directed: Terms such as directed, requested, authorized, selected, approved, required, and permitted mean directed by the Architect/Engineer, requested by the Architect/Engineer, and similar phrases.
 - 3. Approved: The term approved, when used in conjunction, with the Architect/Engineer's action on the Contractor's submittals, applications, and requests, is limited to the Architect/Engineer's duties and responsibilities as stated in the Conditions of the Contract.
 - 4. Regulation: The term regulation includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that are indicated to control performance of the Work.
 - 5. Furnish: The term furnish means supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and other similar operations.
 - 6. Install: The term install describes operations at the Project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
 - 7. Provide: The term provide means to furnish and install, complete and ready for the intended use.
 - 8. Installer: An Installer is the Contractor or any entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
 - a. The term experienced, when used with the term Installer means having completed work on a minimum of five previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.
 - b. Trades: Using terms such as carpentry is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as carpenter. It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.
 - 9. Project Site is the space available to the Contractor for performing construction activities, either exclusively or in conjunction, with others performing other work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
 - 10. Testing Agencies: A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

PART 2 - PRODUCTS

2.1 ELECTRIC MOTORS AND ACCESSORIES

- A. Motors, controllers, and disconnect switches furnished as part of any equipment shall be UL Listed and shall have the voltage and electrical characteristics of the service indicated or as required.
- B. All motors shall be premium efficiency type.
- C. General Motor Requirements:
 - 1. Comply with NEMA MG 1 unless otherwise indicated.
 - 2. Comply with IEEE 841 for severe-duty motors, where indicated.
- D. Motor Characteristics:
 - 1. Duty: Continuous duty at ambient temperature of 40 deg. C. and at altitude of 3300 feet above sea level.
 - 2. 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 at indicated service factor.
- E. Polyphase Motors:
 - 1. Description: NEMA MG 1, Design B, medium induction motor.
 - 2. Efficiency: Energy Efficient, as defined in NEMA MG 1.
 - 3. Service Factor: 1.15, unless otherwise indicated.
 - 4. Rotor: Random-wound, squirrel cage.
 - 5. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
 - 6. Temperature Rise: Match insulation rating.
 - 7. Insulation: Class F, unless otherwise indicated.
 - 8. Code Letter Designation:
 - a. Motors 15 HP and Larger: NEMA Starting Code F or Code G, unless otherwise indicated.
 - b. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic, unless otherwise indicated.
 - 9. Enclosure Material: Cast iron for motor frame sizes 324T and larger: rolled steel for motor frame sizes smaller than 324 T.
 - 10. 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.
- F. Polyphase Motors With Additional Requirements:
 - 1. Motors used with Variable Frequency Controllers:
 - a. 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.
 - b. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - c. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - d. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
 - e. Ratings, characteristics, and features shall be coordinated with and approved by controller manufacturer.
 - f. Motors driven by a variable speed controller shall have a maintenance free, circumferential, conductive microfiber shaft grounding ring (AEGIS-SGR) to discharge shaft currents to ground.
- G. Single-Phase Motors:
 - 1. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - a. Permanent-split capacitor.

- b. Split phase.
 - c. Capacitor start, inductor run.
 - d. Capacitor start, capacitor run.
2. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
 3. Motors 1/20 HP and Smaller: Shaded-pole type.
 4. 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.

2.2 PENETRATION SLEEVES

- A. Sheet metal sleeves shall be fabricated from galvanized sheet metal and shall be of no less than 16 gauge metal for 4 inch diameter and smaller, 14 gauge metal for 5 inch diameter and larger.
- B. Steel pipe sleeves shall be fabricated from Schedule 40 galvanized steel pipe.

PART 3 - EXECUTION

3.1 SUPERVISION AND COORDINATION

- A. The Work of each Prime Contractor shall include the services of an experienced superintendent, who shall be constantly in charge of their work, together with the qualified journeymen, and laborers required to properly unload, install, connect, adjust, start, operate, and test the Work.
- B. Each Prime Contractor shall coordinate all work with all other prime contractors and with the Owner.
- C. Exact locations of ceiling mounted devices and fixtures shall be as shown on reflected ceiling plans.
- D. Do not install anything except electrical raceways in NEC required clear space above any electrical panelboards, switchgear, or transformers.
- E. No materials shall be installed in locations indicated to be occupied by other materials, equipment, fixtures or systems.
- F. Where work cannot be installed as the structure is being erected, the Prime Contractor responsible for such work shall provide and arrange for the building-in of boxes, sleeves, inserts, fixtures, and devices necessary to permit installation of the omitted work during later phases of construction. The Contractor shall arrange for layout, chases, holes, and other openings which must be provided in masonry, concrete, and other work.
- G. Each Prime Contractor shall be responsible for becoming informed of the nature and arrangement of the materials and construction to which his work attaches or passes through.

3.2 INSTALLATION

- A. Motors, Starters, Controls, and Wiring
 1. Alignment of motors, that are factory coupled and mounted or field coupled and mounted, shall be checked after installation is complete and again after 48 hours of operation in design service.
 2. Controllers, disconnects, controls, and wiring shall be coordinated with the appropriate equipment manufacturers.
- B. Cutting and Patching
 1. Cutting and drilling of walls, slabs, and decks, shall be neatly done, removing no unnecessary material. Holes and openings, shall be located where they will not weaken the structure. No structural member shall be cut.

2. Cutting of round holes in masonry and concrete shall be performed with a core drill to minimize spalling, and limit damage to the structure. Locations shall be accurately determined and checked, and the appropriate drill bit shall be used to minimize hole size. Reinforcing steel bars shall be located prior to drilling and shall not be cut.
 3. Size openings for penetrations such that installation shall permit free movement of the penetrating item.
 4. Where any existing items are removed, patch all resulting openings and all resulting exposed surfaces in floors, walls or ceilings. Patching shall be done by an experienced mechanic of the appropriate trade.
 5. All roof patching shall be accomplished by a roofing system manufacturer approved roofing contractor. The Contractor shall be responsible for contacting the original roofing system manufacturer for instructions and for insuring that no existing roof guarantees are voided by the methods of performing the work.
- C. Penetration Sleeves: Install penetration sleeves where raceways or piping pass through walls, floors, ceilings, or roofs.
1. Install sleeves accurately centered on pipe or conduit runs.
 2. At non-fire rated assemblies, size sleeves 1/2" larger than penetrating item so that piping, conduit, and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion.
 3. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface.
 4. Caulk the open space around the penetrating item in nonfire rated sleeves with flexible sealant.
 5. Flash and seal all penetrations of roofs and exterior walls.
- D. Protection
1. Provide protection to the building during the execution of all Work.
 2. This protection shall include covering apparatus, building surfaces, and other materials to protect them from dirt; adequate temporary connections to protect apparatus from damage and required shielding to protect finished parts of the building. The following shall apply where applicable:
 - a. Protect finished floors from chips and cutting oil by the use of metal chip receiving pans and oilproof floor covers.
 - b. Protect equipment and finished surfaces from welding and cutting spatters with baffles and spatter blankets.
 - c. Protect equipment and finished surfaces from paint droppings, insulation adhesive, sizing droppings, etc., by use of drop cloths.
 3. Pumps, motors, fans, and other stored equipment shall be adequately protected with openings, bearings, etc., covered to exclude dust and moisture. Stockpiled pipe, conduit, valves, fittings, ductwork, etc., shall be placed on dunnage and protected from weather and from entry of foreign material.
 4. During installation and until final connections are made, piping, raceways, and ductwork shall be protected against entry of foreign matter by keeping all open ends capped, plugged, or covered. Equipment connections shall be kept sealed until the time of system tie-in.
- E. Accessibility
1. All plumbing, mechanical, and electrical connections to equipment shall be installed in a manner to facilitate inspection, maintenance, and repair of the equipment and its components. Provide a union or flange in the piping at each screwed or welded valve, device, or item of equipment, and elsewhere as required for accessibility or repair. Each union shall be so installed as to permit the removal of the item without disconnection of any piping except at the union.
 2. Install suspended equipment to provide the maximum possible headroom, where mounting heights are not indicated.
 3. Install equipment level and plumb, parallel and perpendicular to other building systems and components, except where otherwise indicated.

4. Install equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

F. Concrete Bases

1. Unless otherwise indicated provide 4 inch minimum height concrete bases for all floor mounted equipment. Where concrete base construction is not detailed or specified elsewhere, provide the following construction.
 - a. Construct concrete equipment bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use minimum 4000 psi, 28-day compressive strength concrete and reinforcement. Reinforcement shall be No. 5 bars spaced not farther apart than 1-6" on center each way, centered in concrete thickness. Bases cast on concrete floors shall be dowelled to floor with No. 5 bars, using a minimum of 1 dowel within 6 inches to 9 inches of each corner of each base.

G. Erection of Metal Supports and Anchorage

1. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor materials and equipment.
2. Field Welding: Comply with AWS D1.1 "Structural Welding Code – Steel."

H. Suspended Construction

1. Locate roof penetrations to avoid joists, beams, and trusses.
2. Provide 3 x 3 x 1/4 inch minimum steel angle or equal strength members between joists, beams, and trusses where hanger rods occur between members. Provide beam clamps or other approved means of attachment for attaching hanger rods and supplemental steel cross supports to joists, beams, and trusses. Supports and attachments shall be sized to limit deflection to L/240 for loads they are intended to support. Welding of attachments to joists or trusses shall not be permitted.
3. No direct connection to metal deck is permitted.
4. Where suspended supports are necessary to be placed at locations other than indicated above, the contractor shall provide supplemental steel spanning between bearing wall, beams, and/or girders. Supplemental steel shall be sized to limit deflection to less than L/240 of the member's length when full load is applied.

I. Selective Demolition

1. Disconnect, demolish, and remove existing construction as indicated.
2. Where pipe, ductwork, insulation, raceways, or other components to remain are damaged or disturbed, remove damaged portions and install new products of equal capacity and quality. The contractor who created the damage shall bear the full cost of repair.
3. Remove indicated exposed pipe, ductwork, wiring, and accessories in their entirety.
4. Abandoned Work: Cut and remove buried or concealed pipe or raceways indicated to be abandoned in place, beneath the face of adjacent construction to remain. Cap pipe or raceways openings and patch surfaces to match existing finish.
5. Unless otherwise indicated, removed items shall be the contractor's property and shall be locally disposed of off site.
6. Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation or reinstallation.
7. Where fixtures, devices, or equipment are removed, remove all connected piping and raceways to 1 inch beyond the exposed surface of the floor below, the floor/ceiling structure above or the first wall to remain.
8. Where items having wiring connections are removed, remove all conductors that no longer serve any remaining loads.

9. Prior to project completion, trace all existing circuits that remain and provide new panelboard directories in all existing panelboards that have been modified as part of the work.
10. Where piping or raceways are removed, cap or plug the particular type of pipe or raceway existing at each application.
11. Drain and refill liquid distribution piping systems as necessary to perform required removals. Provide water treatment for mechanical systems when refilling. Coordinate with Engineer.
12. Where gas piping systems are shut off as part of the work, purge piping prior to starting any equipment.
13. Restart all existing equipment after utility service interruptions have been restarted.
14. Do not damage walls, ceilings or structure to remain in areas to receive selective demolition.
15. Patch all openings in walls, floors, ceilings and roofs created by removals.
16. All items shown on Demolition Plans are existing and shall remain in place unless otherwise indicated. Protect all items to remain from damage.
17. Openings created by selective demolition shall be framed. Openings in wood framed construction shall be framed with lumber sized to match existing lumber framing members. Openings in steel framed construction shall be framed with 3 x 3 x 1/4 inch angle unless otherwise indicated. Frame materials shall be connected to existing framing in accordance with structural specifications and applicable industry standards. Openings in masonry walls shall have lintels installed.
18. All roofing work, including roof patching, shall be accomplished by a contractor approved by the roofing manufacturer.
19. Unless otherwise indicated, where roof mounted equipment is to be removed, remove equipment supports including curbs, rails, frames and any other support items. Also, remove all service piping. Patch deck and roofing.
20. Where electrical devices are removed and device box remains, provide stainless steel device plate on existing device box.

3.3 TESTING AND REPAIR

- A. Upon completion of each respective system specified to be tested or inspected, but prior to covering or backfilling, each system shall be thoroughly internally and externally cleaned to remove construction dirt and foreign matter. Then inspection and testing shall proceed.
- B. Damage resulting from tests shall be repaired or damaged materials replaced at no cost to Owner.

3.4 EMERGENCY REPAIRS OR OPERATION

- A. The Owner reserves the right to make emergency repairs while equipment and systems are in operation without voiding the Contractor's guarantee or bond and without relieving the Contractor of his responsibility during the bonding period.

3.5 FINAL COMPLETION

- A. Work shall be cleaned prior to Substantial Completion of the Work.
- B. Retouch or repaint factory painted prime and finish coats where scratched or damaged.
- C. Deliver all specified spare parts to Owner and obtain signed receipts of delivery.
- D. The Contractor shall clean equipment; restore damaged materials, remove grease, oil, chemical, paint spots, and stains, and leave the Work in condition acceptable to owner.
- E. The Contractor shall remove from the site tools, equipment, surplus materials, and rubbish pertaining to his operations.

END OF SECTION 200500

SECTION 200519 - METERS AND GAGES

PART 1 - GENERAL

1.1 SUBMITTALS

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

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. Miljoco Corporation.
 - b. Palmer Wahl Instrumentation Group.
 - c. Terrice, H. O. Co.
 - d. Weiss Instruments, Inc.
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.
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.
 - a. Design for Air-Duct Installation: With ventilated shroud.
 - b. 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:

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 or CSA.
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.

2.3 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. Miljoco Corporation.
 - b. Palmer Wahl Instrumentation Group.
 - c. Terrice, H. O. Co.
 - d. Weiss Instruments, Inc.
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.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

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

2.5 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Flow Design, Inc.
 2. Miljoco Corporation.
 3. Terrice, H. O. Co.
 4. 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, 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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending to center of pipe 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 direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- G. Install valve and snubber in piping for each pressure gage for fluids (except steam).
- H. Install test plugs in piping tees.
- I. Install thermometers in the following locations:
 - 1. Inlet and outlet of each hydronic boiler.
 - 2. Inlet and outlet of each hydronic coil in air-handling units.

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 SCALE-RANGE SCHEDULE

- A. Scale Range for Heating, Hot-Water Piping: 30 to 240 deg F.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Heating, Hot-Water Piping: 0 to 200 psi.

END OF SECTION 200519

SECTION 200523 - GENERAL-DUTY VALVES FOR PIPING

PART 1 - GENERAL

1.1 The requirements of this Section shall apply to all Work for all Sections listed under Divisions 22 and 23.
1.2 SUBMITTALS

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

1.3 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 B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.
D. Valves shall be lead-free.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

B. Valve Sizes: Same as upstream piping unless otherwise indicated.

C. Valve Actuator Types:

1. Handlever: For quarter-turn valves NPS 6 and smaller.

D. 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.

E. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

2.2 BALL VALVES

A. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. 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: Full.

2.3 BUTTERFLY VALVES

A. Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Victaulic Company

2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Lug or grooved type.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM or NBR.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Aluminum bronze, nickel-plated ductile iron or coated ductile iron.

2.4 LIFT CHECK VALVES

A. Lift Check 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.

2. Description:

- a. Class: 125
- b. Standard: MSS SP-80, Type 1.
- c. CWP Rating: 200 psig.
- d. Body Design: Vertical flow.
- e. Body Material: ASTM B 61 or ASTM B 62, bronze.
- f. Ends: Threaded.
- g. Disc: Bronze or NBR.

2.5 SWING CHECK VALVES

A. Bronze Swing Check Valves:

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

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Crane Co.; Crane Valve Group; Stockham Division.
- d. Hammond Valve.
- e. Milwaukee Valve Company.
- f. NIBCO INC.

2. Description:

- a. Class: 125
- b. Standard: MSS SP-80, Type 3.
- c. CWP Rating: 200 psig.
- d. Body Design: Horizontal flow.
- e. Body Material: ASTM B 62, bronze.
- f. Ends: Threaded.
- g. Disc: Bronze.

B. Iron Swing Check Valves:

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

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Crane Co.; Crane Valve Group; Stockham Division.
- d. Hammond Valve.
- e. Milwaukee Valve Company.
- f. NIBCO INC.

2. Description:

- a. Class: 125
- b. Standard: MSS SP-71, Type I.

- c. CWP Rating: 200 psig.
- d. Body Design: Clear or full waterway.
- e. Body Material: ASTM A 126, gray iron with bolted bonnet.
- f. Ends: Flanged or grooved.
- g. Trim: Bronze.
- h. Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

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

3.2 ADJUSTING

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

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball or butterfly valves.
 - 2. Throttling Service: Ball, or butterfly valves.
 - 3. Pump-Discharge: Lift Check Valves.
- B. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends or solder-joint valve-ends.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends.
 - 3. For Steel Piping, NPS 2 and Smaller: Threaded or grooved ends.
 - 4. For Steel Piping, NPS 2-1/2 and Larger: Flanged or grooved ends.

3.4 DOMESTIC WATER SYSTEMS: VALVE SCHEDULE

- 1. Ball Valves: Class 150, 600-psi CWP, with stem extension.
- 2. Bronze Swing Valves: Class 125, with rubber seat.
- 3. Check Valves: Class 125, swing type.

3.5 HEATING WATER SYSTEMS: VALVE SCHEDULE

1. Ball Valves: Class 150, 600-psi CWP, with stem extension and memory stop.
2. Butterfly Valves: Nickel-plated ductile iron, aluminum bronze, or coated ductile iron disc; EPDM or Buna N sleeve and stem seals.
3. Bronze Swing Valves: Class 125, with composition seat.
4. Check Valves: Swing check shall be Class 125 with bronze seat ring.

END OF SECTION 200523

SECTION 200529 - HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 The requirements of this Section shall apply to all Work for all Sections listed under Divisions 22 and 23.
1.2 **DEFINITIONS**

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

- A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel 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.
- B. Nonmetallic Coatings: Plastic coating, jacket, or liner where indicated.

2.2 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- D. Insert Length: Extend 2 inches beyond sheet metal shield.

2.3 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- B. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
 - 3. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
- D. Hanger-Rod Attachments: Unless otherwise indicated install the following types:
 - 1. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- E. Building Attachments: Unless otherwise indicated install the following types:
 - 1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
 - 2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 4. C-Clamps (MSS Type 23): For structural shapes.
- F. Shields: Unless otherwise indicated install the following types:
 - 1. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

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. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- C. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- F. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- G. 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.
- H. 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 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - 3. 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.
 - 4. Pipes NPS 8 and Larger: Include wood inserts.
 - 5. Insert Material: Length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds.

3.5 ADJUSTING

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

END OF SECTION 200529

SECTION 200553 - IDENTIFICATION FOR PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The requirements of this Section shall apply to all Work for all Sections listed under Divisions 22 and 23.

1.2 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

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

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 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.

B. Pipe Label Color:

1. Verify color coding with Owner before ordering.

END OF SECTION 200553

SECTION 200700 – PIPE INSULATION

PART 1 - GENERAL

1.1 The requirements of this Section shall apply to all Work for all Sections listed under Divisions 22 and 23.

1.2 SUBMITTALS

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

1.3 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. Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.4 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.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- C. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

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

- a. Aeroflex USA Inc.; Aerocel.
- b. Armacell LLC; AP Armaflex.
- c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

D. 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. 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.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

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. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. 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. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
 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. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 4. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
2. Service Temperature Range: 0 to 180 deg F.
3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
4. 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, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 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.

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

2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 11.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. 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. Width: 3 inches.
 - 2. Thickness: 6.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. 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. Width: 2 inches.
 - 2. Thickness: 6 mils.
 - 3. Adhesion: 64 ounces force/inch in width.
 - 4. Elongation: 500 percent.
 - 5. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Width: 2 inches.
 - 2. Thickness: 3.7 mils.
 - 3. Adhesion: 100 ounces force/inch in width.
 - 4. Elongation: 5 percent.
 - 5. Tensile Strength: 34 lbf/inch in width.

2.9 SECUREMENTS

A. 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.
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.
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. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - c. 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. Comply with the following requirements:
 - a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive-backed base with a peel-off protective cover.
5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel, aluminum or stainless-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. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

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

C. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

- B. 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.
- C. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- D. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- E. Keep insulation materials dry during application and finishing.
- F. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- G. Install insulation with least number of joints practical.
- H. 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.
 - 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.
- I. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- J. 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.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations that are not Fire Rated: Install insulation continuously through walls and partitions.

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. 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. For services not specified to receive a field-applied jacket except for flexible elastomeric, 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.
- B. 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.

3.5 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 4 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, 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, 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.

3.8 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

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.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1/2 inch thick.
 - b. Mineral-Fiber: 1/2 inch thick.

B. Chilled Water and Brine, above 40 Deg F:

1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber: 1 inch thick.
2. NPS 1-1/2 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber: 1-1/2 inches thick.

C. Heating-Hot-Water Supply and Return, 200 Deg F and below:

1. NPS 1-1/2 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber: 1 inch thick.
2. NPS 2 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber: 2 inches thick.

D. Domestic Cold Water::

1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1/2 inch thick.
 - b. Mineral-Fiber: 1/2 inch thick.

E. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/2 and Smaller: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1/2 inch thick.
 - b. Mineral-Fiber: 1/2 inch thick.
2. NPS 2 and Larger: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber: 1 inch thick.

END OF SECTION 200700

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
 - 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 - 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.2 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Install domestic water piping level without pitch and plumb.
- B. Install piping at right angles or parallel to building walls.
- C. Install piping adjacent to equipment and specialties to allow service and maintenance.
- D. Install piping to permit valve servicing.
- E. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty if final connection is threaded.

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 HANGER AND SUPPORT INSTALLATION

- A. 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.

3.4 CONNECTIONS

- A. Install piping adjacent to equipment and machines to allow service and maintenance.

3.5 FIELD QUALITY CONTROL

- A. Perform the following piping Inspections:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Perform the following piping Tests:
 - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

3.6 ADJUSTING

- A. Perform the following adjustments before operation:
 1. Close drain valves, hydrants, and hose bibbs.
 2. Open shutoff valves to fully open position.

3.7 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.8 PIPING SCHEDULE

- A. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- B. Fitting Option: Brazed joints may be used on aboveground copper tubing.
- C. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought- copper solder-joint fittings; and brazed or soldered joints.

END OF SECTION 221116

SECTION 221122 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping, Valves, and Regulators: 100 psig minimum unless otherwise indicated.

1.2 SUBMITTALS

A. Product Data: For each type of the following:

1. Pressure regulators. Indicate pressure ratings and capacities.

1.3 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.

1.4 PROJECT CONDITIONS

- ##### A. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide piping and startup of natural-gas supply according to requirements of NFPA 54.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. End Connections: Threaded or butt welding to match pipe.
 - b. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - c. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

2.2 PIPING SPECIALTIES

- A. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 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. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
 - 2. Body: Bronze, complying with ASTM B 584.
 - 3. Ball: Chrome-plated bronze.
 - 4. Stem: Bronze; blowout proof.
 - 5. Seats: Reinforced TFE.
 - 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 - 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 8. CWP Rating: 600 psig.
 - 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- D. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lee Brass Company.
 - b. McDonald, A. Y. Mfg. Co.
2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. 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.
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. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.5 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

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

- a. Actaris.
 - b. American Meter Company.
 - c. Eclipse Combustion, Inc.
 - d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
 - e. Invensys.
 - f. Maxitrol Company.
 - g. Richards Industries; Jordan Valve Div.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 3. Springs: Zinc-plated steel; interchangeable.
 4. Diaphragm Plate: Zinc-plated steel.
 5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 6. Orifice: Aluminum; interchangeable.
 7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 10. Overpressure Protection Device: Factory mounted on pressure regulator.
 11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54 requirements for prevention of accidental ignition.

3.2 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Install piping at right angles or parallel to building walls.
- C. Locate valves for easy access.
- D. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- E. Install piping free of sags and bends.
- F. Install fittings for changes in direction and branch connections.
- G. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. 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.
- H. Extend relief vent connections for line regulators to outdoors and terminate with weatherproof vent cap.
- I. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- J. Connect branch piping from top or side of horizontal piping.
- K. 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.

3.3 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance.

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.
 - 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 CONNECTIONS

- A. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- B. Install piping adjacent to appliances to allow service and maintenance of appliances.
- C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.7 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

B. Submit test and inspection reports.

3.8 INDOOR PIPING SCHEDULE

A. Aboveground, branch piping shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

3.9 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:

1. Two-piece, regular-port, bronze ball valves with bronze trim.
2. Bronze plug valve.

B. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be the following:

1. Two-piece, regular-port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, lubricated plug valve.

C. Valves in branch piping for single appliance shall be the following:

1. Two-piece, regular-port, bronze ball valves with bronze trim.
2. Bronze plug valve.

END OF SECTION 221122

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.

1.2 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.

1.3 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 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.
- B. Solvent Cement and Adhesive Primer:
 - 1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. 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. 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.

- B. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain and Horizontal Sanitary Drainage Piping: 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.
- C. Install PVC soil and waste drainage piping according to ASTM D 2665.
- D. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.2 JOINT CONSTRUCTION

- A. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.3 HANGER AND SUPPORT INSTALLATION

- A. 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.
- B. Install supports for vertical PVC piping every 48 inches.

3.4 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.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests and to ensure compliance with requirements.
- B. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Test sanitary drainage piping according to procedures of authorities having jurisdiction.

3.5 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 SUBMITTALS

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

1.2 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS

- A. Cast-Iron Floor Drains:

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

- a. Josam Company; Josam Div.
- b. MIFAB, Inc.
- c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- d. Tyler Pipe; Wade Div.
- e. Zurn Plumbing Products Group; Specification Drainage Operation.

- B. Floor Drain Type: FD1.

- 1. Description: Coated cast iron floor drain with deep seal integral trap, seepage pan, and adjustable polished 6" diameter stainless steel strainer.

2.2 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Deep-Seal Traps:

- 1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.

- 2. Size: Same as connected waste piping.

- a. NPS 2: 4-inch- minimum water seal.
- b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor.
- B. Install deep-seal traps on floor drains and other waste outlets, unless otherwise indicated.

3.2 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.

END OF SECTION 221319

SECTION 221429 - SUMP PUMPS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Wiring Diagrams: For power, signal, and control wiring.

1.2 QUALITY ASSURANCE

- A. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Comply with pump manufacturer's written rigging instructions for handling.

PART 2 - PRODUCTS

2.1 SUBMERSIBLE SUMP PUMPS

- A. Submersible, Fixed-Position, Single-Seal Sump Pumps:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Pentair Pump Group.
 - b. Weil Pump Company, Inc.
 - c. Zoeller Company.
 - 2. Description: Factory-assembled and -tested sump-pump unit with cast iron construction..
 - 3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
 - 4. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
 - 5. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron and ASTM B 584, cast bronze design for clear wastewater handling, and keyed and secured to shaft.
 - 6. Pump and Motor Shaft: Stainless steel, with factory-sealed, grease-lubricated ball bearings.
 - 7. Seal: Mechanical.
 - 8. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump. Motor Housing Fluid: Oil.
 - 9. Controls: Integral float operated mechanical switch, no external control required.

2.2 SUMP-PUMP BASINS AND BASIN COVERS

- A. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flange and sidewall openings for pipe connections. 24" diameter and 36" deep basin.

1. Material: Fiberglass, Polyethylene or ABS Plastic.
2. Reinforcement: Mounting plates for pumps, fittings, and accessories.
3. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.

- B. Basin Covers: Fabricate steel or cast iron cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.

2.3 MOTORS

- A. Motors for submersible pumps shall be hermetically sealed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Pump Installation Standards: Comply with HI 1.4 for installation of sump pumps.
- B. Extend sump vent piping along wall to existing vent piping from service sink in same room, and connect to existing vent piping.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. Perform each visual and mechanical inspection.
 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 motor rotation and unit operation.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.3 STARTUP SERVICE

- A. Perform startup service.
1. Complete installation and startup checks according to manufacturer's written instructions.
- B. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.
- C. Adjust control set points.

END OF SECTION 221429

SECTION 230130 - HVAC AIR-DISTRIBUTION SYSTEM CLEANING

PART 1 - GENERAL

1.1 REFERENCES

- A. Abbreviations and Acronyms: See ACR, The NADCA Standard.
- B. Reference Standards:
 - 1. Following current standards and publications of issues currently in effect form part of this specification to extent specified:
 - a. American National Standards Institute/Institute of Inspection Cleaning and Restoration Certification (ANSI/IICRC).
 - 1) ANSI/IICRC S520 - Standard for Professional Mold Remediation.
 - b. National Air Duct Cleaners Association (NADCA):
 - 1) ACR, The NADCA Standard - Assessment, Cleaning & Restoration of HVAC Systems (Current Version).
 - c. National Fire Protection Association (NFPA):
 - 1) NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - 2) NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
 - d. North American Insulation Manufacturers Association (NAIMA):
 - 1) Cleaning Fibrous Glass Insulated Air Duct Systems.
 - e. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
 - 1) HVAC Duct Construction Standards - Metal and Flexible.
 - f. Underwriters' Laboratories (UL):
 - 1) UL Standard 181 - UL Standard for Safety Factory-Made Air Ducts and Connectors.
 - 2) UL Standard 181A - UL Standard for Safety Closure Systems for Use with Rigid Air Ducts.
 - g. US Green Building Council (USGBC):

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. Coordinate the Work of this section with the work of other trades, and the work of different contractors.

B. Precleaning Meeting:

1. Conduct precleaning meeting with representatives of Owner, Contractor, and facility occupants affected by cleaning work.
2. Coordinate meeting date with Owner.

C. Sequencing:

1. Perform duct cleaning work after HVAC system construction and duct leakage testing are complete.

D. Scheduling:

1. Prepare and submit HVAC system cleaning activities schedule in according with Division 01 section describing project scheduling requirements.

1.3 SUBMITTALS

A. Action Submittals:

1. Product Data: Submit data for each product.
2. Duct cleaning plan: Before commencing cleaning work, submit written work plan including following information:
 - a. Scope of Work identifying HVAC components are to be cleaned, as well as those components not to be cleaned.
 - b. Itemize specific environmental engineering controls required for workspace, and special work requirements.
 - c. Detail cleaning work means and methods.
 - d. Name, contact information, and functional tasks performed by each representative of each firm and contractor involved with the work.
3. Qualification Statements: Show membership status, project experience, and certifications for:
 - a. HVAC Cleaning Contractor.
 - b. Supervisor.

B. Closeout Submittals:

1. Record Documentation: Submit documentation verifying compliance with this specification for work performed.

1.4 QUALIFICATIONS

A. HVAC System Cleaning Contractor: Current member of NADCA experienced in HVAC cleaning projects of similar size and complexity.

1. Supervisor: Employ NADCA-certified Air Systems Cleaning Specialist (ASCS), full time supervisor at project site.

2. Inspector: Employ NADCA-Certified ASCS, or NADCA-Certified Ventilation Inspector (CVI) to perform site inspections.

PART 2 - PRODUCTS

2.1 TREATMENT MATERIALS

- A. Antimicrobial Agents: Type recommended by [Owner's] Certified Industrial Hygienist (CIH), determined from biological contamination test results.

2.2 DUCT LINER MATERIALS

- A. Duct Liner: Fibrous glass insulation matching existing.
 1. Where replacing internal insulation, furnish materials conforming to UL, NFPA 90A, NFPA 90B and SMACNA standards.
 2. Match thickness and insulation thermal resistance of existing duct liner.

PART 3 - EXECUTION

3.1 HVAC DUCT CLEANING CONTRACTORS

- A. NADCA Member Contractors shall perform cleaning services.

3.2 EXAMINATION

- A. HVAC System Assessment and Site Survey:
 1. Before commencing work, assess HVAC system condition to determine appropriate engineering controls, safety measures, tools, equipment and cleaning products and methods required to complete the work.
 2. Perform HVAC system assessment by ASCS, Certified Ventilation Inspector (CVI), or equivalent.
- B. Work Plans:
 1. Project Schedule: Outline starting date, dates and times when work will take place, and completion date.
 - a. Determine sequence of cleaning each system or portion of the work and coordinate with work of other trades and activities.
 2. Product Data and Safety Data Sheets: Product data submittals listing general use and specific chemical cleaning products and coatings used while performing the work, along with Safety Data Sheets for chemical products used to perform the work.
 3. Safety Plan: Define responsibilities of each organization's designated representative involved with executing work plan throughout project.

3.3 PROTECTION OF IN-PLACE CONDITIONS

- A. Protect existing structures, surfaces, and systems from damage resulting from duct cleaning work.
- B. Report damage caused by this work to Owner.

3.4 HVAC SYSTEM PREPARATION

A. Service Openings:

1. Access duct cleaning work through existing or new service openings, allowing safe access and thorough cleaning throughout specified components.
2. Work through service openings sized to allow mechanical tool entry and visual inspection, as required for cleaning activities.
3. Where possible, work through existing service openings.
4. Where new service openings are required, install openings as follows:
 - a. Do not degrade structural, thermal, or functional system integrity, and comply with applicable SMACNA duct construction methods.
 - b. Install service openings complying with UL and NFPA standards, federal, state, and local code requirements, and requirements of Authorities Having Jurisdiction.
 - c. Where required, install duct access doors complying with UL Standard 181, and fabricated with materials classified for flammability and smoke developed.
 - d. Where required, install tapes complying with UL 181A.
 - e. Where required, install closure panels fabricated from equivalent material and same or heavier gage.
 - f. Mechanically fasten closure panels over service openings with screws or rivets at perimeter, maximum 4 inches spacing.
 - g. Fabricate closure panel to overlap duct opening perimeter, minimum 1 inch.
 - h. Insulate closure panels to match adjacent duct interior and exterior surfaces.
 - i. Seal rigid fibrous glass duct systems in accordance with NAIMA recommended practices.
 - 1) Install closure techniques: UL Standard 181 or UL Standard 181A.
 - j. Close service openings installed in metal ductwork with fibrous glass liner with no exposed fibrous glass edges exposed to airstream.
5. Install service openings that can be reopened for future inspection or remediation.
 - a. Mark outside of duct and report service opening locations to Owner in project closeout documents.
6. Do not cut service openings into flexible duct.
 - a. Disconnect flexible duct at both ends as required for inspection and cleaning.
 - b. Reconnect flexible duct ends in accordance with SMACNA standards.

3.5 CLEANING EQUIPMENT MAINTENANCE AND USE

- A. Maintain equipment employed in work performance in good working order, consistent with equipment manufacturer's written instructions and applicable jurisdictional requirements.
- B. Clean and inspect equipment before bringing to work site.
- C. Do not introduce contaminants from cleaning equipment into indoor environment or HVAC system.

- D. Service equipment to limit possible HVAC system contamination from insufficient service equipment cleaning, and unsafe operating conditions for service personnel and building occupants.
- E. Perform activities requiring opening contaminated vacuum collection equipment on-site, including servicing or filter maintenance, in appropriate containment area or outside building.
- F. Clean and seal collection devices, vacuums and other tools and devices before relocating to different building areas, moving equipment through occupied spaces, and before removing equipment from building.
- G. Locate fuel-powered equipment to prevent combustion emissions and air exhaust emissions from entering building envelope.
 - 1. Monitor and manage equipment operation and location to prevent introduction of combustion emissions into occupied space.
- H. Furnish HEPA-filtered equipment with minimum collection efficiency of 99.97 percent at 0.3 micron particle size, when vacuum collection equipment exhausts within building envelope.

3.6 CLEANING - GENERAL

- A. Perform HVAC system cleaning in accordance with ACR, The NADCA Standard.
- B. Remove visible non-adhered particulates.
 - 1. Clean HVAC components employing agitation device to dislodge contaminants from HVAC component surface, and then capturing contaminants with vacuum collection device.
 - a. Acceptable methods include those that do not damage integrity of ductwork and other system components, and does not damage porous surface materials including internal insulation and duct lining.
 - 2. Clean HVAC components using source removal mechanical cleaning methods designed to extract contaminants from within HVAC system and safely remove contaminants from facility.
 - 3. Select source removal methods rendering HVAC system visibly clean and capable of passing cleanliness verification methods as described in ACR, The NADCA Standard.
 - 4. Do not employ cleaning method, or combination of methods, that can damage HVAC system components or negatively alter system integrity.
 - 5. Do not damage HVAC system and components with wet cleaning, power washing, steam cleaning and other wet process cleaning.
- C. Apply cleaning materials in accordance with manufacturer's instructions.
 - 1. Do not apply cleaning agents or water to electrical, fibrous glass or other porous HVAC system components.
- D. Capture removed contamination and cleaning materials and legally dispose.
- E. Verify HVAC system surface and component cleanliness in accordance NADCA Standard.
- F. Particulate Collection:
 - 1. Employ contaminant removal methods incorporating vacuum collection devices operated continuously during cleaning.
 - a. Connect vacuum collection device to component being cleaned through service opening.
 - b. Employ vacuum collection device of sufficient capacity to maintain areas being cleaned under negative pressure, containing debris is contained and preventing contaminant migration to adjacent areas.

2. When possible, discharge ducted exhaust air from vacuum collection devices outdoors, keeping discharge air clear of outdoor air intakes, operable windows, and other locations allowing outdoor air entry.
 - a. Do not violate outdoor environmental standards, codes or regulations.
 - b. Do not discharge unfiltered air from vacuum collection devices outdoors.
3. When necessary to exhaust vacuum collection devices indoors, including hand-held and wet-vacuum machines, keep discharge air in work area, and provide machine air discharge HEPA filtration, rated at 99.97 percent collection efficiency for 0.3 micron particles and larger.

3.7 AIR HANDLING UNIT (AHU) CLEANING

- A. Clean supply fans and blowers.
 1. Clean blowers, fan housings, ducted plenums, scrolls, blades, or vanes, shafts, baffles, dampers and drive assemblies.
 2. Remove visible non-adhered particulate deposits in accordance with ACR, The NADCA Standard.
- B. Clean air handling unit (AHU) internal surfaces, components and condensate pans, and drains.
- C. Wet-clean heat transfer coils, fans, condensate pans, drains and similar non-porous surfaces in conjunction with mechanical methods as described in ACR, The NADCA Standard.
- D. Control water spray and extraction are sufficient to collect debris and prevent water damage to HVAC components and surrounding equipment.
- E. Capture, contain, test and dispose of waste water generated while performing wet cleaning in accordance with applicable federal, state, and local regulations, and requirements of Authorities Having Jurisdiction.
- F. After cleaning, verify HVAC system surface and component cleanliness in accordance ACR, The NADCA Standard.

3.8 AIR DUCT SYSTEMS:

- A. Clean air ducts to remove non-adhered substances.
- B. Access air duct interiors through service openings in system that are large enough to accommodate mechanical cleaning procedures and allow for cleanliness verification.
- C. Use mechanical agitation methods to remove particulate, debris, and non-adhered particulate.
- D. Capture dislodged substances with vacuum collection device.
- E. Do not employ cleaning methods that damage HVAC components.
- F. Mark position of dampers and air-directional mechanical devices inside HVAC system prior to cleaning.
- G. When cleaning is complete, restore dampers and devices to their marked positions.
- H. After cleaning, verify cleanliness of HVAC system surfaces and components in accordance ACR, The NADCA Standard.

3.9 AHU COILS

- A. Perform visual coil and drain pan inspection to determine whether Type 1 dry cleaning, or Type 2 wet cleaning is required.
- B. Employ cleaning methods rendering coil visibly clean in accordance with ACR, The NADCA Standard.
- C. Isolate coil from duct system during cleaning process. Do not allow removed particles to migrate to, or redeposit on, unintended areas.
- D. Apply coil cleaning products in accordance with manufacturer's published data and labeling.
- E. Clean and flush condensate drain pan and drain line. Verify proper drainage operation before and after cleaning.

- F. Apply cleaning methods and products that do not cause damage to, or erosion of, coil surface or fins.

3.10 TYPE 1 DRY CLEANING METHOD

- A. Operate HEPA-filtered negative air machines with that discharge continuously during Type 1 cleaning process.
- B. Mechanically remove adhered dirt and contaminants in accordance with ACR, The NADCA Standard.

3.11 TYPE 2 WET CLEANING METHOD

- A. Employ Type 2 wet cleaning method when visual inspection reveals suspect microbial matter on coil or drain pan. Access both upstream and downstream sides of each coil section for cleaning.
- B. Employ engineering controls required for coil cleaning in accordance with ACR, The NADCA Standard.
- C. Verify cleanliness after cleaning has been performed as described in ACR, The NADCA Standard.
- D. Perform Type 2 cleaning if debris still remains on the coil or the coil is impacted after Type 1 cleaning has been completed and post-cleaning inspection has been performed.
- E. After cleaning, verify cleanliness of HVAC coils in accordance ACR, The NADCA Standard.

3.12 INTERNALLY INSULATED DUCT SYSTEM COMPONENTS AND SOUND ATTENUATORS

- A. Employ cleaning methods that do not damage internal insulation or sound attenuating components, and that render system capable of passing cleanliness verification tests.
- B. Clean fibrous glass duct liner or duct board present in equipment or air ducts employing mechanical agitation methods to remove particulate, debris, and non-adhered particulate.
- C. Do not create abrasions, breaks, or tears to fibrous glass liner or duct board surfaces.
- D. Maintain HVAC system under constant negative pressure when cleaning internal insulation components.
- E. Do not wet insulation components.
- F. Identify for replacement fibrous glass materials with evidence of damage, deterioration, delaminating, friable materials, biological growth, or moisture that cannot be restored by cleaning or resurfacing.
- G. When required, remediate exposed, damaged insulation exposed to HVAC system air stream.
 - 1. Scrape insulation and adhesive residue from metal duct system surfaces that have undergone degraded insulation removal.
 - 2. Remove loose, visible debris prior to installation of new insulation.
 - 3. Where biologically contaminated insulation was removed, apply antimicrobial agents to remove traces of contamination or abate mold in accordance with ANSI/IICRC S520.
 - 4. When replacement insulation installation is complete, verify that new fibrous glass surfaces are capable of compliance with NADCA cleanliness verification requirements.

3.13 SPECIAL TECHNIQUES

- A. Engineering Controls:
 - 1. Employ engineering controls to maintain worker and building occupant safety, and prevent contaminating surfaces outside work area.
 - a. Comply with government regulations, and industry standards and guidelines relevant to working in the facility environment in which the work is located.
 - b. Control odors , mists, and aromatic vapors during cleaning process.
- B. Controlling Product Emissions:

1. Apply cleaning agents and other chemicals in accordance with manufacturer's recommended procedures and product application instructions, including exhaust ventilation.

C. Negative Duct Pressurization:

1. Throughout cleaning process, keep HVAC system and associated air ducts at negative differential pressure, relative to indoor non-work area.
2. Maintain negative pressure differential between portion of HVAC duct system being cleaned and surrounding indoor occupant spaces.
3. Continuously monitor and verify correct pressure differential.
4. When performing vacuum collection, employ negative air machine drawing air from equipment being cleaned.
5. When negative air machine is not fitted with HEPA filtration, duct exhaust air from negative air machine to outdoor location, keeping discharge air clear of outdoor air intakes, operable windows, and other locations where outdoor air enters building.
 - a. Do not violate outdoor environmental standards, codes or regulations by releasing debris.
 - b. Do not discharge unfiltered air from vacuum collection devices outdoors.

D. Microbial Agents:

1. Apply antimicrobial agents only when active biological growth is reasonably suspected, or where unacceptable levels of biological contamination have been verified through testing.
2. Apply antimicrobial agents after removal of surface deposits and debris.
3. Apply antimicrobial agents in accordance with antimicrobial agent manufacturer's written recommendations and associated EPA registration listing.

3.14 FIELD QUALITY CONTROL

- A. Inspect work to verify cleanliness immediately after HVAC system component cleaning and prior to placing system in operation.
- B. Do not apply treatment, coating, or antimicrobial agent to cleaned HVAC system or components until the work has been inspected and determined to be acceptable.
- C. Visual Inspection:
 1. When cleaning is complete, perform final inspection in presence of Owner.
 2. Perform visual inspection of porous and non-porous HVAC system component surfaces. Verify HVAC system is visibly clean as defined in ACR, The NADCA Standard.
 3. If no contaminants are evident through visual inspection, HVAC is considered clean and acceptable.
 4. If contaminants are evident through visual inspection, repeat cleaning system areas where contaminants are visible.

3.15 SYSTEM STARTUP

- A. Install closures over services access openings before allowing system restart for normal facility operation.
- B. When system is placed in operation, remove temporary filter elements after minimum 24 hours operation.

3.16 DISPOSAL OF JOB SITE DUCT CLEANING WASTE

- A. Seal HVAC system debris and removed contaminated materials in containers before removal from work area.

- B. Handle materials classified as hazardous by governmental agencies in accordance with applicable federal, state, and local, regulations and codes.
- C. Dispose of debris removed from HVAC System in accordance with applicable federal, state, and local requirements.

END OF SECTION

SECTION 230514 – VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for variable frequency drives, including specifications, capacity ratings, dimensions, weights, materials, accessories furnished, and installation instructions.
- B. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to variable frequency drives. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

1.2 QUALITY ASSURANCE

- A. Variable frequency drives shall comply with the following standards: Standard 519, IEEE Guide for Harmonic Content and Control, UL508C, and ICS 7.0, AC Adjustable Speed Drives.
- B. The variable frequency drives and all Electrical Components, Devices and Accessories must be UL Listed and labeled.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Handle variable frequency drives carefully to avoid damage to components, enclosures, and finish. Do not install damaged components; replace and return damaged components to manufacturer.
- B. Store variable frequency drives in clean dry place and protect from weather and construction traffic.
- C. Comply with Manufacturer's rigging and installation instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB Industrial Systems, Inc.
 - 2. GE-Fuji Electric
 - 3. Square D.
 - 4. Yaskawa

2.2 VARIABLE FREQUENCY DRIVES

- A. Description: NEMA ICS 2, soft switching IGBT, PWM, VFD; UL listed and labeled as a complete unit and designed to provide variable speed of a NEMA MG 1, Design B, 3-phase, EPAC 92, standard three phase AC. Induction motor by adjusting output voltage and frequency.
- B. Output Rating: 3-phase; 0 to 60 Hz, with voltage proportional to frequency throughout voltage range. Utilization of the volts/hz-squared output is preferable for energy savings.

- C. The VFD shall utilize soft switching IGBTs (insulated gate bipolar transistors) VFD utilizing SCRs and output filtering will not be accepted.
- D. Unit Operating Requirements:
 - 1. Input AC voltage tolerance of plus or minus 10 percent.
 - 2. Input frequency tolerance of 60 Hz, plus or minus 5 percent.
 - 3. Adjustable carrier frequency, from 4 to 8 kHz or have a dither alternating carrier frequency.
 - 4. Minimum Efficiency: 96% at half speed, 98% at full speed.
 - 5. Minimum Displacement Primary-Side Power Factor: 98 percent.
 - 6. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds and 180% peak, fold back rating.
 - 7. Starting Torque: 180 percent of rated torque (auto start).
 - 8. Speed Regulation: Plus or minimum 1 percent.
 - 9. Power loss ride through of 2 seconds.
 - 10. The VFD shall be capable of starting (FLYING START) into a coasting (rotating) load (forward or reverse) up to full speed and accelerate or decelerate to setpoint without safety tripping or components damage.
 - 11. The VFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.
 - 12. Isolated control interface to follow control signal over a 40:1 speed range.
 - 13. VFD must meet the requirements for Radio Frequency Interference (RFI).
- E. All VFDs shall have the following standard features:
 - 1. All VFDs shall have the same customer interface.
 - 2. Each VFD keypad shall include Hand-Off-Auto selections and manual speed control.
 - 3. There shall be a built-in time clock in the VFD keypad.
 - 4. The VFDs shall utilize pre-programmed application macros.
 - 5. The VFD shall have cooling fans that are designed for easy replacement.
 - 6. The VFD shall have an integral 5% impedance line reactor to reduce the harmonics.
 - 7. The VFD shall be capable of sensing a loss of load (broken belt/broken coupling) and signal the loss of load condition.
- F. Internal Adjustability Capabilities via keypad (HMI) supplied with each VFD:
 - 1. Three (3) programmable critical frequency lockout ranges (critical speed avoidance).
 - 2. Two (2) PID Setpoint controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using VFD for closed loop control.
 - 3. Two (2) programmable analog inputs shall accept current or voltage signals. (0-10 VDC or 0-20 or 4-20 ma) selectable.
 - 4. Two (2) programmable analog outputs (0-20 ma or 4-20 ma). The outputs may be programmed to output proportional signal for Output Frequency (Hz), Motor Speed (RPM), Output Voltage, Output Current (amps), Motor Torque and other data.
 - 5. Six (6) programmable digital inputs for interfacing with external devices.
 - 6. There shall be a run permissive circuit for damper or valve control (uses a DI).
 - 7. Three (3) programmable digital Form-C relay outputs. Outputs shall be true form C type contacts; open collector outputs are not acceptable.
 - 8. Seven (7) programmable preset speeds.
 - 9. Two independently adjustable accel and decel ramps with 1-1800 seconds.
 - 10. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and motor noise.
 - 11. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows the highest carrier frequency without derating the VFD or operating at high carrier frequency only at low speeds.
 - 12. The VFD shall include password protection against parameter changes.

13. Minimum Speed Adjustment: 0 to 95 percent of maximum rpm.
 14. Maximum Speed Adjustment: 5 to 100 percent of maximum rpm.
 15. Current Limit: 60 to 110 percent of nominal rating.
- G. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable).
- H. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in English words:
1. Output Frequency (hz)
 2. Setpoint speed (hz or rpm)
 3. Motor Speed (RPM, %, or Engineering Units)
 4. Motor Current (amps)
 5. Calculated Motor Torque (%)
 6. Calculated Motor Power (kW)
 7. DC Bus Voltage
 8. Output Voltage (volts)
 9. Run time (run hours)
 10. Kwh Calculations
 11. DI Status (1/0)
 12. Analog Input Values (VDC or ma)
 13. Relay Status (1/0)
 14. Analog Output Status (ma)
 15. Last three faults with real time status (no codes—alpha numeric status)
- I. Self-Protection and Reliability Features:
1. Under and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
 2. Notch filter to prevent the VFD-motor-load combination at a natural frequency.
 3. Instantaneous line-to-line and line-to-ground overcurrent trips.
 4. Loss-of-phase protection.
 5. Reverse-phase protection.
 6. Motor Overtemperature fault.
 7. Loss of signal protection with speed default of 80% (programmable) of a recent signal.
- J. Status Indication: Door-mounted Keypad (HMI) shall indicate the following conditions:
1. Power on and operating conditions
 2. Motor RPM (or % speed) and direction.
 3. Fault indication and enunciation of specific fault.
 4. Line Voltage (incoming voltage or DC bus voltage).
 5. Output voltage.
 6. Run or operating hours.
 7. Control location (local/remote or hand/auto)
- K. All VFDs shall include EMI/RFI filters.
- L. Serial Communications:
1. The VFD shall have an RS-485 port as standard. The use of third party gateways and multiplexers are not acceptable.
 2. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad.
 3. The VFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface. This control shall be independent of any VFD function.

M. Service Conditions:

1. Ambient temperature, 32 to 104 deg. F.
2. 0 – 95% relative humidity, non-condensing.
3. Elevations to 3,300 feet without derating.

N. Additional Features:

1. BACnet communication interface board to transmit all parameters using BACnet Protocol to the BAS.
2. Standard enclosure shall be NEMA 1 or NEMA 12 design. Enclosure shall be UL listed as a plenum rated VFD.
3. Door interlocked, main power input circuit breaker or fused disconnect switch with provisions for padlocking.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Except as otherwise indicated or specified, install variable frequency drives in accordance with manufacturer's installation instructions and recognized industry practices to insure that products serve their intended function.
- B. Mount variable frequency drives on building walls unless otherwise indicated.
- C. Electrical Wiring: Install electrical devices furnished by manufacturer specified to be field-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
 1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Verify proper rotation direction of fan wheels and pump impellers. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

3.2 COMMISSIONING

- A. Manufacturer's Field Service: Engage a Certified factory-authorized service representative to inspect field-assembled components and equipment installation, including re-testing, programming, and adjusting VFDs. A certified start-up form shall be filled out for each drive with a copy provided to the Owner, Engineer, and a copy kept on file at the manufacturer.
- B. Verify that electrical wiring installation complies with manufacturer's submittal.
- C. Complete installation and startup checks according to manufacturer's written instructions.

END OF SECTION 230514

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 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.

1.2 SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 45 days of Contractor's Notice to Proceed, submit the Contract Documents review report.
- C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. Certified TAB reports.
- E. Sample report forms.
- F. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.3 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC, NEBB or TABB.
- B. TAB Conference: Meet with Engineer on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.
 - 1. Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Coordination and cooperation of trades and subcontractors.
 - d. Coordination of documentation and communication flow.
- C. Certify TAB field data reports and perform the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.4 PROJECT CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before TAB is completed. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.5 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 equipment performance data including fan and pump curves.
- E. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- F. Examine test reports specified in individual system and equipment Sections.
- G. 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.
- H. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- I. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- J. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- L. Examine system pumps to ensure absence of entrained air in the suction piping.
- M. Examine operating safety interlocks and controls on HVAC equipment.
- N. 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 complete and fully 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.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or SMACNA's "HVAC Systems – Testing, Adjusting, and Balancing" and in this Section.
 1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to insulation specifications.
- 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. For variable-air-volume systems, develop a plan to simulate diversity.
- B. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- C. Check airflow patterns from the outdoor-air dampers and the return-air dampers through the supply-fan discharge and mixing dampers.
- D. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- E. Verify that motor starters are equipped with properly sized thermal protection.
- F. Check dampers for proper position to achieve desired airflow path.
- G. Check for airflow blockages.
- H. Check condensate drains for proper connections and functioning.
- I. Check for proper sealing of air-handling-unit components.
- J. Verify that air duct system is sealed as specified.

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.
 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 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.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
- 4. 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.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
- B. Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
 - 1. Set outdoor-air dampers at minimum, and set return- air dampers at a position that simulates full-cooling load.
 - 2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
 - 3. Measure total system airflow. Adjust to within indicated airflow.
 - 4. Where terminal units are specified to have their maximum flow setpoints adjusted, set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment.
 - 5. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller to ensure that adequate static pressure is maintained at the most critical unit.
 - 6. Record final fan-performance data.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. 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.
 - 5. Set system controls so automatic valves are wide open to heat exchangers.
 - 6. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
 - 7. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures:
 - 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
 - a. Monitor motor performance during procedures and do not operate motors in overload conditions.
 - 3. Verify pump-motor brake horsepower.
 - 4. Report flow rates that are not within specified tolerance.
- B. Set calibrated balancing valves.
- C. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- D. Check settings and operation of each safety valve. Record settings.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.10 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.

3.11 PROCEDURES FOR BOILERS

- A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.

3.12 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each water coil:
 - 1. Entering- and leaving-water temperature.
 - 2. Water flow rate.
 - 3. Water pressure drop.
 - 4. Dry-bulb temperature of entering and leaving air.
 - 5. Wet-bulb temperature of entering and leaving air for cooling coils.
 - 6. Airflow.
 - 7. Air pressure drop.

3.13 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING HYDRONIC SYSTEMS

- A. These procedures apply to the existing heating water pumps and chilled water pumps at Vaile, Charles, and Westview Elementary schools.
- B. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
 - 1. Measure and record the operating speed, flow, and suction and discharge pressures of each pump under two conditions; first with the air handling units to be removed at full flow and second with them at no flow. During this test, all system control valves shall be temporarily forced full open by forcing this action through manipulation of the automatic temperature control system.
 - 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 - 3. Clean strainers before testing.
 - 4. Report on the operating condition of the equipment and the results of the measurements taken.
- C. Perform testing and balancing of existing systems.
 - 1. After the installation of replacement air handling units is complete and their balancing valves have been set to the specified flow rate, measure and record the operating speed, flow, and suction and discharge pressures of each pump under two conditions; first with the air handling unit to be removed at full flow and second with it at no flow. During this test, all system control valves shall be temporarily forced full open by forcing this action through manipulation of the automatic temperature control system.

3.14 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
 - 1. Equipment with Fans: Plus or minus 3 percent.
 - 2. Heating-Water Flow Rate: Plus or minus 5 percent.
 - 3. Cooling-Water Flow Rate: Plus 5 or minus 0 percent.

3.15 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.

3.16 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.

- 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. Engineer's name and address.
 - 6. Contractor's name and address.
 - 7. Report date.
 - 8. Signature of TAB supervisor who certifies the report.
 - 9. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 10. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - 11. Nomenclature sheets for each item of equipment.
 - 12. Notes to explain why certain final data in the body of reports vary from indicated values.
 - 13. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor- and return-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Fan drive settings including settings and percentage of maximum pitch diameter.
 - e. Variable Frequency Drive setting for variable-air-volume systems.
 - f. Settings for supply-air, static-pressure controller.
 - g. Other system operating conditions that affect performance.

- D. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
 - 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.

- g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
2. Motor Data:
- a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
3. Test Data (Indicated and Actual Values):
- a. Total air flow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
 - f. Preheat-coil static pressure differential in inches wg.
 - g. Cooling-coil static-pressure differential in inches wg.
 - h. Heating-coil static-pressure differential in inches wg.
 - i. Outdoor airflow in cfm.
 - j. Return airflow in cfm.
 - k. Outdoor-air damper position.
 - l. Return-air damper position.

E. Apparatus-Coil Test Reports:

1. Coil Data:
- a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch o.c.
 - f. Make and model number.
 - g. Face area in sq. ft.
 - h. Tube size in NPS.
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
- a. Air flow rate in cfm.
 - b. Average face velocity in fpm.
 - c. Air pressure drop in inches wg.
 - d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
 - e. Return-air, wet- and dry-bulb temperatures in deg F.
 - f. Entering-air, wet- and dry-bulb temperatures in deg F.
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
 - h. Water flow rate in gpm.
 - i. Water pressure differential in feet of head or psig.
 - j. Entering-water temperature in deg F.

- k. Leaving-water temperature in deg F.
- F. 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. Pump rpm.
 - i. Impeller diameter in inches.
 - j. Motor make and frame size.
 - k. Motor horsepower and rpm.
 - l. Voltage at each connection.
 - m. Amperage for each phase.
 - n. Full-load amperage and service factor.
 - 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.
- G. Boiler Test Reports:
- 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and type.
 - e. Model and serial numbers.
 - f. Fuel type and input in Btuh.
 - g. Ignition type.
 - h. Burner-control types.
 - i. Voltage at each connection.
 - j. Amperage for each phase.
 - 2. Test Data (Indicated and Actual Values):
 - a. Operating pressure in psig.
 - b. Operating temperature in deg F.

- c. Entering-water temperature in deg F.
- d. Leaving-water temperature in deg F.
- e. Number of safety valves and sizes in NPS.
- f. Safety valve settings in psig .
- g. High-limit setting in psig.
- h. Operating-control setting.
- i. High-fire set point.
- j. Low-fire set point.
- k. Voltage at each connection.
- l. 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.

END OF SECTION 230593

SECTION 230900 - HVAC INSTRUMENTATION AND CONTROLS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. General: The Building management system (BMS) system shall consist of a high-speed, peer-to-peer network of DDC controllers, a control system server, and a web-based operator interface.
- B. System shall use BACnet protocol for communication between the control modules and web server. Communication between the web server and the user's browser shall be HTTP or HTTPS protocol utilizing HTML5. Use of Adobe Flash technology is not acceptable.
New devices shall be integrated into the existing Building Automation System. This includes adding the devices to the existing database and modification or addition of graphics using the Automated Logic or Schneider Electric/Andover Continuum interface. Integration of these devices shall be included with this bid.

1.2 APPROVED BMS/BAS SYSTEMS

- A. The following are approved control system suppliers, manufacturers, and product lines:
 - a. Automated Logic Corporation WebCTRL is basis of design.
 - b. Schneider Electric/Andover Continuum system is acceptable provided equivalency is demonstrated through the submittal process.

1.3 DEFINITIONS

- A. Adjustable (adj.): Adjustable by the end user, through the supplied user interface.
- B. Advanced Application Controllers (AACs): A fully programmable control module. This control module may be capable of some of the advanced features found in Building Controllers (storing trends, initiating read & write requests, etc.) but it does not serve as a master controller. Advanced Application Controllers may reside on either the Ethernet/IP backbone or on a subnet.
- C. Alarm: The control system shall be configured to generate an alarm when this object exceeds user definable limits, as described in the Sequence of Controls.
- D. Application Specific Controllers (ASCs): A pre-programmed control module which is intended for use in a specific application. ASCs may be configurable, in that the user can choose between various pre-programmed options, but it does not support full custom programming. ASCs are often used on terminal equipment such as VAV boxes or fan coil units. In many vendors' architectures ASCs do not store trends or schedules but instead rely upon a Building Controller to provide those functions.
- E. BACnet/BACnet Standard: BACnet communication requirements as defined by the latest version of ASHRAE/ANSI 135 and approved addenda.
- F. Building Controllers (BCs): A fully programmable control module which is capable of storing trends and schedules, serving as a router to devices on a subnet, and initiating read and write requests to other controllers. Typically, this controller is located on the Ethernet/IP backbone of the BAS. In many vendors' architectures a Building Controller will serve as a master controller, storing schedules and trends for controllers on a subnet underneath the Building Controller.
- G. Controller: Intelligent stand-alone control device. Controller is a generic reference to building controllers, custom application controllers, and application specific controllers.

1.4 QUALITY ASSURANCE

- A. Installer and Manufacturer Qualifications
 - a. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.

1.5 CODES AND STANDARDS

- A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances for these plans and specifications. As a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids of the following codes:
 - a. National Electric Code (NEC)
 - b. International Building Code (IBC)
 - c. International Mechanical Code (IMC)
 - d. Underwriters Laboratories (UL/CUL)
 - e. ANSI/ASHRAE Standard 135, BACnet – A Data Communication Protocol for Building Automation and Control Systems.

1.6 SYSTEM PERFORMANCE

- A. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for display through the user's web browser.
- B. Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances shown in table below:

| Controlled Variable | Control Accuracy | Range of Medium |
|---------------------|-------------------|---|
| Air Pressure | ±0.1 in. w.g. | 0–6 in. w.g. |
| Airflow | ±2% of full scale | |
| Space Temperature | ±1.0°F | |
| Duct Temperature | ±1.0°F | |
| Humidity | ±5% RH | |
| Fluid Pressure | ±1 psi | 1–100 psi 0–50 in. w.g. differential |

1.7 SUBMITTALS

- A. Product Data and Shop Drawings: The contractor shall provide shop drawings and product data on hardware, software, and equipment to be installed or provided. No work may begin on any segment of this project until submittals have been approved.
 - a. DDC System Hardware
 - 1) A complete bill of materials to be used indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.
 - 2) Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:
 - a) Direct digital controllers (controller panels)
 - b) Transducers and transmitters

- c) Sensors (including accuracy data)
 - d) Actuators
 - e) Valves
 - f) Relays and switches
 - g) Control panels
 - h) Power supplies
 - i) Batteries
 - j) Wiring
 - k) Wiring diagrams and layouts for each control panel.
 - l) Schematic diagrams for all field sensors and controllers. Provide floor plans of all sensor locations and control hardware. Riser diagrams showing control network layout, communication protocol, and wire types.
- b. Controlled Systems
- 1) A schematic diagram of each controlled system. The schematics shall have all control points labeled with point names shown or listed. The schematics shall graphically show the location of all control elements in the system.
 - 2) A schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.
 - 3) An instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.
 - 4) A mounting, wiring, and routing plan-view drawing. The design shall take into account HVAC, electrical and other systems' design and elevation requirements. The drawing shall show the specific location of all concrete pads and bases and any special wall bracing for panels to accommodate this work.
 - 5) A complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system.
 - 6) A point list for each control system. List I/O points and software points required to provide specified sequence of operations. Indicate alarmed and trended points.
 - 7) BACnet Protocol Implementation Conformance Statement (PICS) for each submitted type of controller and operator interface.

1.8 PROJECT DOCUMENTATION

Upon completion of installation, submit record documents for approval before final completion. Provide record documents in a digital format on suitable digital media such as a USB drive. The record documents shall be in PDF file formats except as noted below. Record documentation shall include the following:

- a. Project Record Drawings. Testing and Commissioning Reports and Checklists.
- b. Operation and Maintenance (O&M) Manual.
- c. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
- d. List of recommended spare parts with part numbers and suppliers.

1.9 OWNERSHIP OF PROPRIETARY MATERIAL

- A. All project-specific software and documentation shall become owner's property.

PART 2 - PRODUCTS

2.4 MATERIALS

- A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Spare parts shall be available for at least ten years after completion of this contract.

2.5 COMMUNICATION

- A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.
- B. All IP based controllers shall be capable of providing IPv4 and IPv6 protocol standards as defined by the Internet Data Communications Standard.
- C. The owner shall furnish and install all communication media, connectors, repeaters and network switches/routers, and network devices necessary to provide a complete and workable high speed Ethernet communications/LAN network meeting or exceeding recommended control network specifications. The owner will provide an active IP/Ethernet port/drop within patch distance to each BMS server and BMS controller for connection to owner's LAN. BMS contractor will furnish and install all communications media, connectors, repeaters, switches/routers, and network devices necessary to provide a complete and workable serial network.
- A. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.
- B. Building Control Panels and Controllers with real-time clocks shall use the BACnet Time Synchronization service. System shall automatically synchronize system clocks daily from an operator-designated device via the internetwork. The system shall automatically adjust for daylight saving and standard time as applicable.

2.6 CONTROLLER SOFTWARE

- A. All controller software applications shall reside and operate in the system controllers.
- B. All application software in controllers furnished by BMS manufacturer shall be editable through operator workstation, web browser interface, or workstation.
- C. Each controller furnished by BMS manufacturer shall have all of its local on board software applications backed up and saved to the BMS web server. In the event of a controller failure, the BMS server shall download backed up software applications to replacement controller.

2.7 CONTROLLERS

- A. General. Provide an adequate number of Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), Smart Actuators (SA), and Smart Sensors (SS) as required to achieve performance as specified by system performance. Every device in the system which executes control logic and directly controls HVAC equipment must conform to a standard BACnet Device profile as specified in ANSI/ASHRAE 135, BACnet Annex L. Hardwired actuators and sensors may be used in lieu of communicating actuators, communicating sensors, BACnet Smart Actuators, and BACnet Smart Sensors
- B. BACnet.
 - a. Building Controllers (BCs): Each BC shall conform to BACnet Building Controller (B-BC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L, and shall be listed as a certified B-BC in the BACnet Testing Laboratories (BTL) Product Listing.
 - b. Advanced Application Controllers (AACs): Each AAC shall conform to BACnet Advanced Application Controller (B-AAC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-AAC in the BACnet Testing Laboratories (BTL) Product Listing.
 - c. Smart Actuators (SAs): An actuator which is controlled by a network connection rather than a binary or analog signal (0-10v, 4-20mA, relay, etc.). Each SA shall conform to BACnet Smart Actuator (B-SA) device profile as specified in ANSI/ASHRAE 135, BACnet

Annex L and shall be listed as a certified B-SA in the BACnet Testing Laboratories (BTL) Product Listing.

- d. Smart Sensors (SSs): A sensor which provides information to the BAS via network connection rather than a binary or analog signal (0-10000 ohm, 4-20mA, dry contact, etc.). Each SS shall conform to BACnet Smart Sensor (B-SS) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-SS in the BACnet Testing Laboratories (BTL) Product Listing.
- e. BACnet Communication.
 - i. Each controller residing on the ethernet data link shall be capable of providing BACnet/SC capability as described in the above Communication Section.
 - ii. Each BC shall reside on or be connected to a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol using BACnet/IP or BACnet/SC.
 - iii. BACnet routing shall be performed by BCs or other BACnet device routers as necessary to connect BCs to networks of AACs and ASCs.
 - iv. Each AAC shall reside on a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol using BACnet/IP or BACnet/SC, or it shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.
 - v. Each ASC shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.
 - vi. Each SA shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.
 - vii. Each SS shall reside on a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol with BACnet/IP addressing, or it shall reside on a BACnet network using ARCNET or MS/TP Data Link/Physical layer protocol.

A. Security

- a. Provide BACnet firewall capability, as defined in the BACnet standard, for controllers that are IP capable.

B. Communication.

- a. Service Port. Each controller shall provide a service communication port for connection to a Portable Operator's Terminal
- b. Signal Management. BC and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.
- c. Data Sharing. Each BC and AAC shall share data as required with each networked BC and AAC.
- d. Stand-Alone Operation. Each piece of equipment shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network such as outdoor air conditions, supply air or water temperature coming from source equipment, etc.

C. Environment. Controller hardware shall be suitable for anticipated ambient conditions.

- a. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 32°F to 120°F.

D. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to a field-removable modular terminal strip or to a termination card connected by a ribbon cable. Each BC and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.

E. Real-time Clock. Controller shall have a real-time clock to keep track of time in the event of a power failure for up to three (3) days.

- F. Memory
 - a. Controller memory shall support operating system, database, and programming requirements.
 - b. Each controller shall use nonvolatile memory and shall retain BIOS and application programming in the event of power loss. System shall automatically download dynamic control parameters following power loss.
- G. Immunity to Power and Noise. Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.
- H. Transformer. Power supply shall be fused or current limiting and shall be rated at a minimum of 125% of controller power consumption.

2.7 INPUT AND OUTPUT INTERFACE

- A. General. Hard-wire input and output points to BCs, AACs, or ASCs .
- B. Protection. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground shall cause no damage to the controller. All input and output points shall be protected from voltage up to 24 V of any duration, such that contact with this voltage will cause no controller damage.
- C. Binary Inputs. Binary inputs shall allow the monitoring of ON/OFF signals from remote devices. Binary inputs shall sense dry contact closure without application of power external to the controller.
- D. Pulse Accumulation Inputs. Pulse accumulation inputs shall conform to binary input requirements and shall also accumulate up to 10 pulses per second.
- E. Analog Inputs. Analog inputs shall monitor low-voltage (0–10 Vdc), current (4–20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.
- F. Binary Outputs. Binary outputs shall provide for ON/OFF operation or a pulsed low-voltage signal for pulse width modulation control. Binary outputs on Building Controllers have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation.
- G. Analog Outputs. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0–10 Vdc or a 4–20 mA signal as required to properly control output devices. Each Building Controller analog output shall have a two-position (auto-manual) switch, a manually adjustable potentiometer, and status lights. Analog outputs shall not drift more than 0.4% of range annually.
- H. Universal Inputs and Outputs. Inputs and outputs that can be designated as either binary or analog in software shall conform to the provisions of this section that are appropriate for their designated use.
- I. Communicating Actuators. Controller shall be capable of using hardwired actuators or an option of using communicating actuators connected to a dedicated actuator network port. The communicating actuator network shall be capable of the following:
 - a. The controller shall be able to communicate the actuator position command through the actuator network.
 - b. The actuator shall be to provide the actuator feedback position to the controller through the actuator network.
- L. Communicating Sensors. Controller shall be capable of using hardwired sensors or an option of using communicating sensors connected to a dedicated sensor network port. The dedicated sensor network shall be capable of monitoring the following communicating sensors:
 - a. Temperature
 - b. Humidity
 - c. CO2

2.8 POWER SUPPLIES AND LINE FILTERING

- A. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.
 - a. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.
 - a. Unit shall operate between 32°F and 120°F. EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.
 - b. Line voltage units shall be UL recognized and CSA listed.
- B. Power Line Filtering.
 - a. Provide internal or external transient voltage and surge suppression for workstations and controllers. Surge protection shall have:
 - a. Dielectric strength of 1000 V minimum
 - b. Response time of 10 nanoseconds or less
 - c. Transverse mode noise attenuation of 65 dB or greater
 - d. Common mode noise attenuation of 150 dB or greater at 40–100 Hz

2.9 AUXILIARY CONTROL DEVICES

- A. Communicating Sensors.
 - a. General
 - a. Sensors shall communicate with DDC controller via sensor network rather than connect via standard controller input. There shall be a maximum of 15 communicating sensors connected to a single network segment
 - b. Combination temperature and humidity shall be provided where all conditions are required to be sensed.
 - c. Duct temperature sensors shall be used where not affected by temperature stratification or where ducts are smaller than 5 sq ft.. The length of the sensor shall be a minimum of one-third of the width of the duct with a maximum length of 12”.
 - d. Averaging temperature sensors shall be used where prone to temperature stratification or where ducts are larger than 5 sq ft; length as required. The length of the sensor shall be 12’ minimum or 1 linear foot per every 1 sq ft of cut cross section, whichever is greater.
 - e. All sensor housings, other than space sensors, shall be provided with threaded conduit entrance.
 - f. All sensors shall include the following:
 - 1) Power Requirements: 12 Vdc @ 210 mA unless otherwise indicated, power to be supplied by controller via communication cable
 - 2) Communication speed: 115 kbps minimum
 - 3) Sensor shall be equipped with a local communication port that allows plug in to a laptop for maintenance and commissioning
 - 4) Compliance United States of America: FCC Part 15-Subpart B-Class B, CE
 - b. Outside Air Sensors
 - a. Outside Air Temperature Sensors
 - 1) Sensor: Thermistor type

- 2) Range: -40°F to 158°F
 - 3) Accuracy: +/- 1.3°F
 - 4) Enclosure: Designed to protect sensors from elements while providing air circulation, made of UV-resistant Polycarbonate with NEMA 4, IP66 rating and UL94V-0 flammability rating
- b. Outside Air Humidity Sensors
- 1) Sensor shall be integral to outside air temperature sensor housing
 - 2) Range: 10 to 90% RH
 - 3) Accuracy: +/- 2% at less than 0.5% drift per year
- c. Space Sensors
- a. Space Temperature Sensors
- 1) Sensor shall be thermistor type
 - 2) Range: -4°F to 122°F
 - 3) Accuracy: +/- 0.35°F
 - 4) Environmental Operating Range: 32°F to 122°F, 10% to 90% RH, non-condensing
 - 5) Options for LCD display, alarm indicator, setpoint adjustment and fan override shall be provided for where called for on the plan or in the sequence of operation
 - 6) Mounting via standard 4" x 2" electrical box
- b. Space Humidity Sensors
- 1) Sensor shall be integral to space temperature sensor housing
 - 2) Range: 10 to 90% RH
 - 3) Accuracy: +/- 1.8%
 - 4) Environmental Operating Range: 32°F to 122°F, 10% to 90% RH, non-condensing
- c. Space Carbon Dioxide Sensors
- 1) Sensor shall be integral to space temperature sensor housing
 - 2) Range: 400 to 2000 ppm
 - 3) Accuracy: greater of +/- 30 ppm or +/- 3% from 400 to 1250 ppm
 - 4) Power Requirements: 12 Vdc @ 190 mA
 - 5) Environmental Operating Range: 32°F to 122°F, 10% to 90% RH, non-condensing
- d. Duct Point Temperature Sensors
- 1) Sensor: Thermistor type
 - 2) Range: 20°F to 120°F
 - 3) Environmental Operating Range: -40°F to 158°F, 0-100% RH, non-condensing
 - 4) Accuracy: +/- 0.36°F (0.5°C)
 - 5) Enclosure: Polycarbonate with NEMA 4, IP66 rating and UL94V-0 flammability rating, closed cell foam shall be utilized to seal the insertion hole and absorb vibration
 - 6) Probe: Stainless steel of sufficient length for size of duct, 8 inches, minimum.
- e. Duct Humidity Sensors
- 1) Sensor shall be integral to duct temperature sensor housing
 - 2) Range: 10 to 90% RH
 - 3) Environmental Operating Range: -40°F to 158°F, 0-100% RH, non-condensing
 - 4) Accuracy: +/- 2% at less than 0.5% drift per year
- f. Averaging Temperature Sensors
- 1) Sensor: Thermistor type
 - 2) Range: 20°F to 120°F
 - 3) Environmental Operating Range: -40°F to 158°F, 0-100% RH, non-condensing
 - 4) Accuracy: +/- 0.36°F
 - 5) Enclosure: Polycarbonate with NEMA 4, IP66 rating and UL94V-0 flammability rating, closed cell foam shall be utilized to seal the insertion hole and absorb vibration
 - 6) Probe: Stainless steel of sufficient length for size of duct, 12 feet, minimum.
- d. Pipe Sensors
- a. Immersion Temperature Sensors
- 1) Sensor: Thermistor type, double encapsulated to be watertight
 - 2) Range: 30°F to 212°F
 - 3) Accuracy: +/- 0.5°F

- 4) Enclosure: Polycarbonate with NEMA 4, IP66 rating and UL94V-0 flammability rating, closed cell foam shall be utilized to seal the insertion hole and absorb vibration
- 5) Probe: Stainless steel of sufficient length (2" or 4") for size of pipe. Install in stainless steel or brass thermowell to accommodate pipe material.

B. Electric Damper and Valve Actuators.

- a. Stall Protection. Mechanical or electronic stall protection shall prevent actuator damage throughout the actuator's rotation.
- b. Spring-return Mechanism. Actuators used for power-failure and safety applications shall have an internal mechanical spring-return mechanism or an uninterruptible power supply (UPS).
- c. Signal and Range. Proportional actuators shall accept a 0–10 Vdc or a 0–20 mA control signal and shall have a 2–10 Vdc or 4–20 mA operating range.
- d. Wiring. 24 Vac and 24 Vdc actuators shall operate on Class 2 wiring.
- e. Manual Positioning. Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 7 N·m (60 in.-lb) torque capacity shall have a manual crank.

C. Control Valves.

- a. Control valves shall be two-way or three-way type for two-position or modulating service as
- b. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
 - a. Water Valves:
 - 1) Two-way: 150% of total system (pump) head.
 - 2) Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
 - c. Water Valves.
 - a. Body and trim style and materials shall be in accordance with manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.
 - b. Sizing Criteria:
 - 1) Two-position service: Line size.
 - 2) Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 5 psi, whichever is greater.
 - 3) Three-way modulating service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), 35 kPa (5 psi) maximum.
 - c. Valves ½ in. through 2 in. shall be bronze body or cast brass ANSI Class 250, spring-loaded, PTFE packing, quick opening for two-position service. Two-way valves to have replaceable composition disc or stainless steel ball.
 - d. Valves 2½ in. and larger shall be cast iron ANSI Class 125 with guided plug and PTFE packing.
 - e. Water valves shall fail normally open or closed, as scheduled on plans, or as follows:
 - 1) Water zone valves—normally open preferred.
 - 2) Heating coils in air handlers—normally open.
 - 3) Chilled water control valves—normally closed.
 - 4) Other applications—as scheduled or as required by sequences of operation..

- D. Temperature Sensors.
- a. Type. Temperature sensors shall be thermistor (10k Type2).
 - b. Duct Sensors. Duct sensors shall be averaging as shown. Averaging sensors shall be a minimum of 5 ft in length per 10 ft² of duct cross-section.
 - c. Immersion Sensors. Provide immersion sensors with a separable stainless steel well. Well pressure rating shall be consistent with system pressure it will be immersed in. Well shall withstand pipe design flow velocities.
 - d. Space Sensors. Space sensors shall have setpoint adjustment, override switch, display, and communication port as shown.
 - e. Differential Sensors. Provide matched sensors for differential temperature measurement.
- E. Humidity Sensors.
- a. Duct and room sensors shall have a sensing range of 20%–80%.
 - b. Duct sensors shall have a sampling chamber.
 - c. Outdoor air humidity sensors shall have a sensing range of 20%–95% RH and shall be suitable for ambient conditions of -40°F–170°F.
 - d. Humidity sensors shall not drift more than 1% of full scale annually.
- F. Relays.
- a. Control Relays. Control relays shall be plug-in type, UL listed, and shall have dust cover and LED “energized” indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
 - b. Time Delay Relays. Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable $\pm 100\%$ from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.
- G. Override Timers.
- a. Unless implemented in control software, override timers shall be spring-wound line voltage, UL Listed, with contact rating and configuration required by application. Provide 0–6 hour calibrated dial unless otherwise specified. Flush mount timer on local control panel face or where shown.
- H. Current Transmitters.
- a. AC current transmitters shall be self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4–20 mA two-wire output. Full-scale unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A, with internal zero and span adjustment. Unit accuracy shall be $\pm 1\%$ full-scale at 500 ohm maximum burden.
 - b. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.
 - c. Unit shall be split-core type for clamp-on installation on existing wiring.
- I. Current Transformers.
- a. AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.
 - b. Transformers shall be available in various current ratios and shall be selected for $\pm 1\%$ accuracy at 5 A full-scale output.
 - c. Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.
- J. Voltage Transmitters.

- a. AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4–20 mA output with zero and span adjustment.
 - b. Adjustable full-scale unit ranges shall be 100–130 Vac, 200–250 Vac, 250–330 Vac, and 400–600 Vac. Unit accuracy shall be $\pm 1\%$ full-scale at 500 ohm maximum burden.
 - c. Transmitters shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized at 600 Vac rating.
- K. Voltage Transformers.
- a. AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.
 - b. Transformers shall be suitable for ambient temperatures of 4°C–55°C (40°F–130°F) and shall provide $\pm 0.5\%$ accuracy at 24 Vac and 5 VA load.
 - c. Windings (except for terminals) shall be completely enclosed with metal or plastic.
- L. Current Switches.
- a. Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.
- M. Pressure Transducers.
- a. Transducers shall have linear output signal and field-adjustable zero and span.
 - b. Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than calibrated span without damage.
 - c. Water pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 150 psi. Transducer shall have 4–20 mA output, suitable mounting provisions, and block and bleed valves.
 - d. Water differential pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 150 psi. Over-range limit (differential pressure) and maximum static pressure shall be 300 psi. Transducer shall have 4–20 mA output, suitable mounting provisions, and 5-valve manifold.
- N. Differential Pressure Switches. Differential pressure switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum) and shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.
- O. Air Flow Measuring Station
- a. Provide airflow/temperature measurement devices where indicated on the plans. Fan inlet sensors shall not be substituted for duct or plenum sensor probes indicated on the plans.
 - a. Duct and plenum mounted sensors shall be fabricated of anodized aluminum alloy tube with 303/304 stainless steel mounting brackets.
 - b. Fan inlet probes shall be field adjustable to fit the fan inlet and have 303/304 stainless steel mounting feet.
 - b. Each measuring device shall consist of one or more multi-point measuring probes and a single microprocessor-based transmitter. Each transmitter shall have an LCD display capable of displaying airflow and temperature. Airflow shall be field configurable to be displayed as a velocity or volumetric rate.
 - c. Each transmitter shall operate on 24 VAC.
 - d. Each sensing point shall independently determine the airflow rate and temperature, which shall be equally weighted and averaged by the transmitter prior to output. Devices, which average multiple non-linear sensing point signals, are not acceptable. Pitot tube arrays are not acceptable.
 - e. A single manufacturer shall provide both the airflow/temperature measuring probe(s) and transmitter at a given measurement location. Probes and transmitters shall not require field matching for proper operation.
 - f. The operating airflow range shall be 50-5,000 FPM unless otherwise indicated on the plans.

- g. The operating temperature range for the measuring probes shall be -20°F to 140°F. The operating humidity range for the measuring probe shall be 0-99% RH (non-condensing).
- h. The operating temperature range for the transmitter shall be -20°F to 120°F. The transmitter shall be protected from weather and water.
- i. Each independent airflow sensor shall have a laboratory accuracy of +/-2% of reading over the entire operating airflow range and be wind tunnel calibrated.
- j. Each independent temperature sensor shall have a laboratory accuracy of +/-15°F over the entire operating temperature range and be calibrated.
- k. The number of sensors for each location shall be as follows:
 - a. Ducts and plenums:

| Area (sq.ft.) | Sensors |
|---------------|---------|
| <=1 | 2 |
| >1 to <4 | 4 |
| 4 to <8 | 6 |
| 8 to <12 | 8 |
| 12 to <16 | 12 |
| >=16 | 16 |

- b. Fan inlets: 2 per inlet
- l. The airflow/temperature measuring device shall be capable of displaying the airflow and temperature readings of each sensor on the transmitter's LCD display.
- m. The transmitter shall be capable of communicating with the host controls using the following interface options:
 - a. Linear analog output signal: Field selectable, fuse protected and isolated, 0-10VDC and 4-20mA (4-wire)
 - b. RS-485: Field selectable ModBus-RTU and Johnson Controls N2Bus
 - c. 10 Base-T Ethernet: Field selectable ModBus TCP and TCP/IP
- n. Airflow/Temperature measuring devices shall be UL listed as an entire assembly.
- o. The manufacturer's authorized representative shall review and approve the placement and operating airflow rates for each measurement location indicated on the plans. A written report shall be submitted to the consulting mechanical engineer if any measurement locations do not meet the manufacturer's placement requirements.
- p. Manufacturer: Ebtron, Paragon or Tek-Air.

2.10 LOCAL CONTROL PANELS.

- A. All indoor control cabinets shall be fully enclosed NEMA 1 construction with (hinged door) key-lock latch and removable subpanels. A single key shall be common to all field panels and subpanels.
- B. Interconnections between internal and face-mounted devices shall be prewired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600 volt service, individually identified per control/ interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
- C. Provide ON/OFF power switch with overcurrent protection for control power sources to each local panel.

2.11 WIRING AND RACEWAYS

- A. General. Provide copper wiring, plenum cable, and raceways as specified in applicable sections of Division 26.
- B. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.
- B. Inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.
- C. Examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate report these discrepancies to the engineer and obtain written instructions for any changes necessary to accommodate the work.

3.02 COORDINATION

- C. Test and Balance.
 - a. Furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
 - b. Provide a qualified technician to assist in the test and balance process.
 - c. The tools used during the test and balance process will be returned at the completion of the testing and balancing
- D. Life Safety.
 - a. Duct smoke detectors required for air handler shutdown are provided under Division 28. Interlock smoke detectors to air handlers for shutdown as specified in sequences of operation.
- E. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated as follows:
 - a. All necessary communication media and equipment shall be provided.
 - b. Coordinate and resolve any incompatibility issues that arise between products provided under this section and those provided under other sections or divisions of this specification.

2.12 GENERAL WORKMANSHIP

- A. Install equipment, piping, and wiring/raceway parallel to building lines.
- B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- C. Install equipment in readily accessible locations as defined by Chapter 1 Article 100 Part A of the National Electrical Code (NEC).
- D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

2.13 FIELD QUALITY CONTROL

- A. All work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances.

2.14 WIRING

- A. All control and interlock wiring shall comply with national and local electrical codes, and Division 26 of this specification.
- B. All NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway according to NEC and Division 26 requirements.
- C. All low-voltage wiring shall meet NEC Class 2 requirements. Low-voltage power circuits shall be subfused when required to meet Class 2 current limit.
- D. NEC Class 2 (current-limited) wires shall be installed in raceway.

- E. All wiring in mechanical, electrical, or service rooms – or where subject to mechanical damage – shall be installed in raceway.
- F. Do not install Class 2 wiring in raceways containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring.
- G. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.
- H. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
- I. Maximum allowable voltage for control wiring shall be 120 V.
- J. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.
- K. Size of raceway and size and type of wire shall be the responsibility of the contractor in keeping with the manufacturer's recommendations and NEC requirements.
- L. Include one pull string in each raceway.
- M. Use color-coded conductors throughout with conductors of different colors.
- N. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.
- O. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.
- P. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of vertical raceways.
- Q. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 3 ft in length and shall be supported at each end. Flexible metal raceway less than ½ in. electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal raceways shall be used.
- R. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings. Terminations shall be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

2.15 COMMUNICATION WIRING

- A. Do not install communication wiring in raceways and enclosures containing Class 1 or other Class 2 wiring.
- B. Maximum pulling, tension, and bend radius for the cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.
- C. Verify the integrity of the entire network following cable installation. Use appropriate test measures for each particular cable.
- D. All runs of communication wiring shall be unspliced length when that length is commercially available.
- E. All communication wiring shall be labeled to indicate origination and destination data.
- F. BACnet ARCnet or MS/TP communications wiring shall be installed in accordance with ASHRAE/ANSI Standard 135. This includes but is not limited to:
 - a. ARCnet
 - a. The network shall use shielded, twisted-pair cable with characteristic impedance between 100 nominal. Distributed capacitance between conductors shall be less than 12.5 pF per foot.
 - b. The maximum number of nodes per segment shall be 32, as specified in the EIA 485 standard.
 - c. An ARCnet network shall have no T connections.

2.16 INSTALLATION OF SENSORS

- A. Install sensors in accordance with the manufacturer's recommendations.

- B. Mount sensors rigidly and adequately for environment within which the sensor operates.
- C. Room temperature sensors shall be installed on concealed junction boxes properly supported by wall framing.
- D. All wires attached to sensors shall be sealed in their raceways or in the wall to stop air transmitted from other areas from affecting sensor readings.
- E. Sensors used in mixing plenums and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner vertically across the duct. Each bend shall be supported with a capillary clip.
- F. Low-limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip. Provide 3 m (1 ft) of sensing element for each 1 m² (1 ft²) of coil area.
- G. All pipe-mounted temperature sensors shall be installed in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.
- H. Differential Air Static Pressure.
 - a. Supply Duct Static Pressure. Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the high-pressure tap tubing of the corresponding building static pressure sensor (if applicable) or to the location of the duct high-pressure tap and leave open to the plenum.
 - b. The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer.
 - c. All pressure transducers shall be located in field device panels, not on the equipment monitored or on ductwork. Mount transducers in a location accessible for service without use of ladders or special equipment.
 - d. All air and water differential pressure sensors shall have gauge tees mounted adjacent to the taps. Water gauges shall also have shut-off valves installed before the tee.
- I. Smoke detectors, freezestats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

2.17 ACTUATORS

- A. General. Mount and link control damper actuators according to manufacturer's instructions.
 - a. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.
 - b. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
 - c. Provide all mounting hardware and linkages for actuator installation.
- B. Electric/ Electronic
 - a. Dampers: Actuators shall be direct mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° travel available for tightening the damper seal. Actuators shall be mounted following manufacturer's recommendations.
 - b. Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.

2.18 IDENTIFICATION OF HARDWARE AND WIRING

- A. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 2 in. of termination with control system address or termination number.
- B. Permanently label or code each point of field terminal strips to show the instrument or item served.
- C. Identify control panels with minimum ½ inch letters on laminated plastic nameplates.
- D. Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.
- E. Identify room sensors related to terminal boxes or valves with nameplates.
- F. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.
- G. Identifiers shall match record documents.

2.19 CONTROLLERS

- A. Provide a separate controller for each AHU or other HVAC system. A DDC controller may control more than one system provided that all points associated with the system are assigned to the same DDC controller. Points used for control loop reset, such as outside air or space temperature, are exempt from this requirement.
- B. Building Controllers and Custom Application Controllers shall be selected to provide the required I/O point capacity required to monitor all of the hardware points listed in sequences of operations.

2.20 PROGRAMMING

- A. Provide sufficient internal memory for the specified sequences of operation and trend logging
- B. Point Naming. Coordinate with owner for point naming conventions. Name points as shown on the equipment points list provided with each sequence of operation or as directed by owner. If character limitations or space restrictions make it advisable to shorten the name, abbreviations as coordinated with owner may be used. Where multiple points with the same name reside in the same controller, each point name may be customized with its associated Program Object number.
- C. Software Programming.
 - a. Provide programming for the system and adhere to the sequences of operation provided. All other system programming necessary for the operation of the system, but not specified in this document, also shall be provided. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation. Use the appropriate technique based on the following programming types:
 - b. Standard Graphics. Provide graphics for all mechanical systems and floor plans of the building. Point information on the graphic displays shall dynamically update. Show on each graphic all input and output points for the system. Also show relevant calculated points such as setpoints. As a minimum, show on each equipment graphic the input and output points and relevant calculated points as indicated on the applicable Points List or sequence of operations.
 - c. Provide all the labor necessary to install, initialize, start up, and troubleshoot all operator interface software and its functions.

2.21 CONTROL SYSTEM CHECKOUT AND TESTING

- A. Startup Testing. All testing listed in this article shall be performed by the contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the owner's representative is notified of the system demonstration
 - a. The contractor shall furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification.
 - b. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.

- c. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures according to manufacturers' recommendations.
- d. Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.
- e. Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The contractor shall check all control valves and automatic dampers to ensure proper action and closure. The contractor shall make any necessary adjustments to valve stem and damper blade travel.
- f. Verify that the system operation adheres to the sequences of operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops.
- g. Alarms and Interlocks:
 - a. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.
 - b. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
 - c. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

2.22 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration.

- a. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed their own tests.
- b. The tests described in this section are to be performed in addition to the tests that the contractor performs as a necessary part of the installation, start-up, and debugging process. The Owner will be present to observe and review these tests. The Owner shall be notified at least 10 days in advance of the start of the testing procedures.
- c. The contractor shall provide at least two persons equipped with two-way communication and shall demonstrate actual field operation of each control and sensing point for all modes of operation. The purpose is to demonstrate the calibration, response, and action of every point and system. Any test equipment required to prove the proper operation shall be provided by and operated by the contractor.
- d. As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.
- e. Demonstrate compliance with sequences of operation through all modes of operation.
- f. Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests

B. Acceptance.

- a. All tests described in this specification shall have been performed to the satisfaction of both the engineer and owner prior to the acceptance of the control system as meeting the requirements of completion. Any tests that cannot be performed due to circumstances beyond the control of the contractor may be exempt from the completion requirements if stated as such in writing by the engineer. Such tests shall then be performed as part of the warranty.
- b. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved.

2.23 TRAINING

- A. Provide training for a designated staff of Owner's representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods.

2.24 CONTROL VALVE INSTALLATION

- A. Valves shall be installed in accordance with the manufacturer's recommendations.
- B. Control valves shall be installed so that they are accessible and serviceable and so that actuators may be serviced and removed without interference from structure or other pipes and/or equipment.
- C. Isolation valves shall be installed so that the control valve body may be serviced without draining the supply/return side piping system. Unions shall be installed at all connections to screw-type control valves.

2.25 DUCT SMOKE DETECTION

- A. Provide a dry-contact alarm output in the same room as the HVAC equipment to be controlled.

2.26 PACKAGED EQUIPMENT CONTROLS

- A. General. The electronic controls packaged with any equipment furnished under this contract shall communicate with the building direct digital control (DDC) system. The DDC system shall communicate with these controls to read the information and change the control setpoints as shown in the points list, sequences of operation, and control schematics. The information to be communicated between the DDC system and these controls shall be in the standard object format as defined in ANSI/ASHRAE Standard 135 (BACnet). Controllers shall communicate with other BACnet objects on the internetwork using the Read (Execute) Property service as defined in Clause 15.5 of Standard 135.

2.27 START-UP AND CHECKOUT PROCEDURES

- A. Start up, check out, and test all hardware and software and verify communication between all components.
 - a. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
 - b. Verify that all analog and binary input/output points read properly.
 - c. Verify alarms and interlocks.
 - d. Verify operation of the integrated system.

END OF SECTION 230900

SECTION 230993 - SEQUENCE OF OPERATION

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION

- A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified.

PART 2 - PRODUCTS (Not applicable to this section)

PART 3 – EXECUTION

3.1 HVAC SEQUENCE OF OPERATION

A. HOT WATER SYSTEM

1. The hot water system shall be enabled at all times. The lead pump VFD shall start and slowly ramp up to maintain the system pressure. Lead/Lag designation shall be rotated on a monthly basis.
2. A 4-20 mA signal shall be sent to the boiler control panel for setpoint. The boiler control panel furnished by the boiler manufacturer shall control the operation of the condensing boilers to maintain setpoint as determined by the BAS.
3. Hot water supply temperature setpoint shall be reset based on the following schedule: at 20 deg. F. outside air temperature, hot water supply temperature setpoint shall be 180 deg. F., and at 70 deg. F. outside air temperature, hot water supply temperature shall be 12 deg. F. The hot water supply temperature setpoint shall be linear between these values and constant below 20 degrees and above 70 degrees.
4. Modulate the hot water pump VFDs to maintain system pressure differential of approximately 8 PSI (adj.) as measured by the differential pressure transmitter. When the signal to the lead pump VFD has exceeded 55 Hz for 10 minutes, the lead pump signal shall be reduced to 40 Hz and the lag pump shall be started. Once operation has been confirmed, both VFDs will be allowed to modulate to maintain the setpoint. If both pumps are operating at less than 30 Hz for 30 minutes, the lag pump shall be disabled. The final setpoint shall be determined during pump and system water flow balancing by cooperative effort between the balancing and the temperature controls on-site personnel. This differential pressure setpoint shall be established to be as low as possible while still enabling the system to meet all building heating loads.
5. Existing differential pressure sensors, transmitters, cabling, and accessories shall be replaced with new. The Contractor shall locate the existing units and replace at the same location.
6. Pump status shall be monitored at the VFD through the BACnet communication interface. Should pump status not be confirmed within 2 minutes after command to start, initiate an alarm and start the lag pump.

B. VARIABLE AIR VOLUME AIR HANDLING UNITS

1. Each air handling unit shall have its own dedicated DDC controller that will operate in a standalone mode should communication with the BAS be lost. The controller shall utilize the BACnet protocol for communication to the BAS.

2. DDC control panel shall be furnished with an override function to manually enable the air handling unit.
3. The BAS shall index the DDC controller to the occupied mode based on the optimum start/stop program or the time scheduling program.
4. The BAS shall modulate the supply fan speed to maintain the duct static pressure setpoint. The final setpoint shall be determined during system air balancing by cooperative effort between the balancing and the temperature controls on-site personnel. This differential pressure setpoint shall be established to be as low as possible while still enabling the system to meet all building heating loads. Maximum acceptable setpoint shall be 1.5 inches W.G. Existing differential pressure sensors, transmitters, cabling, and accessories shall be replaced with new. The Contractor shall locate the existing units and replace at the same location.
5. Supply fan status shall be monitored at the VFD through the BACnet communication interface. Should fan status not be confirmed within 2 minutes after a command to start, initiate an alarm.
6. Once supply fan operation is confirmed, the outside air dampers shall open. Modulate the outside air and return air dampers to maintain the minimum CFM setpoint as measured by the outside airflow measuring station.
7. If the outside air enthalpy is below the return air enthalpy, the AHU shall be indexed to economizer mode. The outside economizer damper and return air dampers shall modulate to maintain the discharge setpoint. If the outside air temperature is below 35 degrees F. (adj.) the economizer mode shall be disabled.
8. Modulate cooling coil valve and preheat coil in sequence to maintain discharge air setpoint. Discharge air setpoint shall be 55 degrees except under conditions where two or more rooms are more than 2 degrees warmer than their setpoints or in dehumidification mode. Under either of these conditions, discharge air setpoints shall be reduced to 52 degrees at Vaile Elementary School, 53 degrees at Charles Elementary School, or 53.5 degrees at Westview Elementary School.
9. Low limit thermostats shall shut down the AHU system through hardwire interlock should any 1' length of the element fall below the thermostat setpoint (38 deg. F.). The DDC controller shall monitor status of the low limit thermostats, and upon activation, close the outside air damper and open the preheat coil valve. When the temperature rises by 12 deg. F., the low limit thermostat shall reset and the DDC controller shall initiate a normal start-up sequence. This will be allowed to occur three times before the unit operation is locked out requiring an operator reset. An alarm at the workstation shall then be annunciated.
10. A high static pressure limit switch shall stop the fan when the discharge pressure exceeds 5.0" W.C. The DDC controller shall initiate an alarm upon activation.
11. Smoke detectors in supply and return ducts shall stop the fan through hardwire interlock when smoke is detected by either detector. The DDC controller shall initiate an alarm upon activation.
12. The BAS shall monitor the supply air duct static pressure.
13. The BAS shall control the supply fan speed to maintain the duct static pressure setpoint.
14. A differential pressure transducer shall be installed across the filter bank to monitor filter pressure drop. An alarm shall be generated if either a HIGH OR LOW limit setpoint is exceeded when the fan is operating.
15. When the BAS indexes the AHU controller to the unoccupied mode, the DDC controller shall shut down the fan, close all outside air dampers, and close the cooling coil valve and heating coil valve. The air handling unit shall be cycled along with the VAV terminal reheat units to maintain space temperature of 65 to 78 deg. F. (adj.), the outside air dampers shall remain closed and the heating and cooling coils shall modulate as in the occupied mode.
16. If the space humidity exceeds the setpoint of 60% RH (adj.) at either the Media Center space humidity sensor or the return air duct humidity sensor, and dehumidification is not disabled, the BAS shall index the VAV terminals to the occupied mode and signal the AHU to start (if unoccupied) and initiate a dehumidification sequence. The chilled water valve shall fully modulate to maintain discharge air temperatures as indicated above the VAV terminal reheat coils shall modulate to maintain the discharge setpoint. When the humidity falls below 50%, the unit will be released to its normal operating mode. During dehumidification, the minimum flow setpoint of the VAV terminals shall be doubled to increase airflow to the space.
17. System monitoring: Provide monitoring and control points as shown on the points list.

C. SINGLE ZONE CONSTANT VOLUME AIR HANDLING UNIT

1. The air handling unit shall have its own dedicated DDC controller that will operate in a standalone mode should communication with the BAS be lost. The controller shall utilize BACnet protocol for communication to the BAS.
2. DDC control panel shall be furnished with an override function to manually enable the air handling unit.
3. If the outside air enthalpy is below the return enthalpy, the AHU shall be indexed to economizer mode. The outside and return air dampers shall modulate to maintain the room temperature setpoint. If the mixed air temperature goes below the Mixed Air Minimum Setpoint (50 deg. F. adj.), the OA damper position shall modulate to maintain the Mixed Air Minimum Setpoint.
4. Except during economizer operation mode, the CO₂ in the space shall be monitored and the outside air CFM modulated to maintain a setpoint 900 ppm (adj.) up to a maximum flow rate of 900 CFM as determined by damper position testing during balancing.
6. When space humidity exceeds 60% RH (adj.) and dehumidification is not disabled, the AHU shall be indexed to full cooling. Modulate reheat coil valve to maintain room temperature.
9. If the outside air temperature is below 50 deg. F., the preheat coil valve shall modulate to maintain room temperature setpoint. When heat is called for and outdoor air temperature is above 50 degrees, the reheat coil valve shall modulate to maintain room temperature.
10. In the heating mode the unit shall maintain space temperature of 70 deg. F. (adj.). When space temperature rises above the heating space temperature setpoint and before cooling is initiated the unit shall enter an adjustable no load deadband to 75 deg. F. (adj.). During this time the reheat coil valve shall close, the fan shall run, and the outside air dampers shall be at minimum position.
11. In the cooling mode, either mechanical or economizer, the unit shall maintain space temperature of 75 deg. F. (adj.). When the space temperature drops below the cooling space temperature setpoint, and before heating is initiated, the unit shall enter an adjustable no load deadband to 70 deg. F. (adj.). During this time the cooling coil valve shall close, the fan shall run, and the outside air dampers shall be at minimum position.
12. If the humidity level exceeds 60% during the no load deadband, the unit shall be indexed to dehumidification as specified and shall maintain cooling setpoint of 75 deg. F. (adj.).
13. Low limit thermostats shall shut down the AHU system through hardwire interlock should any 1' length of the element fall below the thermostat setpoint (38 deg. F.). DDC controller shall monitor status of the low limit thermostats and upon activation, close the outside air damper and open the reheat coil valve. When the temperature rises by 12 deg. F., the low limit thermostat shall reset and the DDC controller shall initiate a normal start-up sequence. This will be allowed to occur three times before the unit operation is locked out, requiring an operator reset. An alarm at the workstation shall then be annunciated.
14. Smoke detectors in supply and return ducts shall stop the fan through hardwire interlock when smoke is detected by either detector.
15. A differential pressure transducer shall be installed across the filter bank to monitor filter pressure drop. An alarm shall be generated if either a HIGH OR LOW limit setpoint is exceeded when the fan is operating.
16. When the BAS indexes the DDC controller to the unoccupied mode, the DDC controller shall shut down the fan, close the outside air damper, and close the cooling coil valve and reheat coil valve. Unit shall be cycled during unoccupied mode to maintain space temperature to within 65 to 78 deg. F. The unit shall also be enabled in a dehumidification mode. The outside air damper shall remain closed and the valves modulated.
17. System monitoring: Provide monitoring and control points as shown on the points list.

D. SUMP PUMP

1. Provide high liquid level sensor in sump and input to the BAS to initiate an alarm report.

E. COLOR GRAPHIC REQUIREMENTS

1. Provide color graphics for each of the following systems:

Hot Water System
Air Handling Units

F. POINTS LIST

1. The following points shall as a minimum be included. All points necessary to complete sequence of operation as specified shall be provided.
2. The following abbreviations are used for the points list: AI=Analog In, AO=Analog Out, BI=Binary In, BO=Binary Out.

Hot Water System:

| | |
|---|----|
| Boiler System Enable/Disable | BO |
| Pump HWP-1 VFD Start/Stop | BO |
| Pump HWP-2 VFD Start/Stop | BO |
| Pump HWP-1 VFD Status | BI |
| Pump HWP-2 VFD Status | BI |
| Pump HWP-1 VFD Alarm | BI |
| Pump HWP-2 VFD Alarm | BI |
| Pump HWP-1 VFD Speed | AO |
| Pump HWP-2 VFD Speed | AO |
| Boiler Alarm System | BI |
| Boiler B-1 Alarm | BI |
| Boiler B-2 Alarm | BI |
| Building Hot Water Temperature Setpoint | AO |
| Building Hot Water Supply Temperature | AI |
| Building Hot Water Return Temperature | AI |
| Outdoor Air temperature | AO |
| Piping System Differential Pressure | AI |

Variable Air Volume Air Handling Units :

| | |
|---------------------------|----|
| Supply Fan VFD Start/Stop | BO |
| Supply Fan Status | BI |
| Supply Fan VFD Alarm | BI |
| High Static Alarm | BI |
| Supply Smoke Detector | BI |
| Return Smoke Detector | BI |
| Low Limit | BI |

| | |
|------------------------------------|----|
| RA and OA Dampers | AO |
| Heating Coil Valve Position | AO |
| Cooling Coil Valve Position | AO |
| Supply Fan VFD Speed | AO |
| Discharge Temperature Setpoint | AO |
| Humidity Setpoint | AO |
| Minimum OA AFMS (CFM) | AI |
| Mixed Air Temperature | AI |
| Cooling Coil Discharge Temperature | AI |
| Fan Discharge Temperature | AI |
| Filter Pressure Drop | AI |
| Space Temperature | AI |
| Supply Duct Static Pressure | AI |
| Space Humidity | AI |
| Return Duct Humidity | AI |

Single Zone Constant Volume Air Handling Unit:

| | |
|------------------------------------|----|
| Fan Start/Stop | BO |
| Fan Status | BI |
| Fan Alarm | BI |
| Supply Smoke Detector | BI |
| Return Smoke Detector | BI |
| Low Limit | BI |
| RA and OA Dampers | AO |
| Preheat Coil valve Position | AO |
| Reheat Coil Valve Position | AO |
| Cooling coil Valve Position | AO |
| Filter Pressure Drop | AI |
| Mixed Air Temperature | AI |
| Fan Discharge Temperature | AI |
| Cooling Coil Discharge Temperature | AI |
| Space Temperature | AI |
| Space CO ₂ | AI |
| Space Humidity | AI |
| Space Temperature Setpoint | AI |
| Space Humidity Setpoint | AI |
| Space CO ₂ Setpoint | AI |

Sump High Water Alarm

| | |
|--------------|----|
| Liquid Level | BI |
|--------------|----|

END OF SECTION

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 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: 150 psig at 200 deg F.
 - 2. Chilled-Water Piping: 150 psig at 200 deg F.
 - 3. Makeup-Water Piping: 80 psig at 150 deg F.
 - 4. Condensate-Drain Piping: 150 deg F.
 - 5. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

1.2 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. Hydronic specialties.

1.3 QUALITY ASSURANCE

- A. 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 01.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. 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.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.
- 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. Grooved Mechanical-Joint Fittings and Couplings:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Victaulic Company of America.
 - c. Grinnell Corporation
- 2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
- 3. Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

- I. 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 non-conductive 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:

- a. Capitol Manufacturing Company.
- b. Matco-Norca, Inc.
- c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- d. Wilkins; a Zurn company.

2. Description:

- a. Standard: ASSE 1079.
- b. Pressure Rating: 150 psig minimum at 200 deg F.
- 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. Matco-Norca, Inc.
- c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- d. Wilkins; a Zurn company.

2. Description:

- a. Standard: ASSE 1079.
- b. Factory-fabricated, bolted, companion-flange assembly.
- c. Pressure Rating: 150 psig minimum at 200 deg F .
- d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

2.5 VALVES

A. 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. Griswold Controls.
- e. 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.

B. 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.
 - c. Flow Design Inc.
 - d. Griswold Controls.
 - e. Taco.
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.

C. 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.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: Stainless steel, 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.

2.6 AIR CONTROL DEVICES

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

1. Wessels
2. Amtrol, Inc.
3. Armstrong Pumps, Inc.
4. Bell & Gossett Domestic Pump; a division of ITT Industries.

5. 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.
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.

D. Bladder-Type Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

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: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, 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, NPS 2-1/2 and larger, shall be any of 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. Chilled-water piping, 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.
- D. Chilled-water piping, NPS 2-1/2 and larger, shall be any of 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.
- E. Makeup-water piping shall be the following:
1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- F. Condensate-Drain Piping: Schedule 40 PVC.
- G. Air-Vent Piping:
1. Inlet: Same as service where installed.
 2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.
- H. 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.

3.2 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each supply and return connection to each piece of equipment.
- B. Install calibrated-orifice balancing valves in the return pipe of each heating or cooling terminal.
- C. 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 nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.
- D. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.3 PIPING INSTALLATIONS

- A. Install piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- B. Install piping to permit valve servicing.
- C. Install piping at indicated slopes.
- D. Install piping free of sags and bends.
- E. Install fittings for changes in direction and branch connections.
- F. 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.
- G. Install piping at a uniform slope of not less than 0.2 percent to allow to drain except where otherwise indicated..

- H. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- I. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe.
- J. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- K. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- L. Install strainers on inlet side of each control valve, pressure-reducing valve, 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.
- M. Keep open ends of existing piping capped at all times.
- N. Ensure that each pipe length and fitting is completely clean inside before installing it.

3.4 HANGERS AND SUPPORTS

- A. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
- B. 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.
- C. 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.

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.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- H. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

3.6 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at all 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.
- C. Install bladder tanks on the floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system Project requirements.

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.

3.8 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9.
- B. Perform the following tests on hydronic piping:
 1. Use system operating fluid 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. Test piping system by operating the system at full pressure and flow for a period of 4 hours.
 5. During testing, 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.
 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 to specified values.
 7. Verify lubrication of motors and bearings.

END OF SECTION 232113

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and specified seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.2 SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Liners and adhesives.
 - 2. Sealants and gaskets.
- B. Shop Drawings:
 - 1. Factory- and shop-fabricated ducts and fittings.
 - 2. Fittings.
 - 3. Reinforcement and spacing.
 - 4. Seam and joint construction.
 - 5. Equipment connections.
 - 6. Hangers and supports, including methods for duct and building attachment.

1.3 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 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: G90.
- 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 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - a. Maximum Thermal Conductivity:
 - 1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 - 3. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Insulation Pins and Washers:
 - 1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. 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, use sealant that has 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. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
 11. Service: Indoor or outdoor.
 12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- C. 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, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.5 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- B. Install ducts with fewest possible joints.
- C. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- D. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- E. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- F. Install ducts with a clearance of 1 inch.
- G. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Fasteners appropriate for construction materials to which hangers are being attached.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor.

- 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 CLEANING NEW HVAC SYSTEMS

- A. Perform cleaning before air balancing.
- B. Use service openings, as required, for physical and mechanical entry and for inspection.
- C. Clean the following metal duct systems by removing interior surface contaminants and deposits:
 - 1. Supply fans including fan housings, sheet metal plenums and fan accessories.
 - 2. Air-handling unit internal surfaces and components including mixing box, coil section, condensate drain pans, and filter sections.
 - 3. Coils and related components.
 - 4. Return-air ducts, dampers, and actuators.
 - 5. Supply-air ducts, dampers, actuators, and turning vanes.
- D. Mechanical Cleaning Methodology:
 - 1. Clean metal duct systems to extract contaminants from within duct systems and remove contaminants from building.
 - 2. Clean fibrous-glass duct liner with vacuuming equipment; do not permit duct liner to get wet.
 - 3. Clean coils and coil drain pans. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
- E. Cleanliness Verification:
 - 1. Visually inspect metal ducts for contaminants and submit report where cleaning is completed.

3.6 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel.
- B. Supply Ducts:
 - 1. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - 2. Ducts Connected to Variable-Air-Volume Air-Handling Units:
 - a. Pressure Class: Positive 4-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
- C. Return Ducts:
 - 1. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.

D. Liner:

1. Supply Air Ducts: Fibrous glass, 1 inch thick.
2. Return Air Ducts: Fibrous glass, 1 inch thick.
3. Outside Air Ducts: Fibrous glass, 1 inch thick.

E. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - a. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUBMITTALS

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

1.2 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.

2.2 TURNING VANES

- A. 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.
- B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".
- C. Vane Construction: Single wall.

2.3 DUCT-MOUNTED ACCESS DOORS

- A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".
 - 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - d. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Minimum number of Hinges and Locks:
 - a. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - b. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.

2.4 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.
- B. Install test holes at fan inlets and outlets and elsewhere as indicated.
- C. Install duct access doors on sides of ducts to allow for duct cleaning access in new and existing ducts.
- D. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Inspect locations of access doors and verify that purpose of access door can be performed.
 2. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300

SECTION 235216 - CONDENSING BOILERS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Shop Drawings: For boilers, boiler trim, and accessories. Include product description, model number, dimensions, clearances, weights, components and options.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
- B. Manufacturer's Certification: The boiler manufacturer shall certify the following:
 - 1. The products and systems furnished are in strict compliance with the specifications.
 - 2. ASME Certification in the form of ASME Stamp on the product and completed and signed data sheet.
 - 3. ASME CSD-1 Certification, in the form of completed data sheet.
 - 4. cULus Certification in the form of an affixed label to the equipment.
 - 5. The specified factory tests have been satisfactorily performed.
 - 6. The specified field tests have been satisfactorily performed.

1.2 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or provide replacement components of boilers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Fire-Tube Condensing Boilers:
 - a. The pressure vessel shall be guaranteed against thermal shock for the lifetime of the boiler when utilized in a closed loop hydronic heating system with a temperature differential of 120 °F or less. The boiler pressure vessel shall be guaranteed accordingly without a minimum flow rate or return water temperature requirement. The boiler shall not require the use of flow switches or other devices to ensure minimum flow.
 - b. The pressure vessel, tubes and tube sheets (heat exchanger) shall be guaranteed against flue gas corrosion and materials/workmanship for a period of 15 years. The condensate collection box shall be guaranteed for 20 years. The burner cylinder shall be warranted for a period of 5 years.
 - c. All parts not covered by the above warranties shall carry a 2 year warranty from startup, or 30 months from shipment, whichever occurs first. This shall include all electrical components and burner components.

1.3 PERFORMANCE REQUIREMENTS

- 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. ASME Compliance: Fabricate and label boilers to comply with the current version of the ASME Boiler and Pressure Vessel Code.

- C. ASHRAE/IES 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
- D. AHRI Testing: The boilers shall be tested and certified per AHRI requirements for efficiency ratings.
- E. UL Compliance: Test boilers for compliance with UL 795 and CAN1-3.1-77. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.
- F. CSA or cULus certified as an indirect or direct vent boiler and comply with standard CAN1-3.1-77.
- G. Boiler and controls shall be compliant with ASME CSD-1 Code requirements.

1.4 For securing boiler to concrete base.

- A. Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler pressure vessel, accessories, and components with reinforcement strong enough to withstand seismic forces as required for jobsite when mounting base is anchored to building structure. The boiler manufacturer shall provide required anchoring provisions. Contractor shall anchor boilers to meet manufacturer's recommendations.

PART 2 - PRODUCT

2.1 HIGH MASS FIRETUBE STAINLESS STEEL CONDENSING BOILERS

- A. Subject to compliance with requirements, provide Cleaver Brooks Clearfire Boiler(s) model CFC-E or approved equal by:
 - 1. Cleaver Brooks – Model Clearfire CFC-E (Basis of Design)
 - 2. Fulton Boiler Works, Inc. - Endura
 - 3. AERCO International - Benchmark
- B. Description: Each unit shall be furnished complete with burner and automatic controls. The boiler, with all piping and wiring, shall be a factory package. Each boiler shall be neatly finished, thoroughly tested and properly packaged for shipping. Boiler design and construction shall be in accordance with Section IV of the ASME Code for hot water heating boilers with a maximum working pressure of 125 PSIG.
- C. Heat Exchanger: Stainless steel combustion chamber.
- D. Pressure Vessel: Carbon steel with welded heads and tube connections.
- E. The boiler shall operate in a condensing mode when as little as 10% of the flow is returned to the low temperature return with a maximum temperature of 120°F.
- F. The boiler shall be low flow tolerant without minimum flow requirements or the use of a flow switch.
- G. Burner: Natural gas, forced draft burner mounted in and integral with the boiler.

1. The burner shall be a linkage-less, self-regulating, air-fuel ratio gas valve-venturi system. Burner regulation shall be accomplished without the use of fuel/air mixing valves.
 2. The burner shall be achieve sub 20 ppm NO_x when firing on natural gas at all firing rates.
- H. Burner Head: shall be constructed of a stainless steel metal fiber for solid body radiation of the burner flame. Combustion shall take place on the surface of the burner mantle, which shall be constructed of a woven stainless steel metal fabric resulting a 360 degree low temperature radiant flame.
1. Burner shall be minimum 5:1 fully modulating turndown. (Natural gas)
 2. Burner shall maintain no more than 7% O₂ levels throughout the firing rate without additional sensors, linkages, or controls.
- I. Blower: Centrifugal fan to operate during each burner firing sequence and to prepurge and postpurge the combustion chamber.
1. The blower motor shall have a variable speed ECM motor with integrated drive electronics.
- J. Gas Train: The gas train shall meet the requirements of CSA/UL and ASME CSD-1 and shall include:
1. Low Gas Pressure Interlock, manual reset.
 2. High Gas Pressure Interlock, manual reset.
 3. Upstream and downstream manual test cocks.
 4. Ball Type manual shutoff valve upstream of the main gas valve.
 5. Unibody double safety gas valve assembly.
 6. Gas Pressure Regulator
 7. Union connection to permit burner servicing.
 8. Proof of Closure Valve (6000 MBH only)
- K. Ignition: Spark ignition or Pilot ignition with 100 percent main-valve shutoff with UV scanner for flame supervision.
- L. Combustion air proving switch shall be furnished to ensure sufficient combustion airflow is present for burner ignition firing.
- M. To ensure that the flue is not blocked, the burner shall include a High Air Pressure Switch sensing the outlet pressure connection relative to stack backdraft.
- N. Casing:
1. Jacket: metal cabinet with snap-in or interlocking closures.
 2. Control Compartment Enclosures: NEMA 250, Type 1A.
 3. Finish: Powder-coated protective finish.
Insulation: mineral-fiber insulation surrounding the heat exchanger.
 4. Combustion-Air Connections: Inlet and vent duct collars.

2.2 TRIM

- A. Safety valve(s) shall be ASME Section IV approved side outlet type mounted on the boiler air vent outlet. Size shall be in accordance with code requirements and set to open at 50 psig.
- B. Temperature and pressure gauge shall be mounted on the water outlet.

- C. Solid State Low water cut-off probe control with manual reset and test switch.
- D. Manual Reset High Limit Temperature sensor; range not to exceed 210 deg F and shall be an integral device of the Boiler Burner Control and UL Recognized as a limit control.
- E. Outlet water supply sensing probe for operating water limit setpoint.
- F. Return water-sensing probe for operating limit setpoint.
- G. Drain valve
- H. Automatic air vent
- I. Auxiliary low water cutoff
- J. Alarm lights and horn
- K. Stack temperature sensor – UL Recognized as a limit control.
- L. Condensate neutralization kit combination tank and trap
- M. Automatic isolation valve, including valve, actuator, and transformer to power isolation valve through the boiler. The valve, actuator, and transformer shall ship loose for field installation and wiring.
 - 1. The isolation valve shall be 2-way resilient seated butterfly valve with ANSI 150# flanges.
 - 2. The electric actuator shall a 24VAC, spring return fail in safe position, with auxiliary end switch.

2.3 CONTROLS

- A. The Boiler shall include a computerized boiler burner control which shall be an integrated, solid state digital micro-processing modulating device, complete with sequence indication, fault reset, mode selection, and parameter set-point. It shall be mounted at the front of the boiler panel for easy access and viewing.
 - 1. Controller shall provide for both flame safeguard and boiler control through separate power supplied CPU's (to meet NFPA).
 - 2. Burner sequencing with safe start check, pre-purge, Electronic direct spark ignition and post purge. A UV scanner shall be used to prove combustion.
 - 3. Flame Supervision. The control shall provide pre-purge and post-purge and shall maintain a running history of operating hours, number of cycles, and the most recent fifteen lockouts. The control shall be connected to a touchscreen display interface that will display this information in clear English text descriptions.
 - 4. Safety Shutdown with display of lockout or hold condition.
 - 5. PID modulating control of the variable speed fan for firing capacity relative to load requirements to meet supply water temperature set point.
 - 6. Gas pressure supervision, high and low.
 - 7. Combustion Air Proving Supervision.

8. High Air Pressure Supervision.
9. The supply temperature and set-point temperature shall be displayed at all times on the touch screen display.
10. Controller shall be equipped with a touch screen display for set up, trouble shooting, and operational display, and shall include ModBus communication capability of this information.
11. Include the programming of circulating pump or isolation valve control and support the control of 2 heating demand loops.
 - B. All parameter input control set-points shall be factory pre-configured. Parameter settings are to be established to suit jobsite conditions -- settings shall be configured at the initial jobsite setup.
 - C. All controls to be panel mounted.
 - D. Electrical power supply shall be 115 volts, 60 cycle single phase.
 - E. When multiple boilers are to be installed together, a system integration control shall be provided to stage boilers. The control shall include automatic selection of needed boilers based on energy demand, an adjustable outdoor reset schedule, and system programming. The control shall stage and modulate the boilers utilizing firing rate threshold staging and parallel modulation to optimize condensing potential while minimizing energy wasting short cycling. This strategy shall take full advantage of the inverse efficiency characteristic (lower fire rate, higher efficiency) of condensing boilers. The control shall monitor supply water temperature, return water temperature and shall communicate between boilers via RS-485 network wiring.
 - F. Boilers shall communicate with BACnet I/P building management system utilizing a protocol translator for requirements other than the native ModBus RTU.
 1. Protocol translator shall be mounted in a NEMA 1 panel with power supply and terminals.
 2. Protocol translator shall be shipped loose for installation in boiler control panel with required power supply.
 - G. The boiler controls shall include provisions for outside air reset.
 - H. The boiler controls shall include provisions for sending signal to open/close automatic isolation valve.
 - I. Boiler shall have capability to have 24/7 remote monitor without connections to a BAS through an encrypted secure channel. The remote interface shall have the following features and capabilities
 - a. Display real time boiler system operation, cycle counts, temperature readings, and runs hours, firing rate, steam pressure, inlet/outlet water temps, alarms, stack temperature, and more
 - b. View data on mobile app and customizable online dashboard
 - c. Multiple user authorization with different levels of access
 - d. Multiple site integration to allow user to see all boiler plants and control individual plants
 - e. Email and text alerts
 - f. Data trending

2.4 ELECTRICAL POWER

- A. Single-Point Field Power Connection: Factory-installed and -wired electrical devices necessary shall provide a single-point field power connection to boiler. Separate power and control connections will not be allowed.
 - 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 or conduit.

2.5 VENTING

- A. Exhaust Stack: Complete system, per UL 1738 for Category IV appliances, stainless steel, pipe, vent terminal, thimble, vent adapter, and sealant.
 - 1. Stack to be designed and manufactured by boiler manufacturer.
- B. Combustion-Air Intake: Complete system, PVC, pipe, vent terminal with screen, inlet air coupling, and sealant, by others.

2.6 SOURCE QUALITY CONTROL

- A. Burner and Hydrostatic Test: Factory pressure test gas train, test fire burner and gas train assembly, and perform a functional controls test for all safety devices; perform hydrostatic test.
- B. Test and inspect factory-assembled boilers, before shipping, according to most current ASME Boiler and Pressure Vessel Code.

PART 3 - EXECUTION

3.1 BOILER INSTALLATION

- A. Installation shall be provided by the contractor in accordance with manufacturer's recommendations. All of the contractor's work shall be performed by experienced personnel previously engaged in boiler plant construction and shall be under the supervision of a qualified installation supervisor.
- B. Equipment Installation:
 - 1. Comply with manufacturer's recommendations for seismic-restraint devices.
 - 2. Install equipment in strict compliance with manufacturer's installation instructions.
 - 3. Install equipment in strict compliance with state and local codes and applicable NFPA standards.
 - 4. Maintain manufacturer's recommended clearances around sides and over top of equipment.
 - 5. Install components that were furnished loose with equipment for field installation.
 - 6. Provide all interconnecting electrical control and power wiring.
 - 7. Provide all fuel gas vent and service piping.
 - 8. Provide all piping for boiler pipe connections.

3.2 CONNECTIONS

- A. Install piping adjacent to boiler to allow service and maintenance.
- B. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection.
- C. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas-train connection.
- 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. Boiler Venting:
 - 1. Install flue venting and combustion-air intake.
- G. Connect wiring according to manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

- A. General: The boiler supplier's factory authorized service organization shall be responsible for performance of inspections, start up and testing of the package boiler, and accessory equipment and materials furnished under this Section. A detailed written record of the startup performance, including burner setting data over the entire load range shall be furnished to the engineer before final acceptance. All labor, equipment, and test apparatus shall be furnished by the authorized service organization. All equipment defects discovered by the tests shall be rectified either by the service organization or boiler manufacturer.
- B. Equipment inspection: Boiler representative shall inspect boilers and other equipment, verifying completeness of the installation.
- C. Equipment shall be flushed prior to start-up in accordance with the manufacturer's recommendations.
- D. Start-up shall be conducted by experienced and factory authorized technician in the regular employment of the authorized service organization, and shall include:
 - 1. Demonstrate that boiler, burner, controls, and accessories comply with requirements.
 - 2. Readings at different firing rates (20, 50, 75 and 100%) of load for the modulating burner shall be taken with a written report of the tests submitted to the engineer. The reports shall include readings for each firing rate tested and include stack temperatures, O₂, CO, NO_x, and overall boiler efficiency.
 - 3. Auxiliary Equipment and Accessories: Observe and check all valves, draft fans, electric motors and other accessories and appurtenant equipment during the operational and capacity tests for leakage, malfunctioning, defects, and non-compliance with referenced standards or overloading as applicable.
 - 4. Commissioning Requirements:

1. Fireside inspection
2. Set up fuel train and combustion air system
3. Set up operating set points
4. Check all safeties, including Flame safeguard, LWCO, Airflow, Fuel pressures, High limits.
5. Set up and verify efficiencies at 20%, 50%, 75%, and 100%
6. Set up and verify burner turndown.

3.4 DEMONSTRATION

- A. Provide Owner training to include all safety procedures, maintenance procedures, control operations, and diagnostic procedures.

END OF SECTION 235216

SECTION 237313 - MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Casing panels shall be self-supporting and capable of withstanding ± 5 " static pressure, without panel joints exceeding a deflection of L/200 where "L" is the unsupported span length within completed casings.

1.2 SUBMITTALS

- A. Product Data: For each air-handling unit indicated.
 - 1. Unit dimensions and weight.
 - 2. Cabinet material, metal thickness, finishes, insulation, and accessories.
 - 3. Fans:
 - a. Certified fan-performance curves with system operating conditions indicated.
 - b. Certified fan-sound power ratings.
 - c. Fan construction and accessories.
 - d. Motor ratings, electrical characteristics, and motor accessories.
 - 4. Certified coil-performance ratings with system operating conditions indicated.
 - 5. Dampers, including housings and linkages.
 - 6. Filters with performance characteristics.

1.3 QUALITY ASSURANCE

- A. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.
- B. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.4 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: One set for each air-handling unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Trane; American Standard Inc.
 2. Carrier Corporation; a member of the United Technologies Corporation Family.
 3. YORK by Johnson Controls.

2.2 UNIT CASINGS

- A. General Fabrication Requirements for Casings:
1. Materials: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed. Casing shall be supported in such a manner so that maximum allowable air leakage shall not exceed 1% and panel deflection shall not exceed a L/200 ratio when subjected to ± 5 -in. w.g. static pressure. All panels shall be completely gasketed prior to shipment and shall be removable for unit access and removal of components. Removal of any or all panels shall not affect the structure integrity of the unit.
 - a. Outside Casing: Galvanized steel.
 - b. Inside Casing: Galvanized steel.
 - c. Floor Plate: Galvanized steel.
 2. Factory Finish for Galvanized-Steel Casings: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on enamel finish, consisting of prime coat and thermosetting topcoat.
 3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
- B. Casing Insulation: Comply with NFPA 90A.
1. Thermal Resistance (R-Value): Minimum 12.
 2. Location and Application: Encased between outside and inside casing.
- C. Inspection and Access Panels and Access Doors:
1. Panel and Door Fabrication: Formed and reinforced, double-wall and insulated panels of same materials and thicknesses as casing.
 2. Inspection and Access Panels:
 - a. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
 - b. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.
 3. Access Doors:
 - a. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.

- b. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - c. Size: At least 14 inches wide by full height of unit casing.
- 4. Locations and Applications:
 - a. Fan Section: Doors.
 - b. Coil Section: Doors
 - c. Filter/Damper Section: Doors large enough to allow periodic removal and installation of filters.
- D. Condensate Drain Pans:
 - 1. Fabricated with one percent minimum slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and to direct water toward drain connection.
 - a. Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1-2004.
 - b. Depth: A minimum of 2 inches deep.
 - 2. Formed sections.
 - 3. Double-wall, stainless-steel sheet with space between walls filled with foam insulation and moisture-tight seal.
 - 4. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - a. Minimum Connection Size: NPS 1.
 - 5. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.
- E. Air-Handling-Unit Mounting Frame: Formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.

2.3 FAN, DRIVE, AND MOTOR SECTION

- A. Fan and Drive Assemblies: Statically and dynamically balanced direct drive fans designed for continuous operation at maximum-rated fan speed and motor horsepower.
 - 1. Shafts: Designed for continuous operation at maximum-rated fan speed and motor horsepower, and with field-adjustable alignment.
 - a. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
 - b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
- B. Centrifugal Fan Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.
 - 1. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 - 2. Housing for Supply Fan: Attach housing to fan-section casing with metal-edged flexible duct connector.

3. Flexible Connector: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized-steel sheet or 0.032-inch- thick aluminum sheets; select metal compatible with casing.
 - a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.
 - 1) Fabric Minimum Weight: 26 oz./sq. yd..
 - 2) Fabric Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3) Fabric Service Temperature: Minus 40 to plus 200 deg F.
- C. Plenum Fan Housings: Steel frame and panel; fabricated without fan scroll and volute housing.
- D. Fan Shaft Bearings:
 1. Grease-Lubricated Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing with grease lines extended to outside unit.
 - a. Ball Bearing Rating Life: ABMA 9, L10 of 200,000 hours
 - b. Roller Bearing Rating Life: ABMA 11, L10 of 200,000 hours.
- E. Internal Vibration Isolation: Fans shall be factory mounted with manufacturer's standard vibration isolation mounting devices having a minimum static deflection of 1 inch.
- F. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified for motors.
 1. Enclosure Type: Totally enclosed, fan cooled.
 2. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
 3. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.4 COIL SECTION

- A. General Requirements for Coil Section:
 1. Comply with ARI 410.
 2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
 3. Coils shall not act as structural component of unit.
- B. Water Coils: Continuous circuit coil fabricated according to ARI 410.
 1. Piping Connections: Threaded, on same end.
 2. Tubes: Copper
 3. Fins: Aluminum with fin spacing as scheduled.
 4. Fin and Tube Joint: Mechanical bond.
 5. Headers: Cast iron with drain and air vent tapings or seamless copper tube with brazed joints, prime coated.
 6. Frames: Galvanized-steel channel frame, 0.052 inch.
 7. Ratings: Design tested and rated according to ASHRAE 33 and ARI 410.
 - a. Working-Pressure Ratings: 200 psig, 325 deg. F.
 8. Source Quality Control: Test to 300 psig and to 200 psig underwater.

2.5 AIR FILTRATION SECTION

A. General Requirements for Air Filtration Section:

1. Comply with NFPA 90A.
2. Provide filter holding frames arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
3. The filters shall be 2 inch, MERV 8, 30 percent efficient, throwaway type mounted in front loading frames.

2.6 DAMPERS

- A. General Requirements for Dampers: Leakage rate, according to AMCA 500, "Laboratory Methods for Testing Dampers for Rating," shall not exceed 2 percent of air quantity at 2000-fpm face velocity through damper and 4-inch wg pressure differential.
- B. Outdoor- and Return-Air Mixing Dampers: Parallel-blade, double-skin, airfoil design galvanized-steel dampers mechanically fastened to steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously. Dampers shall have jamb and blade edge seals.

2.7 SOURCE QUALITY CONTROL

- A. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.
- B. Fan Performance Rating: Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."
- C. Water Coils: Factory tested to 300 psig according to ARI 410 and ASHRAE 33.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Equipment Mounting: Install air-handling units on concrete bases unless otherwise indicated. Secure units to anchor bolts installed in concrete.
- B. Arrange installation of units to provide access space around air-handling units for service and maintenance.
- C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during testing, with new, clean filters.

3.2 CONNECTIONS

- A. Install piping adjacent to air-handling unit to allow service and maintenance.
- B. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.
- C. Connect condensate drain pans using 1 inch minimum schedule 40 PVC pipe. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction. Where the unit bottom is too near the floor to install the recommended depth of trap, cut out the floor to sufficient depth to install the trap as recommended by the manufacturer.

- D. Hot- and Chilled-Water Piping: Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

3.3 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.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Leak Test: After installation, fill water coils with water, and test coils and connections for leaks.
 - 2. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that shipping, blocking, and bracing are removed.
 - 3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
 - 4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
 - 5. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.
 - 6. Comb coil fins for parallel orientation.
 - 7. Install new, clean filters.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.
- B. Starting procedures for air-handling units include the following:
 - 1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm.
 - 2. Measure and record motor electrical values for voltage and amperage.
 - 3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.5 ADJUSTING

- A. Adjust damper linkages for proper damper operation.

3.6 CLEANING

- A. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

END OF SECTION 237313

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUBMITTALS

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

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. 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. 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.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Stranded.
- B. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION, APPLICATIONS AND WIRING METHODS

- A. Common Neutrals Prohibited: Every feeder and branch circuit that has a grounded conductor (a neutral conductor) shall have its own individual, dedicated grounded conductor throughout the length of the circuit. This grounded conductor shall terminate to the neutral bus in the panelboard or switchboard containing the circuit's overcurrent protective device and shall not be connected to the grounded conductor of any other circuit.

3.3 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Feeders: Type THHN-THWN, single conductors in raceway unless otherwise indicated.
- B. Branch Circuits: Type THHN-THWN, single conductors in raceway unless otherwise indicated.
- C. Control Circuits: Type THHN-THWN, in raceway unless otherwise indicated.

3.4 INSTALLATION OF CONDUCTORS AND CABLES

- A. Use manufacturer-approved pulling compound or lubricant where necessary; compound used shall 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. Final routing and location of branch circuit raceways shall be determined by contractor.

3.5 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.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test conductors for continuity and insulation integrity.
 - 2. Perform visual and mechanical inspection and electrical tests as described in NETA Acceptance Testing Specification.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.

2.2 CONNECTORS

- A. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts. Clamp type, sized for pipe.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Copper.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

- A. Rated Strength: All components connecting to the structure shall be selected to be adequate in tension, shear, and pullout strength to resist maximum loads calculated or imposed, with a minimum structural safety factor of five times the applied force.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 2. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 3. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - 2. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 3. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 4. Toggle Bolts: All-steel springhead type.
 - 5. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

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 where requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel support system, sized so loads can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry applied loads. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 6. To Cold Formed Steel: Sheet metal screws.
 - 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate .
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

3.4 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.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Product Data: For surface raceways and fittings.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. EMT: ANSI C80.3.
- D. FMC: Zinc-coated steel.
- E. LFMC: Flexible steel conduit with PVC jacket.
- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Fittings for EMT: Steel or die-cast, set-screw or compression type.
- G. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- D. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Comply with the following indoor applications, unless otherwise indicated:
 - 1. Exposed: Rigid galvanized steel or intermediate grade conduit. Conduits installed in joist space may be EMT.
 - 2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 - 3. Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.
- B. Minimum Raceway Size: 3/4-inch trade size.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Where height of horizontal raceways is not specifically indicated, install as high as possible.
- C. Complete raceway installation before starting conductor installation.
- D. 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.
- E. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- F. 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.
- G. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
- H. Raceways shall be installed parallel with building lines.
- I. The contractor shall be responsible for determining raceway sizes and quantities and for determining how conductors are to be grouped in raceways in accordance with NEC requirements where not indicated on drawings or in specifications.

3.3 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 260533

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUBMITTALS

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

1.2 QUALITY ASSURANCE

- A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 3. Leviton Mfg. Company Inc. (Leviton).
 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5351 (single), 5352 (duplex).
 - b. Hubbell; HBL5351 (single), CR5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 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 Unfinished Spaces: Galvanized steel.

2.4 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: Almond or Ivory, unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise indicated.
- B. Conductors:
 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
- C. Device Installation:
 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 2. Keep each wiring device in its package or otherwise protected until it is time to connect 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. Tighten unused terminal screws on the device.
 7. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- D. Arrangement of Devices:
 1. Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top.

3.2 IDENTIFICATION

- A. Receptacles: Identify panelboard and circuit number from which served. Label inside of device plate.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 1. Test Instruments: Use instruments that comply with UL 1436.
 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Tests for Convenience Receptacles:
 1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.

3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Comply with NEMA FU 1 for cartridge fuses.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Edison Fuse, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

- A. Cartridge Fuses:
 - 1. Motor Branch Circuits: Low Peak, time delay.
 - 2. Other Branch Circuits: Low Peak.
 - 3. Control Circuits: Class CC, Low Peak.

3.2 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUBMITTALS

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

1.2 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.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; a brand of Schneider Electric.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 4. Siemens Energy & Automation, Inc.
- B. Heavy Duty, Single or Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

2.2 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; a brand of Schneider Electric.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 4. Siemens Energy & Automation, Inc.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.

2.3 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fuses in fusible devices.
- B. Comply with NECA 1.

3.2 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

3.3 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816

SECTION 283113 – EXTENSION OF EXISTING FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

- A. Extension of existing fire alarm system.
- B. All wiring shall be in raceways, meeting requirements of Division 26 – Electrical specifications for power wiring.
- C. All wiring shall meet the recommendations of the system manufacturer.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as, an extension of existing system.

1.4 PROJECT CONDITIONS

- A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
 - 1. Notify Owner no fewer than two days in advance of proposed interruption of fire-alarm service.
 - 2. Do not proceed with interruption of fire-alarm service without Owner's written permission.

PART 2 - PRODUCTS

2.1 SYSTEMS OPERATIONAL DESCRIPTION

- A. Match operation of existing system.

2.2 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
 - 1. Comply with UL 268.
 - 2. Detectors shall match existing.
- B. Duct Smoke Detectors: Type shall match existing complying with UL 268A.

1. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
2. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
 1. Connect new equipment to existing control panel in existing part of the building.
 2. Expand, modify, and supplement existing equipment as necessary to extend existing functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
- C. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

3.2 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Tests and Inspections:
 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

END OF SECTION 283113

