BID DOCUMENTS FOR:

MUSKEGON AREA ISD

WESLEY SCHOOL

MECHANICAL UPGRADES

WESLEY SCHOOL

915 E. WESLEY AVE.

MUSKEGON, MI 49441

CONSTRUCTION HANDBOOK

A/E PROJECT 1347-23

CONCEPT DESIGN STUDIO

800 EAST ELLIS ROAD, SUITE #508

NORTON SHORES, MI 49441

PHONE: (231) 799-4838

Concept Design Studio
800 East Ellis Road, Suite #508, Norton Shores, MI 49441
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Applicable Provisions of bidding requirements, project guidelines and general requirements (Division 1) apply to the work specified in these sections.

Concept Design Studio **PH: (231) 799-4838**
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SECTION 00 11 13
NOTICE TO BIDDERS

1 .1 NOTICE TO BIDDERS

A. Muskegon Area Intermediate School District (MAISD), Muskegon, Michigan, will receive proposals from qualified contractors for mechanical upgrades / boiler replacement @ Wesley School, 915 Wesley Ave., Muskegon, MI 49442

B. The Owner will enter into one contract with the successful Mechanical Contractor who will be fully responsible for all trades and for coordination of all required work between trades. It is the owner's goal to complete this project before the end of 2023.

C. Proposals must be mailed or delivered in person to Mr. Michael Schluentz, Associate Superintendent, MAISD Administrative Offices, 684 Harvey Street, Suite 202, Muskegon, MI 49442; Phone: 231-777-2637. All proposals must be sealed in envelopes, plainly labeled "Mechanical Upgrades – Wesley School" and must be received prior to 2:00 P.M., local time, on Friday, July 14th, 2023. Bids will be publicly opened @ the MAISD South Admin. offices, 684 Harvey Street, Muskegon, MI 49442 @ 2:00. Evaluation of proposals and award will be at a later date; the successful contractor will receive a letter of intent prior to receipt of contract.

D. A Pre-bid meeting will be held on Thursday July 6th, 2023 @ 2:30 PM, starting at the CTC, East entry and continuing on to the other 2 sites. For additional access please contact Steve Fillmore, Maintenance Supervisor, for access to the building. (231) 767-3695.

E. The Schedule of Work shall be as follows:

July 6th, 2023 @ 2:30 PM	Pre-Bid Conference
July 14th, 2023 at 2:00 PM	Bids Due
July 17th, 2023	Anticipated award of contract
July 18th, 2023	Anticipated start of construction
December 30th, 2023	Anticipated substantial Completion

F. All bidders are required to furnish Bid Security in the amount of five (5%) percent of the Base Bid. Form of the security may be a bid bond, certified or cashiers' check made payable to MAISD. This will be a guarantee that the bidder selected by the MAISD will furnish the required PLM Bonds; failure to do so could mean forfeiture of the Bid Security.

G. All bidders must indicate, where shown on the Proposal Form, the cost of Performance and Labor and Material Payment Bonds covering 100% of the value of the Project. Do not include the cost of the Bonds in the Base Bid.

H. All bids shall be accompanied by a sworn statement disclosing any familial relationship that exists between the owner(s) or any employee of the bidder and any member of the Board of Education of the School District or the Superintendent of the School District. The Board of Education shall not accept a bid that does not include a sworn and notarized familial relationship disclosure statement.

I. All bids shall be accompanied by Affidavit of Compliance – Iran Economic Sanctions Act in compliance with "Iran linked business" within the meaning of the Iran Economic Sanctions Act, Michigan Public Act No. 517 of 2012. The Board of Education shall not accept a bid that does not include the Affidavit of Compliance.

J. Applicable Michigan use and sales tax apply to this project.

K. All bidders should note that this project is being funded with local resources and does not require prevailing wages.

L. Availability of Documents: Complete sets of documents may be obtained at the following address:

Ajax Imaging; 777 East Sherman Boulevard, Muskegon, MI 49444.

Drawings may be viewed at the Architects office.

Contact the Architect for digital files.

M. The Owner reserves the right to accept or reject any or all bids and to waive all irregularities in Proposals. Proposals shall remain firm for thirty (30) days from date of Bid Opening.

END OF SECTION

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SECTION 00 22 13
SUPPLEMENTAL / SPECIAL CONDITIONS TO THE INSTRUCTIONS TO BIDDERS

THE FOLLOWING CONDITIONS AMEND, SUBTRACT OR ADD TO THE
INSTRUCTIONS TO BIDDERS, AIA DOCUMENT A-701, 1997 EDITION

ARTICLE 2

BIDDERS REPRESENTATIONS

2.1.4 DELETE the word “Bid” and INSERT therefore the words “Base Bid”.

ARTICLE 3

BIDDING DOCUMENTS

3.3 SUBSTITUTIONS

3.3.2 In the first sentence DELETE all the wording after the word “unless” and in the second sentence DELETE the first two words “Such requests”. INSERT the word “it” after “unless” and join the first two sentences together.

ARTICLE 4

BIDDING PROCEDURES

4.1 FORM AND STYLE OF BIDS

4.1.7 DELETE the words “Copy of the” after the first word “Each”. In the third sentence DELETE the word “copy” after the word “Each” and INSERT the word “Bid”.

ARTICLE 7

PERFORMANCE BOND AND PAYMENT BOND

7.1 BOND REQUIREMENTS

7.1.1 DELETE this paragraph and INSERT the following:

If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract. The Owner, subsequent to the award of contracts, shall reimburse the cost of their Bond Premiums to the Bidder upon submission of the Bidders premium cost invoice to the Owner. Bonds may be secured through the Bidder’s usual sources.

ADD the following paragraph:

7.1.4 The Owner reserves the right to waive bonds for any Contractor. All Bidders shall anticipate the need to provide bonds; however, the cost of these bonds shall **not** be included in the Base Bid.

11.3.7 THRU 11.3.10 DELETE these sections completely.

11.4.1 MODIFY as follows:

11.4.1 Each Contractor to whom awards are made and if required shall furnish a contract Performance Bond and Labor Material Payment Bond within ten (10) days after official notice of the contract by the Owner. Said contract Performance Bond shall be in the amount at least equal to one hundred percent (100%) of the contract price as security for:

1) The faithful performance of all provisions of the contract and the satisfactory completion of work included thereunder.
2) The payment of all persons performing labor and furnishing materials in connection with the contract.
3) The covering all guarantees included herein.

11.4.3 ADD the following:
The successful bidder must furnish a Labor and Material Payment Bond for the full amount (100%) of the contract with the same conditions as stated.

END OF SECTION

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SECTION 00 24 12
PROPOSAL SECTION

ATTENTION ALL BIDDERS

A. MANDATORY INTERFACES

A.1 The scope of each contractor's work is defined in these specifications. Each sub-contractor shall familiarize himself with the requirements of those trades that interface with his own. He shall consider the fact that his work will interface with the work of another sub-contractors.

B. BIDDING AND AWARDS

B.1 All Contractors must submit their proposals on the form provided. Failure to do so will jeopardize the offerers chances of receiving an award.

C. ACCEPTANCE OR REJECTION OF BIDS

C.1 The bidder acknowledges the right of the Owner to accept or reject any and all bids and to waive any informality or irregularity in any bid received.

C.2 The bidder further represents that neither his Work nor the Work of other sub-contractors will be prejudiced because of sex, race, color, creed, or labor affiliation of other contractors under Contract to the Owner on this project.

D. PROMPTNESS OF EXECUTION

D.1 It is the intention of the Owner to complete the Project by Fall of 2023. Whereas varying conditions inherent to construction will vary the progress of the work, it is the intent of this contract that each sub-contractor maintain the progress at the quickest possible pace.

E. PAYMENT FOR STORED MATERIALS

E.1 As a means of offsetting escalation on short-lead items of material and equipment, and in the interest of obtaining good competitive bids, the Owner will provide payment for contract items stored off as well as on the site of the work. In order to qualify for payment, the material or equipment must be safely stored, protected and insured against loss or damage, inspected and dedicated to this Project only. Any extra cost of off-site storage is to be included in the proposal.

E.2 Materials stored within contract limits shall be in an area designated by the Owner. Materials or equipment lost through theft or mishandling shall be replaced by the contractor without cost to the Owner.

F. QUALITY CONTROL BY OWNER

F.1 The quality and completeness of the work is to be maintained on a day to day basis. Inaccurate, faulty, incomplete and defective work shall be corrected by the contractor as it is brought to his attention by the Owner's Representative. Failure to cooperate in this continuous punch list effect will affect completion percentages developed for Progress Payments. When your work is complete, request inspection.

G. CONTRACTOR QUALITY CONTROL

G.1 It is the intent that each sub-contractor be responsible for the quality of his workmanship within the requirements of the contract documents and within the context of the level of workmanship inherent to the industry. Every care shall be exercised to ensure that the quality specified is the quality provided.

G.2 If at any time a contractor is of the opinion that the quality of his work is, or will be, jeopardized as a result of the schedule or coordination of the Project, or for any other reason known to him, he shall immediately stop work and just as immediately inform the Owner of his action and reasons therefore. The contractor shall document his action and his reasons in writing on the same day his action took place, and submit it to the Owner for the record, with a copy sent to the Architect. Upon immediate investigation by the Owner and the Architect, a decision shall be made on the point of jeopardy, and the problem resolved in accordance with the intent of the contract documents.

H. LAYOUT AND MEASUREMENTS

I.1 The responsibility for all layout and measurements pertaining to the work of each sub-contractor is his own. Each sub-contractor shall verify the dimensional accuracy of the work his work is reliant upon. He shall report all inaccuracies to the Architect and not proceed until corrections are made. If a Contractor inadvertently or knowingly, proceeds with his work on dimensionally inaccurate work of another, he will be liable for the cost of all corrections to his work when the error is corrected. (Ref. Article 18 Supplemental General Conditions)

I. MANDATORY ATTENDANCE AT MEETINGS

I.1 It is the responsibility of each sub-contractor, under the terms of the contract, to attend Project and Progress Meetings as determined by the Owner. (Ref. Article 17 Supplemental General Conditions)

J. FINAL PUNCH LIST PROCEDURE

J.1 When the Primary Contractor's work is ninety-five percent (95%) complete, he will be provided with a blank Certificate of Substantial Completion, which he is to file with the Owner after proper certification by the A/E. A listing of work in need of correction and a list of incomplete items shall be attached to the Certificate when it is filed by the Contractor. The A/E shall have input to each list so as to insure their completeness.

J.2 The Primary Contractor will be allowed fifteen (15) days to complete the items on both of his lists beginning from the date stipulated on the Certificate of Substantial Completion. To insure this accomplishment, the Owner shall issue a letter to the General Contractor, on the date the Owner accepts the Substantial Completion status of each sub-contractor, and in accordance with Article 3.4 of the General Conditions of Contract, AIA Document A201.

J.3 The Primary Contractor shall begin completion and correction activities within seven (7) days of receipt of the letter and complete all activities within the fifteen (15) day period specified. Contractors failing to perform in accordance with these time parameters will be subject to the provisions of Article 3.4 and the work will be completed by others as provided.

K. PRE ON-SITE ACTIVITY MEETINGS

K.1 The Primary Contractor and sub-contractors are required to meet on the site with the Owner prior to beginning his work on site. The purpose of the meeting is to thoroughly review the intent of the contract documents. Attendance at the pre-construction meeting qualifies a Contractor for this requirement.

END OF SECTION

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SECTION 00 24 13
DESCRIPTION OF WORK

1 DESCRIPTIONS

1 .1 MECHANICAL CONTRACTOR

A. Work Included: The contract of this work shall include all the labor, materials, and permits necessary and incidental to the complete construction, as specified herein for the mechanical Upgrades / Boiler replacement at the existing Wesley School, 915 Wesley Avenue.

B. This facility **will** be occupied during construction.

C. The contractor shall maintain proper barricades and other protection for the public.

D. The mechanical Contractor shall provide, a part-time field superintendent acceptable to the Owner, and coordinate the Mechanical work and all other Sub-trades.

E. Building Layout: It shall be the responsibility of the Mechanical Contractor to have the building laid out, establishing all lines and grades and maintaining a check on the same throughout construction. Mechanical contractors shall be responsible for maintaining all invert elevations in relation to finish floor elevations as set by this Contractor.

F. Guarantee and Waiver of Lien:

1. All work shall be guaranteed for one year from date of acceptance, unless specifically required for a longer guarantee, during which time any imperfections or failure of products, which may develop in workmanship or materials shall be made good without cost to the Owner.
2. When required for payment or closing out of contract, guarantees and waivers of liens shall be provided by contractors, sub-contractor and materials suppliers.

G. Permits:

1. The Mechanical Permit required for the Proposed Project will be obtained from the City of Muskegon.
2. The Mechanical Contractor shall be responsible for any additional permits required by the City of Muskegon or Muskegon County, Michigan.
3. The Mechanical Contractor is also responsible to pay for any and all fees in connection with the required permits and permit applications.
4. Permits are required for, but not limited to, the following:
    a. Mechanical / Boiler work
    b. Electrical

H. Bonding & Licensing: The Mechanical and Sub-Contractors are required to comply with the City of Muskegon requirements for Bonding, Insurance and Licensing before commencement of any and all work.

1 .2 MECHANICAL CONTRACTOR – PRIMARY CONTRACTOR

A. The contract of this work shall include removal and furnishing & installation of a new boilers, completely operable and tested per the following specifications.

B. Also included are sales tax, layout and cleanup, all necessary equipment, labor, inspections and approvals, and responsibility for receiving of equipment, erection and startup.

END OF SECTION

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SECTION 00 41 00
PROPOSAL FORM

PROPOSAL DUE

(July 14th, 2023 at 2:00 P.M., Local Time)

The **MECHANICAL CONTRACTOR PROPOSAL** shall include and cover ALL TRADES, including but not limited to; Mechanical trades and required sub-trades, as well as being responsible for all coordination between trades.

_____

Please indicate Company name above. PROJECT: "Mechanical Upgrades – Wesley School"

TO: Muskegon Area ISD
684 Harvey Street
Suite 202
Muskegon, MI 49442

ATTN: Michael Schluentz

The undersigned represents that they have:

A. Familiarized themselves with the local conditions affecting the cost of the work and with the Contract Documents, including Instructions to Bidders; Proposal Section; General, Supplementary and Special Conditions; etc., Drawings, Specifications and any Addenda issued and on file at the office of Concept Design Studio, Inc. 800 E. Ellis Road, Suite 508, Norton Shores, MI 49441, and hereby proposes to perform everything required to provide and furnish all labor, materials, necessary tools, expendable equipment, and all utility and transportation services, etc., necessary to perform and complete in a workmanlike manner all of the Work required for the Mechanical Upgrades at Wesley School, 915 Wesley Ave., Muskegon, MI 49442.

B. in accordance with the Contract Documents, including Addenda No. ,_____,_____.

C. Included with this proposal a Bid Bond, Certified or Cashier's Check in the amount of five (5) percent or_____dollars ($_____).

D. Reviewed the Work fully understands the scope of the work required by interfacing Sub-Contractors as well as that required by the General Contractor, all of which is covered in this Proposal.

E. Agreed that their proposal, if accepted by the Owner, will be the basis for a contract directly with the Owner and to enter into such contract in accordance with the Intent of the Contract Documents.

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BASE BID

The work described and specified shall be performed for the following Lump Sum, such amount constituting the Base Bid:

_____dollars ($_____)
(amount of bid)

Number of days or date of Substantial Completion _____days or by _____

PLM BOND

The cost for the Performance Bond and Labor and Material Payment Bond for the Base Bid Work shall be _____dollars ($_____) in addition to the Base Bid cost.

VOLUNTARY ALTERNATES

It is understood that if the following voluntary alternates are accepted, the base bid proposal will be adjusted accordingly:

ITEM DESCRIPTION (Note Add or Deduct)

NO. 1:_____

_____

_____

NO. 2:_____

_____

_____

NO. 3:_____

_____

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AGREEMENT

In submitting this bid, it is understood that the right is reserved by the Owner to reject any or all bids. It is agreed that this bid is binding for a period of thirty (30) - days from the opening thereof.

Date _____

COMPANY NAME _____

ADDRESS _____

_____

PHONE _____

BY _____
(Signature)

_____
(Type or Print)

TITLE _____

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AFFIDAVIT OF BIDDER

The undersigned, the owner or authorized officer of_____ (the "Bidder"), pursuant to the familial disclosure requirement provided in the Muskegon Area ISD (the "School District") advertisement for construction bids, hereby represent and warrant, except as provided below, that no familial relationships exist between the owner(s) or any employee of_____ and any member of the Board of Education of the School District or the Superintendent of the School District.

List any Familial Relationships:

BIDDER:

_____

By: _____

Its: _____

STATE OF MICHIGAN)
)ss.
COUNTY OF_____)

This instrument was acknowledged before me on the_____day of_____, 2015, by_____.

_____
, Notary Public

_____County, Michigan

My Commission Expires: _____

Acting in the County of: _____

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AFFIDAVIT OF COMPLIANCE – IRAN ECONOMIC SANCTIONS ACT

Michigan Public Act No. 517 of 2012

The undersigned, the owner or authorized officer of_____ (the "Bidder"), pursuant to the compliance certification requirement provided in the **Muskegon Area ISD** (the "School District") Request For Proposals For **Mechanical Upgrades – Wesley School** hereby certifies, represents and warrants that the Bidder (including its officers, directors and employees) is not an "Iran linked business" within the meaning of the Iran Economic Sanctions Act, Michigan Public Act No. 517 of 2012 (the "Act"), and that in the event Bidder is awarded a contract / purchase order as a result of the aforementioned Request For Proposal, the Bidder will not become an "Iran linked business" at any time during the course of performing the Work or any services under the contract.

The Bidder further acknowledges that any person who is found to have submitted a false certification is responsible for a civil penalty of not more than $250,000.00 or 2 times the amount of the contract/purchase order or proposed contract for which the false certification was made, whichever is greater, the cost of the School District's investigation, and reasonable attorney fees, in addition to the fine. Moreover, any person who submitted a false certification shall be ineligible to bid on a request for proposal for three (3) years from the date it is determined that the person has submitted the false certification.

BIDDER:

_____

By: _____

Its: _____

Date: _____

STATE OF_____)
)ss.
COUNTY OF_____)

This instrument was acknowledged before me on the_____day of_____, 2020, by_____.

_____
, Notary Public

_____County, Michigan

My Commission Expires: _____

Acting in the County of: _____

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SECTION 01 33 00
SUBMITTALS AND SUBSTITUTIONS

1 GENERAL

1 .1 DESCRIPTION

A. Work Included:

1. Wherever possible throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined by manufacturer's name and catalog number, reference to recognized industry and government standards, or description of required attributes and performance.
2. To ensure that the specified products are furnished and installed in accordance with design intent, procedures have been established for advance submittal of design data and for their review by the Architect/Engineer.
3. Make all submittals required by the Contract Documents, and revise and resubmit as necessary to establish compliance with the specified requirements.

B. Related Work Described Elsewhere: Individual requirements for submittals are described in other pertinent Sections of these Specifications.

1 .2 QUALITY ASSURANCE

A. Coordination of Submittals: Prior to each submittal, carefully review and coordinate all aspects of each item being submitted and verify that each item and the submittal conforms in all respects with the requirements of the Contract Documents. By affixing the Contractor's signature to each submittal, certify that this coordination has been performed.

B. Certificates of Compliance:

1. Certify that all materials used in the work comply with all specified provisions thereof. Certification shall not be construed as relieving the Contractor from furnishing satisfactory materials if, after tests are performed on selected samples, the material is found not to meet specified requirements.
2. Show on each certification the name and location of the work, name and address of contractor, quantity and date or dates of shipment or delivery to which the certificate applies, and name of the manufacturing or fabricating company. Certification shall be in the form of letter or company-standard forms containing all required data. Certificates shall be signed by an officer of the manufacturing or fabricating company.
3. In addition to the above information, all laboratory test reports submitted with Certificates of Compliance shall show the date or dates of testing, the specified requirements for which testing was performed, and results of the test or tests.

1 .3 SUBMITTALS

A. Certificates of Compliance: Upon completion of the work, and as a condition of its acceptance, submit to the Architect/Engineer all Certificates of Compliance.

B. Make all submittals of Shop Drawings, Samples, requests for substitution, and other items, in strict accordance with this Section.

2 PRODUCTS

2 .1 SUBMITTAL SCHEDULE

A. General: Compile a complete and comprehensive schedule of all submittals anticipated to be made during progress of the work. Include a list of each type of item for which Contractor's Drawings, Shop Drawings, Certificates of Compliance, material samples, guarantees, or other types of submittals are required. Upon approval by the Architect/Engineer this schedule will become part of the Contract and the Contractor will be required to adhere to the schedule except when specifically otherwise permitted.

B. Coordination: Coordinate the schedule with all necessary subcontractors and materials suppliers to ensure their understanding of the importance of adhering to the approved schedule and their ability to so adhere. Coordinate as required to ensure the grouping of submittals as described in Paragraph 3.2 below.

2 .2 SHOP DRAWINGS

All Shop Drawings, except color selection samples (see below), shall be submitted electronically.

A. Scale and measurements: Make all Shop Drawings accurately to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the work.

B. **Electronic File submittal**: Files shall meet the following guidelines:

1. Submittals made electronically will be sent back electronically to the address sent from.
2. Only .PDF's will be accepted and must be unlocked and printable.
3. E-mail file attachments shall not exceed a total of 10MB.
4. Acceptable Sizes: 8-1/2 x 11, 11 x 17, 24 x 36, or 30 x 42. All other sizes or file formats will be rejected.
5. Architect will not be responsible for e-mails that are rejected or fail to be received for any reason. File should be sent with "Return Receipt Notification".

C. Review of Shop Drawings: Distribution of processed Shop Drawings for the Architect/ Engineer's use will be by the Architect/Engineer. All processed notations of the Architect/ Engineer will be shown on the drawing(s) when it is returned to the Contractor. The Contractor shall distribute all copies required for his purposes.

2 .3 MANUFACTURER'S LITERATURE

A. General: Where contents of submitted literature from manufacturers includes data not pertinent to the submittal, clearly indicate which portion of the contents is being submitted for review.

B. Number of Copies Required: Submit the number of copies which are required to be returned plus two (2) copies which will be retained by the Architect/Engineer.

2 .4 SAMPLES

A. Accuracy of Samples: Samples shall be of the precise article proposed to be furnished.

B. Number of samples required: Unless otherwise specified, submit all Samples in the quantity which is required to be returned plus one which will be retained by the Architect/Engineer.

C. Samples Submission Process: All physical samples must be submitted along with a full color electronic scan of the sample for processing and recording purposes. Electronic scan shall be submitted in accordance with Paragraph 2.2/B (above).

D. Reuse of Samples: In situations specifically so approved by the Architect/Engineer, the Architect/Engineer's retained sample may be used in the construction as one of the installed items.

2 .5 COLORS AND PATTERNS

Unless the precise color and pattern is specifically described in the Contract Documents, and whenever a choice of color or pattern is available in a specified product, submit accurate color and pattern physical samples to the Architect/Engineer for review and selection.

2 .6 SUBSTITUTIONS

A. Approval Required:

1. The Contract is based on the standards of quality established in the Contract Documents.
2. All products proposed for use, including those specified by required attributes and performance, shall require approval by the Architect/Engineer before being incorporated into the work.
3. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this work by the Architect/Engineer.
4. Request for approval shall be submitted to the Architect a minimum of 10 days prior to bid date.

B. “Or Equal”:

1. Where the phrase “or equal” or “or equal as approved by the Architect/Engineer”, occurs in the Contract Documents, do not assume that materials, equipment, or methods will be approved as equal unless the item has been specifically approved for this work by the Architect/Engineer.
2. The decision of the Architect/Engineer shall be final.
3. Request for approval shall be submitted to the Architect a minimum of 10 days prior to bid date.

3 EXECUTION

3 .1 IDENTIFICATION OF SUBMITTALS

A. General: Consecutively number all submittals. Accompany each submittal with a Letter of Transmittal containing all pertinent information required for identification and checking of submittals.

B. Internal Identification: On at least the first page of each copy of each submittal, and elsewhere as required for positive identification, clearly indicate the submittal number in which the item was included.

C. Resubmittals When material is resubmitted for any reason, transmit under a new Letter of Transmittal and with a new submittal number.

D. Submittal Log: Maintain an accurate submittal log for the duration of the Contract, showing current status of all submittals at all times. Make the submittal log available for the Architect/ Engineer’s review upon request.

3 .2 COORDINATION OF SUBMITTALS

A. General: Prior to submittal for approval, use all means necessary to fully coordinate all material including, but not necessarily limited to:

1. Determine and verify all interface conditions, catalog numbers, and similar data.
2. Coordinate with other trades as required.
3. Clearly indicate all deviations from requirements of the Contract Documents.

B. Grouping of Submittals: Unless otherwise specified, make all submittals in groups containing all associated items to ensure that information is available for checking each item when it is received. Partial submittals may be rejected as not complying with the provisions of the Contract Documents and the Contractor shall be strictly liable for all delays so occasioned.

3 .3 TIMING OF SUBMITTALS

A. General: Make all submittals far enough in advance of scheduled dates for installation to provide all time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery.

B. Authority to Proceed: The notations “Processed”, or “Processed with Notations”, authorize the Contractor to proceed with fabrication, purchase, or both, of the items so noted, subject to the revisions, if any, required by the Architect/Engineer’s review comments.

C. Revisions: Make all revisions required by the Architect/Engineer. If the Contractor considers any required revision to be a change, he shall so notify the Architect/Engineer as provided for under “Changes” in the General Conditions. Show each drawing revision by number, date, and subject in a revision block on the drawing. Make only those revisions directed or approved by the Architect/Engineer.

D. Revisions After Approval: When a submittal has been reviewed by the Architect/Engineer, resubmittal for substitution of materials or equipment will not be considered unless accompanied by an acceptable explanation as to why the substitution is necessary.

END OF SECTION

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SECTION 01 40 00
QUALITY REQUIREMENTS

1 GENERAL

1 .1 SECTION INCLUDES

A. References and standards.

B. Quality assurance submittals.

C. Control of installation.

D. Testing and inspection services.

1 .2 REFERENCE STANDARDS

A. ASTM C 1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008.

B. ASTM C 1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2008.

C. ASTM C 1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2008.

D. ASTM D 3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2008.

E. ASTM E 329 - Standard Specification for Agencies Engaged Construction Inspection and/or Testing; 2008.

F. ASTM E 543 - Standard Specification for Agencies Performing Nondestructive Testing; 2008a.

1 .3 SUBMITTALS

A. Testing Agency Qualifications: Prior to start of Work, submit agency name, address, and telephone number, and names of full time specialist and responsible officer.

B. Test Reports: After each test/inspection, promptly submit one copy each of report directly to Architect/Engineer and directly to Contractor.

1. Include:

a. Date issued.

b. Project title and number.

c. Name of inspector.

d. Date and time of sampling or inspection.

e. Identification of product and specifications section.

f. Location in the Project.

g. Type of test/inspection.

h. Date of test/inspection.

i. Results of test/inspection.

j. Conformance with Contract Documents.

k. When requested by Architect/Engineer, provide interpretation of results.

2. Test report submittals are for Architect/Engineer's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

1 .4 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to current reference standard at date of issue of contract documents or date specified in the individual specification sections, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect/Engineer shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1 .5 TESTING AND INSPECTION AGENCIES

A. Contractor Employed Agency:

1. Testing agency: Comply with requirements of ASTM E 329, ASTM E 543, ASTM C 1021, ASTM C 1077, and ASTM C 1093.

2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.

   a. Personnel performing visual weld inspection shall have certification as an ASW Certified Welding Inspectors (CWI) in accordance with the provisions of AWS QC1.

   b. Personnel performing nondestructive testing other than visual shall be qualified as NDT Level II technicians in accordance with ASNT Recommended Practice No. SNT-TC-1A. Inspection agency shall provide testing procedures used.

3. Laboratory: Authorized to operate in Michigan.

4. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.

5. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

2 EXECUTION

2 .1 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

D. Verify compliance with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Verify Work is being performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

2 .2 TESTING AND INSPECTION

A. See individual specification sections and Related Requirements listed above for testing and inspection required.

B. Testing Agency Duties:

1. Test samples of mixes submitted by Contractor.
2. Provide qualified personnel at site. Cooperate with Architect/Engineer and Contractor in performance of services.
3. Perform specified sampling and testing of products in accordance with specified standards.
4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify Architect/Engineer and Contractor of observed irregularities or non-conformance of Work or products.
6. Perform additional tests and inspections required by Architect/Engineer.
7. Attend preconstruction meetings.
8. Test Reports: After each test/inspection, promptly submit one copy each of report directly to Architect/Engineer and directly to Contractor.

C. Limits on Testing/Inspection Agency Authority:

1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the Work.
3. Agency may not assume any duties of Contractor.

D. Contractor Responsibilities:

1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
    a. To provide access to Work to be tested/inspected.
    b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    c. To facilitate tests/inspections.
    d. To provide storage and curing of test samples.

4. Notify Testing Agency a minimum of 24 hours prior to expected time for operations requiring testing/inspection services
5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect/Engineer.

F. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

G. If, after re-testing, the construction is still found to be in non-conformance, the Architect/Engineer will direct an appropriate remedy.

END OF SECTION

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SECTION 01 42 19
APPLICABLE STANDARDS

1 GENERAL

1 .1 DESCRIPTION

A. Work shall include the following:

1. Throughout the Contract Documents, reference is made to codes and standards which establish qualities and type of workmanship and materials, and which establish methods for testing and reporting on the pertinent characteristics.
2. Where materials or workmanship are required by these Contract Documents to meet or exceed the specifically named code or standard, it is the Contractor's responsibility to provide materials and workmanship which meet or exceed the specifically named code or standard.
3. It is also the Contractor's responsibility, when so required by the Contract Documents or by written request from the Owner, to deliver to the Owner all required proof that the materials or workmanship, or both, meet or exceed the requirements of the specifically named code or standard. Such proof shall be in the form requested in writing by the Owner, and generally will be required to be copies of a certified report of tests conducted by a testing agency approved for that purpose by the Owner.

B. Related Work Described Elsewhere: Specific naming of codes or standards occurs on the Drawings and in other Sections of these Specifications.

1 .2 QUALITY ASSURANCE

A. Familiarity with Pertinent Codes and Standards: In procuring all items used in this Work, it is the Contractor's responsibility to verify the detailed requirements of the specifically named codes and standards and to verify that the items procured for use in this work meet or exceed the specified requirements.

B. Rejection of Non-Complying Items: The Owner reserves the right to reject items incorporated into the Work which fail to meet the specified minimum requirements. The Owner further reserves the right, and without prejudice to other recourse the Owner may take, to accept non-complying items subject to an adjustment in the Contract Amount as approved by the Owner.

C. Applicable standards listed in these Specifications include, but are not necessarily limited to, standards promulgated by the following agencies and organizations:

1. AA = Aluminum Association, 818 Connecticut Avenue, N.W., Washington, DC 20006
2. AABC = Associated Air Balance Council, 1000 Vermont Avenue, N.W., Washington, DC 20005
3. AASHTO = American Association of State Highway and Transportation Officials, 341 National Press Building, Washington, D.C. 20004.
4. ACI = American Concrete Institute, Box 9094, Farmington Hills, Michigan 48333-9094.
5. ADC = Air Diffusion Council, 230 North Michigan Avenue, Chicago, IL 60601
6. AGC = Associated General Contractors of America, 1957 E. Street, N.W., Washington, DC 20006
7. AI = Asphalt Institute, Asphalt Institute building, College Park, MD 20740

8. AIA = American Institute of Architects, 1735 New York Avenue, N.W., Washington, DC 20006
9. AISC = American Institute of Steel Construction, Inc., 1221 Avenue of the Americas, New York, New York 10020.
10. AISI = American Iron and Steel Institute, 1000 16th Street, N.W., Washington, DC 20036
11. AITC = American Institute of Timber Construction, 333 W. Hampden Avenue, Englewood, CO 80110
12. AMCA = Air Movement and Control Association, 30 West University Drive, Arlington Heights, IL 60004
13. ANSI = American National Standards Institute (successor to USASI and ASA0, 1430 Broadway, New York, New York 10018.
14. APA = American Plywood Association, Box 11700 Tacoma, WA 98411
15. ARI = Air-Conditioning and Refrigeration Institute, 1501 Wilson Boulevard, Arlington, VA 22209
16. ASHRAE = American Society of Heating, Refrigerating and Air Conditioning Engineers, 1791 Tullie Circle, N.E., Atlanta, GA 30329
17. ASME = American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017
18. ASPA = American Sod Producers Association, 4415 West Harrison Street, Hillside, IL 60162
19. ASTM = American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.
20. AWI = Architectural Woodwork Institute, 2301 South Walter Reed Drive, Arlington, VA 22206.
21. AWPA = American Wood-Preservers' Association, 7735 Old Georgetown Road, Bethesda, MD 20014
22. AWS = American Welding Society, Inc., 2501 N.W. 7th Street, Miami, Florida 33125.
23. AWWA = American Water Works Association, Inc., 6666 West Quincy Avenue, Denver, Colorado 80235.
24. BIA = Brick Institute of America, 11490 commerce Park Drive, Reston, VA 22091.
25. CDA = Copper Development Association, 57th Floor, Chrysler Building, 405 Lexington Avenue, New York, NY 10174.
26. CLFMI = Chain Link Fence Manufacturers Institute, 1101 Connecticut Avenue, N.W., Washington, DC 20036.
27. CRSI = Concrete Reinforcing Steel Institute, 228 North LaSalle Street, Chicago, Illinois 60610.
28. CS = Commercial Standard of NBS, U.S. Department of Commerce, Government Printing Office, Washington, D.C. 20402.
29. DHI = Door and Hardware Institute, 7711 Old Springhouse Road, McLean, VA 22102.

30. EJCDC = Engineers' Joint Contract Documents Committee, American Consulting Engineers Council, 1015 15th Street, N.W., Washington, DC 20005
31. EJMA = Expansion Joint Manufacturers Association, 25 North Broadway, Tarrytown, NY 10591
32. FGMA = Flat Glass Marketing Association, 3310 Harrison, Topeka, Kansas 66611.
33. FM = Factory Mutual System, 1151 Boston-Providence Turnpike, P.O. Box 688, Norwood, MA 02062.
34. FS = Federal Specification, General Services Administration, Specifications and Consumer Information.
35. WFSIS= Distribution Section (WFSIS), Washington Navy Yard, Bldg. 197, Washington, DC 20407.
36. GA = Gypsum Association, 1603 Orrington Avenue, Evanston, IL 60201.
37. ICBO = International Conference of Building Officials, 5360 W. Workman Mill Road, Whittier, CA 90601.
38. IEEE = Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, NY 10017.
39. IMIAC = International Masonry Industry All-Weather Council, International Masonry Institute, 815 15th Street, N.W., Washington, DC 20005.
40. MBC = Michigan Building Code, PO Box 30254, Lansing, MI 48909.
41. MFMA = Maple Flooring Manufacturers Association, 60 Rivere Drive, Northbrook, IL 60062.
42. MIL = Military Specification, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.
43. ML/SFA= Metal Lath/Steel Framing Association, 221 North LaSalle Street, Chicago, IL 60601.
44. NAAMM = The National Association of Architectural Metal Manufacturers, 1033 South Boulevard, Oak Park, Illinois 60302.
45. NCMA = National Concrete Masonry Association, P.O. Box 781, Herndon, VA 22070.
46. NEBB = National Environmental Balancing Bureau, 8224 Old Courthouse Road, Vienna, VA 22180.
47. NEC = National Electrical Code (see NFPA).
48. NEMA = National Electrical Manufacturers Association, 155 East 44th Street, New York, New York 10017.
49. NFPA = National Fire Protection Association, 470 Atlantic Avenue, Boston, Massachusetts 02210.
50. NFPA = National Forest Products Association, 1619 Massachusetts Avenue, N.E., Washington, DC 20036.
51. NSWMA= National Solid Wastes Management Association, 1730 Rhode Island Ave., N.E., Washington, DC 20036.

52. NTMA = National Terrazzo and Mosaic Association, 3166 Des Plains Avenue, Des Plains, IL 60018.
53. NWMA = National Woodwork Manufacturers Association, 205 W. Touhy Avenue, Park Ridge, IL 60068.
54. PCA = Portland Cement Association, 5420 Old Orchard Road, Skokie, IL 60077.
55. PCI = Prestressed Concrete Institute, 201 North Wells Street, Chicago, IL 60606.
56. PS = Product Standard, U.S. Department of Commerce, Washington, DC 20203.
57. RCSHSB = Red Cedar Shingle and Handsplit Shake Bureau, 515 116th Avenue, Bellevue, WA 98004.
58. RIS = Redwood Inspection Service, One Lombard Street, San Francisco, CA 94111.
59. SDI = Steel Deck Institute, 135 Addison Avenue, Elmhurst, Illinois 60125.
60. SDI = Steel Door Institute, 712 Lakewood Center North, 14600 Detroit Avenue, Cleveland, OH 44107.
61. SIGMA = Sealed Insulating Glass Manufacturers Association, 111 East Wacker Drive, Chicago, IL 60601.
62. SJI = Steel Joist Institute, 1205 48th Avenue North, Suite A, Myrtle Beach, SC 29577.
63. SMACNA = Sheet Metal and Air Conditioning Contractors' National Association, 8224 Old Court House Road, Vienna, VA 22180.
64. SSPC = Steel Structures Painting Council, 4400 Fifth Avenue, Pittsburgh, Pennsylvania 15213.
65. TCA = Tile Council of America, Inc., P.O. Box 326, Princeton, New Jersey 08540.
66. UL = Underwriters' Laboratories, Inc., 207 East Ohio Street, Chicago, Illinois 60611.
67. WCLIB = West Coast Lumber Inspection Bureau, 6980 S.W. Varns Road, Box 23145, Portland, OR 97223.
68. WWPA = Western Wood Products Association, 1500 Yeon Building, Portland, OR 97204.
69. Fed. Specs. and Fed. Standards: Specifications Sales (3FRI), Building 197, Washington Navy Yard, General Service Administration, Washington, D.C. 20407.

END OF SECTION

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SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

1 GENERAL

1 .1 DESCRIPTION

A. Work Included: Temporary facilities and controls required for this work include, but are not necessarily limited to:

1. Temporary utilities shall be available for use within the existing space.
2. Enclosures such as tarpaulins, barricades, and canopies.
3. Securing of the construction area.

B. Related Work described Elsewhere:

1. Except that all equipment furnished by contractors shall comply with all requirements of pertinent safety regulations, the ladders, planks, hoists, and similar items normally furnished by the individual trades in execution of their own portions of the work are not part of this section.

1 .2 PRODUCT HANDLING

Use all means necessary to maintain temporary facilities and controls in proper and safe conditions throughout progress of the work.

1 .3 JOB CONDITIONS

Make all required connections to existing utility systems with minimum disruption to services in the existing utility systems. When disruption of the existing service is required, do not proceed without the Architect/Engineer's approval and, when required, provide alternate temporary service.

2 PRODUCTS

2 .1 UTILITIES

A. General: All temporary facilities shall be subject to the Architect/Engineer's approval.

B. Temporary Water: Available on-site within the facility.

C. Temporary Power: Available on-site within the facility.

D. Temporary Office: Not required.

E. Temporary Access: Ladders, railings, barriers, scaffolds, etc., as required for the proper execution of the work shall be provided by the specific contractor and/or subcontractor requiring same.

F. Toilet Facilities: Building facilities may be used by on-site personal.

G. Glass Replacement: The Mechanical Contractor shall assume all costs of replacement of glass broken, cracked, or damaged by him. Glass scratched through improper cleaning shall be considered damaged and shall be replaced by the party that caused the damage.

H. Cleaning Up: The Mechanical Contractor shall arrange for all clean-up operations. Clean-up must be timely as well as thorough in order to meet safety regulations and permit other contractors to perform without hindrance from dirt and debris.

2 .2 ENCLOSURES

Furnish, install, and maintain for the duration of construction all required scaffolds, tarpaulins, barricades, canopies, warning signs, steps, bridges, platforms, and other temporary construction necessary for proper completion of the work in compliance with all safety and other regulations.

END OF SECTION

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SECTION 01 73 29
CUTTING AND PATCHING

1 GENERAL

1 .1 DESCRIPTION

A. Work Included: This Section establishes general requirements pertaining to cutting (including excavating), fitting, and patching of the work required to:

1. Make the several parts fit properly.
2. Uncover work to provide for installation, inspection, or both, of ill-timed work.
3. Remove and replace work not conforming to requirements of the Contract Documents.
4. Remove and replace defective work.

B. Related Work Described Elsewhere:

1. In addition to other requirements specified, upon the Owner's request, uncover work to provide for inspection by the Owner's Representative of covered work, and remove samples of installed materials for testing.
2. Do not cut or alter work performed under separate contract without the Owner's written permission.

1 .2 QUALITY ASSURANCE

Perform all cutting and patching in strict accordance with pertinent requirements of these Specifications and, in the event no such requirements are determined, in conformance with the Owner's written direction.

1 .3 SUBMITTALS

A. Request for The Owner's Consent:

1. Prior to cutting which affects structural safety, submit written request to the Owner for permission to proceed with cutting.
2. Should conditions of the work, or schedule, indicate a required change of materials or methods for cutting and patching, so notify the Owner and secure his written permission prior to proceeding.

2 PRODUCTS

2 .1 MATERIALS

For replacement of work removed, use materials which match as closely as possible to materials that were removed or damaged.

3 EXECUTION

3 .1 CONDITIONS

A. Inspection:

1. Inspect existing conditions, including elements subject to movement or damage during cutting, excavating, backfilling, and patching.
2. After uncovering the work, inspect conditions affecting installation of new work.

B. Discrepancies: If uncovered conditions are not as anticipated, immediately notify the Owner and secure needed directions.

3 .2 PREPARATION PRIOR TO CUTTING

Provide all required protection including, but not necessarily limited to, shoring, bracing, and support to maintain structural integrity of the work.

3 .3 PERFORMANCE

Perform all required excavating and backfilling as required under pertinent Sections of these Specifications. Perform cutting and removal by methods which will prevent damage to other portions of the work and will provide proper surfaces to receive installation of repair and new work.

END OF SECTION

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SECTION 01 74 00
CLEANING

1 GENERAL

1 .1 DESCRIPTION

A. Work Included: Throughout the construction period, each Contractor shall maintain the site in a standard of cleanliness as described in this section.

B. Related Work Described Elsewhere: In addition to standard described in this Section, comply with all requirements for cleaning up as described in various other sections of these specifications.

1 .2 QUALITY ASSURANCE

A. Inspection: Conduct daily inspection, and more often if necessary, to verify that requirements of cleanliness are being met.

B. Codes and Standards: In addition to the standards described in this section, comply with all pertinent requirements of governmental agencies having jurisdiction.

2 PRODUCTS

2 .1 CLEANING MATERIALS AND EQUIPMENT

Provide all required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

3 EXECUTION

3 .1 PROGRESS CLEANING

A. General:

1. Retain all stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.
2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this work.

3 .2 FINAL CLEANING

Unless otherwise specifically directed, each Contractor is responsible for cleaning his own area/work.

A. Building: As necessary to his work, the Contractor shall provide services to vacuum all carpeted areas, damp mop all hard surface areas of floor, wipe with clean damp cloth all tile and hard surface areas of walls and ceiling. Vacuum all construction dust off wood trim, millwork and equipment, clean windows and window frames (including removal of stickers/tags not required by codes), remove construction dust from all light fixtures and other suspended items.

B. Cleaning Approval: Approval of final cleaning will be subject to Architect/Engineer(s) walk-through and punch list(s).

END OF SECTION

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SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

1 GENERAL

1 .1 DESCRIPTION

A. Work Included: To aid in the continued instruction of operating and maintenance personnel, and to provide a positive source of information regarding the products incorporated in the work, furnish and deliver the data described in this section and in pertinent other sections of these specifications.

B. Related Work Described Elsewhere:

1. Make all submittals in strict accordance with the provisions of Section 01 33 00.
2. Required contents of submittals may also be amplified in other pertinent Sections.

1 .2 QUALITY ASSURANCE

In preparation of data required by this Section, use only personnel who are thoroughly trained and experienced in operation and maintenance of the described items, completely familiar with the requirements of this Section, and skilled in technical writing to the degree needed for communicating the essential data.

1 .3 SUBMITTALS

A. Preliminary: Submit two copies of a preliminary draft of the proposed Manual or Manuals to the Architect/Engineer, for review and comments.

B. Final: Unless otherwise directed in other pertinent Sections, or in writing by the Architect/Engineer, submit three copies of the final Manual to the Architect/Engineer prior to indoctrination of operation and maintenance personnel.

2 PRODUCTS

2 .1 INSTRUCTION MANUALS

A. General: Where instruction are required to be submitted under other sections of these specifications, prepare in accordance with the following:

B. Format:

1. Size: 8-1/2” x 11”.
2. Paper: White bond, at least 20 lb. weight.
3. Text: Neatly typewritten.
4. Drawings: 11” in height preferable; bind in with text; foldout acceptable; larger drawings acceptable, but fold to fit within the Manual and provide a drawing pocket inside rear cover or bind in with text.
5. Flysheets: Separate each portion of the Manual with neatly prepared flysheets briefly describing contents of the ensuing portion; flysheets may be in color.
6. Binding: Use heavy-duty plastic or cardboard covers with binding mechanism concealed inside the Manual; 3-ring binders will be acceptable; all binding shall be subject to the Architect’s approval.
7. Measurements: Show the U.S. measurements plus the SI equivalents.

C. Covers: Provide front and back covers for each Manual, using durable material approved by the Architect/Engineer and clearly identified on or through the front cover with a least the following information:

PROJECT NAME
(general subject of this Manual)
(space for approval signature of the Architect/Engineer)
and approval date)

D. Contents: Include at least the following:

1. Neatly typewritten index near the front of the Manual, giving immediate information as to location within the Manual of all emergency data regarding the installation.
2. Complete instructions regarding operation and maintenance of all equipment involved, including lubrication, disassembly, and reassembly.
3. Complete nomenclature of all parts of all equipment.
4. Complete nomenclature and part number of all replaceable parts, name and address of nearest vendor, and all other pertinent data regarding procurement procedure.
5. Electrostatic copy of all guarantees and warranties issued.
6. Manufacturers' bulletins, cuts, and descriptive data, where pertinent, clearly indicating the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturer's data with which this installation is not concerned.
7. Such other data as required in other pertinent Sections of these specifications.

3 EXECUTION

3 .1 INSTRUCTION MANUALS

A. Preliminary: Prepare a preliminary draft of each proposed Manual. Show general arrangement, nature of contents in each portion, probable number of drawings and their size, and proposed method of binding and covering. Secure the Architect/Engineer's approval prior to proceeding with final.

B. Final: Complete the Manuals in strict accordance with the approved preliminary drafts and the Architect/Engineer's review comments.

C. Revisions: Following the indoctrination and instruction of operation and maintenance personnel, review all proposed revisions of Manuals with the Architect/Engineer. If the Contractor is required by the Architect to revise previously approved Manuals, compensation will be made as provided under "Changes" in the General Conditions.

END OF SECTION

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SECTION 01 78 39
PROJECT RECORD DOCUMENTS

1 GENERAL

1 .1 DESCRIPTION

A. Work Included:

1. Throughout progress of the work, each contractor shall maintain an accurate record of all changes in the Contract Documents, as described in Paragraph 3.1 below.
2. Upon completion of the work of this contract, transfer the recorded changes to a set of Record Documents, as described in Paragraph 3.2 below.

B. Related Work Described Elsewhere:

Section 01 33 00: Submittals and Substitutions

1 .2 QUALITY ASSURANCE

A. General: Each contractor shall delegate the responsibility for maintenance of Record Documents to one person on the contractor's staff as approved in advance by the Architect/Engineer.

B. Accuracy of Records: Thoroughly coordinate all changes within the Record Documents, making adequate and proper entries on each page of specifications and each sheet of drawings and other documents where such entry is required to properly show the change. Accuracy of records shall be such that future search for items shown in the Contract Documents may reasonably rely on information obtained from the approved Record Documents.

C. Timing of Entries: Make all entries within 24 hours after receipt of information.

1 .3 SUBMITTALS

A. General: The Architect/Engineer's approval of the current status of Record Documents will be a prerequisite of the Architect/Engineer's approval of Requests for Progress Payment and Request for Final Payment under the Contract.

B. Progress Submittals: Prior to submitting each request for progress payment, secure the Architect/Engineer's approval of the Record Documents as currently maintained.

C. Final Submittal: Prior to submitting Request for Final Payment, submit the final Record Documents of the Architect/Engineer and secure his approval.

1 .4 PRODUCT HANDLING

Use all means necessary to maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the work and transfer of the recorded data to the final Record Documents. In the event of loss of recorded data, use all means necessary to secure the data to the Architect/Engineer's approval; such means shall include, if necessary in the opinion of the Architect/Engineer, removal and replacement of concealing materials and, in such case, all replacements shall be to the standard originally specified in the Contract Documents.

2 PRODUCTS

2 .1 RECORD DOCUMENTS

A. Job Set: Promptly following Award of Contract, secure from the Architect/ Engineer at no charge to the Contractor, one complete set of all Documents comprising the Contract.

B. Final Record Documents: At a time near the completion of the work, secure from the Architect/Engineer at no charge to the contractor, one complete set of reproducibles of all Drawings included in the Contract.

3 EXECUTION

3 .1 MAINTENANCE OF JOB SET

A. Identification: Immediately upon receipt of the job set described in Paragraph 2.1 above, identify each of the Documents with the title “Record Documents - Job Set”.

B. Preservation:

1. Considering the contract completion time, the probable number of occasions upon which the job set must be taken out for new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set to the approval of the Architect/ Engineer.
2. Do not use the job set for any purpose except entry of new data and for review by the Architect/Engineer, until start or transfer of data to final Record Documents.
3. Maintain the job set at the site of Work as that site is designated by the Architect/Engineer.

C. Making Entries on Drawings: Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by note and by graphic line, as required. Date all entries. Call attention to the entry by a “cloud” around the area or areas affected. In the event of overlapping changes, different colors may be used for each of the changes.

D. Making Entries on Other Documents:

1. Where changes are caused by directives issued by the Architect/Engineer, clearly indicate the change by note in ink, colored pencil, or rubber stamp.
2. Where changes are caused by contractor-originated proposal approved by the Architect/Engineer, including inadvertent errors by the Contractor which have been accepted by the Architect/Engineer, clearly indicate the change by note in erasable colored pencil.
3. Make entries in the pertinent Documents as approved by the Architect/Engineer.

E. Conversion of Schematic Layouts:

1. In most cases on the Drawings, arrangement of conduits and circuits, piping, ducts, and other similar items, is shown schematically and is not intended to portray precise physical layout. Final physical arrangement is as determined by the Contractor, subject to the Architect/Engineer’s approval. However, design of future modifications of the facility may require accurate information as to the final physical arrangement of items which are shown only schematically on the Drawings.
2. Show on the job-set of Record Drawings, by dimension accurate to within 1”, the center line of each run of items such as are described in Paragraph 3.1-E-1 above. Clearly identify the item by an accurate note such as “cast iron drain”, “galv. water”, etc. Show by symbol or note, the vertical location of the item (“under slab”, “in ceiling plenum”, “exposed”, etc.). Make all identification sufficiently descriptive that it may be related reliably to the Specifications.

3. The Architect/Engineer may waive the requirements for conversion of schematic data where, in the Architect/Engineer's judgment, such conversion serves no beneficial purpose. However, do not rely upon waivers being issued except as specifically issued in writing by the Architect/ Engineer.
4. Timing of Entries: Be alert to changes in the work from how it is shown in the Contract Documents. Promptly, and in no case later than 24 hours after the change has occurred and been made known to the Contractor, make the entry or entries required.
5. Accuracy of Entries: Use all means necessary, including the proper tools for measurement, to determine actual locations of the installed items.

3 .2 FINAL RECORD DOCUMENTS

A. General: The purpose of the final Record Documents is to provide factual information regarding all aspects of the work, both concealed and visible, to enable future modification of design to proceed with lengthy and expensive site measurement, investigations, and examination.

B. Approval of Recorded Data Prior to Transfer: Following receipt of the sepia transparencies described in Paragraph 2.1-B above, and prior to start of transfer of recorded data thereto, secure a review by the Architect of all recorded data. Make all required revisions.

C. Transfer of Data to Drawings: Carefully transfer all change data shown on the job-set of Record Drawings to the corresponding sepias, coordinating the changes as required, and clearly indicating at each affected detail and other drawing the full description of all changes made during construction and the actual location of items described in Paragraph 3.1-E above. Call attention to each entry by drawing a "cloud" around the area or areas affected. Make all change entries on the sepias neatly, consistently, and in ink or crisp black pencil.

D. Transfer of Data to Other Documents: If the Documents other than Drawings have been kept clean successfully during progress of the Work, and if entries have been sufficiently orderly thereon to the approval of the Architect/Engineer, the job-set of those Documents (other than Drawings) will be accepted by the Architect/Engineer as final Record Documents for those Documents. If any such Document is not so approved by the Architect/Engineer, secure a new copy of that Document from the Architect/Engineer at the Architect/Engineer's usual charge for reproduction; carefully transfer the change data to the new copy and to the approval of the Architect/ Engineer.

E. Review and Approval: Submit the completed total set of Record Documents to the Architect as described in Paragraph 1.3-C above. Participate in review meeting or meetings as required by the Architect/Engineer, make all required changes in the Record Documents, and promptly deliver the final Record Documents to the Architect/Engineer.

3 .3 CHANGES SUBSEQUENT TO ACCEPTANCE

The Contractor shall have no responsibility for recording changes in the work subsequent to acceptance of the work by the Owner, except for changes resulting from replacements, repairs, and alternations made by Contractor as part of his guarantee.

END OF SECTION

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SECTION 15010 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide labor, materials, and equipment to disconnect & demolish existing two (2) boilers, Two (2) existing boiler pumps, two (2) existing system pumps, one (1) air/dirt separator and one (1) expansion tank.

B. Provide labor, materials and equipment to furnish and install two (2) new high efficiency condensing boilers rated for minimum input of 399 MBH each. If required, provide new Bacnet gateway for compatibility with your existing BMS system.

C. Provide two (2) new boiler pumps with ECM or VFD controlled motors. Size pump to equal existing.

D. Provide two (2) new system pumps with ECM or VFD controlled motors. Size pump to equal existing.

E. Provide one (1) new Air/Dirt separator. Sized to equal existing.

F. Provide one (1) new expansion tank. Sized to equal existing.

G. Provide new Venting system for new condensing boilers per manufactures recommendations.

H. Provide and install new pressure reducing valve.

1.1 SUMMARY

A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1.

1. General Mechanical Provisions
2. Codes, ordinances, permits, fees, or assessments
3. Submittals
4. Record Documents
5. Maintenance Manuals
6. Delivery, storage, and handling
7. Rough-ins
8. Cutting and Patching
9. Substitutions
10. Temporary utilities
11. Infection control requirements

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 15. Each Division 15 Section applies where applicable to all other Division 15 Sections.

1.3 GENERAL MECHANICAL PROVISIONS

A. The work in this Division consists of furnishing all labor and materials, accessories, equipment, transportation, supervision, start-up services, instructions, permits and incidentals, and related items necessary to complete installation and successfully test, start-up and operate, in a practical and efficient manner, all mechanical work and systems indicated on the drawings and described in each

Section of this Division. The work shall also include any items which, while not specifically included in these specifications or drawings, are reasonable and properly inferable there from or are accepted trade practice or necessary for the proper completion of this System.

B. The General Requirements of these specifications govern all portions of this heating, ventilating and plumbing system and will apply in full force to this contract. These Contractors shall, therefore, consider them as forming an integral part of this contract.

C. Submission of a Bid Proposal is considered evidence that a contractor has visited the site, examined the drawings and specifications of all Trades and has fully informed himself as to project and site conditions and is proficient, experienced and knowledgeable of all state, local and federal standards, codes, ordinances, permits and regulations which affect every subcontractor trade's completion, cost and time required and that all costs are included in his Bid Proposal.

D. The Contractor shall be responsible for all Subcontractors and suppliers, and shall include in his Bid Proposal and properly apportion, all materials, labor and equipment to the Subtrades.

E. All labor, materials and equipment shall be guaranteed by the Contractor and/or warranted by the manufacturer for one calendar year after date of final acceptance, except where specific, longer periods are specified. Make all necessary alterations, repairs, adjustments and replacements during guarantee period as directed by Engineer to comply with drawings and specifications. Such work shall be at no cost to the Owner.

F. Provide the service of factory-trained personnel for such periods of time as required to instruct the Owner's personnel on operation and maintenance of installed equipment.

G. This Contractor shall have in charge of the work at all times during construction a thoroughly competent Field Superintendent with experience in the work to be installed under this contract.

H. Where a conflict exists between the drawings and specifications it shall be immediately brought to the engineers attention. If such a conflict is not resolved before work commences, contractor shall provide the most work of greatest value.

I. All products shall be installed per the manufacturers written instructions. Where a conflict exists between the contract documents and the manufacturers' instructions, the engineer shall be notified immediately to resolve the conflict.

J. Refer to architectural specifications for infection control procedures

1.4 CODES, ORDINANCES, PERMITS, FEES OR ASSESSMENTS

A. All work and materials shall be installed in accordance with the standards as described by local and state codes or ordinances including the rules of the Michigan Plumbing Code, National Fire Protection Association, American Standards Association, and with the prevailing rules and regulations pertaining to adequate protection and guarding of any moving parts or otherwise hazardous locations.

B. Should the drawings or specifications call for sizes and grades different than required by the governing code, this Contractor shall furnish and install the larger size of the higher grade.

C. In addition, this Contractor shall give all notices, file all drawings, obtain all necessary approvals, obtain all permits, pay for all fees, deposits and expenses required for installation of all work under this contract, as stated therein and in the General Requirements. In such instances where permits are not required, the contractor shall engage a third party, preferably the local official, to inspect the work.

D. In addition to all applicable federal, state and local codes, the standards and codes listed below shall apply to all mechanical work. Where standards or codes are mentioned in these specifications, the latest edition or revision shall be followed; hence, the specified numbers may be superseded by new numbers.

1. American National Standard Institute (ANSI)
2. American Society for Testing Materials (ASTM)
3. American Society of Mechanical Engineers (ASME)
4. American Water Works Association (AWWA)
5. Air Moving and Condition Association, Inc. (AMCA)
6. Air Diffusion Council (ADC)
7. American Society Heating, Ventilating and Refrigerating and Air Conditioning Engineers (ASHRAE)
8. National Electrical Manufacturer's Association (NEMA)
9. American Refrigeration Institute (ARI)
10. ANSI Code of Pressure Piping and Unfired Pressure Vessels
11. Cast Iron Soil Pipe Institute
12. Underwriter's Laboratories (U.L.)
13. National Fire Protection Association (NFPA)
14. American Gas Association (AGA)
15. Michigan Occupational Safety and Health Acts (MIOSHA)
16. Sheet Metal and Air Conditioning National Association (SMACNA)
17. Michigan 2012 Mechanical Code
18. Michigan 2012 Plumbing Code
19. Michigan 2012 Building Code
20. ASHRAE Standard 90.1
21. ASME
22. International Fuel Gas Code

1.5 SUBMITTALS

A. General

1. Follow the procedures specified in Division 1 Section, Submittal Procedures.

1.6 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section, Closeout Procedures. In addition to the requirements specified in Division 1, indicate the following installed conditions:

1. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.
2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
4. Contract Modifications, actual equipment and materials installed.

1.7 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1 Section, Closeout Procedures. In addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. 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 operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.8 MANUFACTURERS

A. Refer to Division 1 section, “Product Requirements.”

B. Manufacturers and model numbers of products on which the design was based are listed either in the drawings or specifications. Manufacturers known to have products of equivalent quality and function are listed in the specification sections. Products by these manufacturers may be included in this contractor’s base bid if the product dimensions are similar to the basis of design and all other requirements of the specifications are met. This Contractor shall be considered liable for all added costs both to himself and others (including those costs as incurred by the Engineer, for redesigning or redrawing) resultant from the use of products not the basis of the design.

1.9 SUBSTITUTIONS

A. Refer to Division 1 Section, “Product Requirements.”

B. This Contractor shall be considered liable for all added costs both to himself and others (including those costs as incurred by the Engineer, for redesigning or redrawing) resultant from the substitution of products not the basis of the design.

C. This Contractor shall be responsible for the verification of adequate space (considering dimensions, required clearances, weights, and roughing-in requirements) for the installation of items or systems not the basis of the design. He shall be responsible for advising all other trades. He shall submit revised drawing layouts for the approval of the Engineer and shall not proceed without this approval.

1.10 TEMPORARY UTILITIES

A. Mechanical Contractor shall use existing outside sill cocks for temporary water.

B. Mechanical Contractor shall be responsible for all temporary heat and all associated costs.

1. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.11 INFECTION CONTROL REQUIREMENS

A. Maintain negative air pressure, as compared to adjacent Owner occupied areas, within the construction area at all times by utilizing existing dedicated exhaust fans as indicated on the mechanical drawings or by auxiliary fans which are exhausted directly to the exterior atmosphere.

Ensure location of exhaust discharge is not in close proximity to existing air intakes and operable windows. Owner will provide monitoring or pressure differential. Provide filters on existing intakes throughout construction to clean intake air. Replace filters on a weekly basis.

B. Provide intake fans with HEPA filters in Ante rooms. Fans shall maintain a positive pressure in the Ante room at all times.

PART 2 - EXECUTION

2.1 CUTTING AND PATCHING

A. Perform cutting and patching in accordance with Division 1 Section, Cutting and Patching. In addition to the requirements specified in Division 1, the following requirements apply:

1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
2. Refer to drawing notes.

B. Perform cutting, fitting and patching of mechanical equipment and materials required to:

1. Uncover work to provide for installation of ill-time work.
2. Remove and replace defective work.
3. Remove and replace work not conforming to requirements of the Contract Documents.
4. Remove samples of installed work as specified for testing.
5. Install equipment and materials in existing structures.
6. Cut, channel, chase and drill floors, wells, partitions, ceilings and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.
7. Upon written instructions from the Architect, uncover and restore work to provide for Architect/Engineer observation of concealed work.

C. Cut, remove and legally dispose of selected mechanical equipment, components and materials as indicated, including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new work.

D. Protect the structure, furnishings, finishes and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

F. Patch existing finished surfaces and building components using new materials matching existing materials and utilizing experienced installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION

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SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 15 Sections.

1. Sequencing and scheduling requirements common to all division 15 specification sections.
2. Piping materials and installation instructions common to most piping systems.
3. Concrete equipment base construction requirements.
4. Equipment nameplate data requirements.
5. Condensate

B. Pipe and pipe fitting materials are specified in piping system Sections.

1.2 DEFINITIONS

A. Pipe, pipe fittings and piping include tube, tube fittings and tubing.

B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

D. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

E. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include rooftop locations.

F. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for following piping specialties:

1. Mechanical sleeve seals
2. Identification materials and devices
3. Fire Stopping Materials
4. Access Panels

C. Samples of color, lettering style, and other graphic representation required for each identification material and device.

D. Shop drawings detailing fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

E. Welder certificates signed by contractor certifying that welders comply with requirements specified under the Quality Assurance Article.

1.4 QUALITY ASSURANCE

A. Qualify welding processes and operators for piping according to ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.

1. Comply with provisions of ASME B31 Series, Code for Pressure Piping.
2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

B. ASME A13.1 for lettering size, length of color field, colors and viewing angles of identification devices.

C. Equipment Selection: Equipment of greater or larger power, dimensions, capacities and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases and equipment spaces are increased. No additional costs will be approved for these increases if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Products stored on site shall be protected from damage. If products are intended for interior installation they shall be kept dry while in storage. Any damage caused by improper storage shall be corrected at the contractors expense.

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

D. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.

E. Protect flanges, fittings and pipe specialties from moisture and dirt.

F. Protect stored plastic pipes from direct sunlight. Support to prevent sagging and bending.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for chases, slots and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Sequence, coordinate and integrate installations of mechanical materials and equipment for efficient flow of the work. Coordinate installation of large equipment requiring positioning before closing in the building.

E. Coordinate connection of electrical services.

F. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

G. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section, Access Doors.

H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

1.7 FIRE STOP SYSTEMS

A. Mechanical Contractor shall furnish and install all fire stop systems required at all piping penetrations through rated walls and floors.

B. For penetrations by combustible items (penetrants consumed by high heat aflame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe (closed piping systems) the following materials are accepted:

1. Hilti FS ONE High Performance Intumescent Firestop Sealant.
2. Hilti CP 618 Firestop Putty.
3. Hilti CP 642 Firestop Jacket.
4. Hilti CP 643 Firestop Jacket.
5. 3M Fire Barrier CP25 WB.
6. 3M Fire Barrier FS 195 Wrap.Strip.
7. Tremco Tremstop WBM Intumescent Firestop Sealant.

C. For penetrations by combustible plastic pipe (open piping systems), the following materials are acceptable:

1. Hilti CP 642 Firestop Jacket.
2. Hilti CP 643 Firestop Jacket.
3. Hilti FS ONE High Performance Intumescent Firestop Sealant.
4. 3M Fire Barrier PPO Plastic Pipe Device.

D. For large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways' the following materials are acceptable:

1. Hilti FS 635 Trowelable Firestop Compound.
2. Hilti FIRE BLOCK.
3. 3M Firestop Foam 2001.
4. 3M Fire Barrier CS 195 Composite Sheet.

E. For openings between structurally separate sections of wall and floors. Top of walls, the following materials are acceptable:

1. Hilti FS 60t Elastomeric Firestop Sealant.
2. Hilti CP 601s Elastomeric Firestop Sealant.
3. Hilti CP 606 Flexible Firestop Sealant.
4. Hilti FS ONE High Performance Intrumescent Firestop Sealant.
5. 3M Fire Barrier CP 25 WB.

F. Provide a firestop system with a "F" rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

G. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction being penetrated.

H. Firestopping at valve boxes.

1. Hilti CP 618 Firestop Putty Stick.
2. Hilti CP 617 and CP 617L Firestop Putty Pad.

I. For pipe penetrations of cast in place concrete floors and concrete over metal decking the following material is acceptable:

1. Hilti CP 680 Cast-in Firestop Device (No equal).

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Refer to individual piping system specifications Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual piping system specification sections in Division 15 for special joining materials not listed below.

B. Solder Filler Metal: ASTM B 32.

1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent), having 0.10 percent lead content.
2. Alloy Sn50: Tin (50 percent) and lead (50 percent). For non-potable pipe use only.
3. Alloy E: Tin (approximately 95 percent) and copper (approximately 5 percent) having 0.10 maximum lead content.
4. Alloy HA: Tin-antimony-silver-copper-zinc, having 0.10 percent maximum lead content.
5. Alloy HB: Tin-antimony-silver-copper-nickel, having 0.10 percent maximum lead content.

C. Welding Filler Metals: Comply with AWS D10-12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

D. Solvent Cements: Manufacturer's standard solvents complying with the following:

1. Acrylonitrile-Butadiene-Styrene (ABS): ASTM D 2235.
2. Chlorinated Poly (Vinyl Chloride) (CPVC): ASTM F 493.
3. Poly (Vinyl Chloride) (PVC): ASTM D 2564.
4. PVC to ABS Transition: Made to requirements of ASTM D 3138, color other than orange.

E. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end pressure pipes.

1. Sleeve: ASTM A 126, Class B, gray iron
2. Followers: ASTM A 47 (ASTM A 47M), Grade 32510 or ASTM A 536 ductile iron
3. Gaskets: Rubber
4. Bolts and Nuts: AWWA C111
5. Finish: Enamel paint

2.3 PIPING SPECIALTIES

A. Escutcheons: Manufactured wall, ceiling and floor plates; deep-pattern type where required to conceal protruding fittings and sleeves.

1. Inside Diameter: Closely fit around pipe, tube, and insulation.
2. Outside Diameter: Completely cover opening.
3. Stamped Steel: Split-plate, with concealed hinge, spring clips, and chrome-plated finish.

B. Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.

1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld neck end types and matching piping system materials.
2. Insulating Material: Suitable for system fluid, pressure, and temperature.
3. Dielectric Couplings: Galvanized-steel coupling, having inert and non-corrosive thermoplastic lining, with threaded ends and 300-psig minimum working pressure at 225 degrees F temperature.
4. Dielectric Nipples: Electroplated steel nipple, having inert and non-corrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig minimum working pressure at 225 degrees F temperature.

C. Sleeves: The following materials are for wall, floor, slab and roof penetrations:

1. Steel Sheet-Metal: 24-gauge or heavier galvanized sheet metal, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized plain ends.
3. Underdeck Clamp: Clamping ring with set screws.

2.4 IDENTIFYING DEVICES AND LABELS

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 15 Sections. Where more than one type is specified for listed application, selection is Installer's option, but provide single selection for each product category.

B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped, permanently fastened to equipment.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances and similar essential data.
2. Location: An accessible and visible location.

C. Stencils: Standard stencils, prepared for required applications with letter sizes conforming to recommendations of ASME A13.1 for piping and similar applications, but not less than 1-1/4 inch high letters for ductwork and not less than ¾ inch high letters for access door signs and similar operational instructions.

1. Material: Fiberboard.
2. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated, either brushing grade or pressurized spray-can form and grade.
3. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.

D. Snap-On Plastic Pipe Markers: Manufacturer's standard pre-printed, semi-rigid snap-on, color-coded, pressure-sensitive vinyl pipe markers, conforming to ASME A13.1.

E. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white (letter color) melamine subcore, except when other colors are indicated.

1. Fabricate in sizes required for message.
2. Engraved with engraver's standard letter style, of sizes and with working to match equipment identification.
3. Punch for mechanical fastening.
4. Thickness: 1/8-inch, except as otherwise indicated.
5. Fasteners: Self-tapping stainless-steel screws.

F. Plastic Equipment Markers: Laminated-plastic, color-coded equipment markers. Conform to following color code:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Yellow/Green: Combination cooling and heating equipment and components.
4. Nomenclature: Include following, matching terminology on schedules as closely as possible:

a. Name and plan number.
b. Equipment service.

G. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

1. Multiple Systems: Where multiple systems of same generic name are indicated, provide identification that indicates individual system number as well as service such as "Boiler No. 3," "Air Supply No. 1H," or "Standpipe F12."

2.5 GROUT

A. Non-shrink, Nonmetallic Grout: ASTM C 1107, Grade B

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, non-staining, non-corrosive, non-gaseous and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength
3. Packaging: Premixed and factory-packaged

2.6 FIRE STOP SYSTEMS

A. Elastomeric Firestop Sealant

1. Metal Pipe
2. Where pipe movement or vibration is expected
3. Construction joints

B. Intumesent Firestop Sealant

1. Plastic pipes – closed or vented piping systems
2. Single and bundled cables
3. Insulated metal pipes

C. High Performance Firestop Sealant

1. Metal pipe – static conditions and sleeved openings

D. Trowlable Firestop Compound

1. Large openings

a. Cable trays
b. Electrical busway
c. Multiple metal pipes

E. Fire Barrier Collar

1. Plastic pipe – 3 inch, 4 inch, 5 inch and 6 inch

F. Approved Supplies

1. Must be approved by State Fire Marshals Office

a. Hilti, Firestop Systems
b. Fire Protection Systems, Incorporated

2.7 ACCESS PANELS

A. Refer to Division 8 Section, “Access Doors and Frames.”

B. Provide access doors as follows:

1. Wherever valves, traps, strainers, filters, dampers, humidifiers, control devices, or other items which require service are located above fixed suspended ceilings, or are concealed in walls, provide approved 18 inch by 18 inch steel access panels, flush type, for mounting in ceilings and walls as indicted and/or required. Locate to provide access for all required maintenance. Provide more than one where required.
2. Mechanical trades shall furnish for installation by the General Trades unless otherwise noted.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping as described below, except where system Sections specify otherwise. Individual piping system specification sections in Division 15 specify piping installation requirements unique to the piping system.

B. General Locations and Arrangements: Drawings (plans, schematics and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated.

C. Install piping at indicated slope.

D. Install components having pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's printed instructions.

M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Uninsulated Piping Wall Escutcheons: Stamped steel
2. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates
3. Insulated Piping: Stamped steel, with concealed hinge, spring clips, and chrome-plated finish
4. Piping in Utility Areas: Stamped-steel, with set-screw or spring clips

N. Sleeves are not required for core drilled holes.

O. Permanent sleeves are not required for holes formed by PE plastic (removable) sleeves.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, concrete floor and roof slabs, and where indicated.

1. Cut sleeves to length for mounting flush with both surfaces.

   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.
   b. Build sleeves into new walls and slabs as work progresses.
   c. Install large enough sleeves to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

      - PVC Pipe Sleeves: For pipes smaller than 6 inches.
      - Steel Pipe Sleeves: For pipes smaller than 6 inches.
      - Steel Sheet-Metal Sleeves: For pipes 6 inches and larger that penetrate gypsum-board partitions.
      - Cast-iron Sleeve Fittings: For floors having membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Flashing is specified in Division 7 Section, Flashing and Sheet Metal.
      - Seal space outside of sleeve fittings with non-shrink, nonmetallic grout.

2. Below Grade, Exterior Wall, Pipe Penetrations: Furnish cast-iron wall penetration system sleeves equal to "Link Seal". Install `according to manufacturer's printed installation instructions.

3. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings and floors at pipe penetrations. Seal pipe penetrations with firestopping sealant material specified in this section.
4. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.

    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: Construct joints according to AWS, Soldering Manual, Chapter 22, The Soldering of Pipe and Tube.
    d. 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 inside diameter. Join pipe fittings and valves as follows:

        - Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
        - Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
        - Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

    e. Welded Joints: Construct joints according to AWS D10.12, Recommended Practices and Procedures for Welding Low Carbon Steel Pipe, using qualified processes and welding operators according to the Quality Assurance Article.
    f. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
    g. Plastic Pipe and Fitting Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloths or paper towels. Join pipe and fittings according to the following standards:

        - Comply with ASTM F 402 for safe handling of solvent-cement and primers.
        - Poly (Vinyl Chloride) (PVC) Non-Pressure Application: ASTM D 2855
        - PVC to ABS (Non-Pressure) Transition: Procedure and solvent cement described in ASTM D 3138.

    h. Plastic Pipe and Fitting Heat-Fusion Joints: Prepare pipe and fittings and join with heat-fusion equipment according to manufacturer's printed instructions.

        - Plain-End Pipe and Fittings: Butt joining
        - Plain-End Pipe and Socket-Type Fittings: Socket joining

5. Piping Connections: Except as otherwise indicated, make piping connections as specified below:
    a. Install unions in piping 2 inches and smaller adjacent to each valve and at final connection to each piece of equipment having a 2-inch or smaller threaded pipe connection.
    b. Install flanges in piping 2½ inches and larger adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
    c. Dry Piping Systems (Gas): Install dielectric unions and flanges to connect piping materials of dissimilar metals.

d. Wet Piping Systems (Water): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
Where piping is indicated to be installed below floor slab, it shall be within a PVC sleeve sized to accommodate piping and insulation.

3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the work are shown only in diagrammatic form. Refer conflicts to the Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

D. Install mechanical 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.

E. Install equipment giving right-of-way to piping systems installed at a required slope.

F. Coordinate mechanical systems, equipment and materials installation with other building components.

G. Verify all dimensions by field measurements.

H. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.

I. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

J. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring position prior to closing in the building.

K. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

3.4 LABELING AND IDENTIFYING

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: Complying with ASME A13.1.
2. Locate pipe markers wherever piping is exposed in finished spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums), and exposed exterior locations as follows (near shall be interpreted to mean "in-sight-of):

a. Near each valve and control device.
b. Near each branch, excluding short take-offs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
c. Near locations where pipes pass through walls, floors, ceilings, or enter inaccessible enclosures.

d. At access doors, manholes, and similar access points that permit view of concealed piping.
e. Near major equipment items and other points of origination and termination.
f. Spaced at a maximum of 50-foot intervals along each run. Reduce intervals to 25 feet in congested areas of piping and equipment.
g. On piping above removable acoustical ceilings.

3. Equipment: Install engraved plastic laminate sign or equipment marker on or near each major item of mechanical equipment.
4. Adjusting: Relocate identifying devices, which become visually blocked by work of this Division or other Divisions.

B. Valve Tags

1. Install brass tags chained to handwheel of all valves and stop cocks (except drain valves). Each tag to be stamped with a number to identify system and unit served.
2. Provide typewritten directory with numbers corresponding to numbers on valve tags. Numbers indicating system and unit or devices serviced or controlled by particular valve. Mount directory in wooden frame with glass face. Locate as directed by the Architect.

3.5 PAINTING AND FINISHING

A. Refer to Division 9 Section, “Interior Painting”, for field painting requirements.

B. Damage and Touch-Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. All exposed ducts and pipes in finished areas shall be painted by the General Contractor.

3.6 CONCRETE BASES

A. Construct concrete equipment bases of dimensions indicated, but not less than 4 inches larger than supported unit in both directions. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psi, 28-day compressive strength concrete and reinforcement as specified in Division 3 Section, Cast-In-Place Concrete.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, Structural Welding Code - Steel.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit and place wood grounds, nailers, blocking and anchorage to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate member where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.9 DEMOLITION

A. Disconnect, demolish and remove work specified under Division 15 and as indicated.

B. Where pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Abandoned Work: Cut and remove buried pipe abandoned in place, 2 inches beyond the face of adjacent construction. Cap and patch surface to match existing finish.

E. Removal: Remove indicated equipment from the project site.

F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect and make operational equipment indicated for relocation.

3.10 GROUTING

A. Install nonmetallic non-shrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.

B. Clean surfaces that will come in contact with grout.

C. Provide forms for placement of grout, as required.

D. Avoid air entrapment when placing grout.

E. Place grout to completely fill equipment bases.

F. Place grout around anchors.

G. Cure placed grout according to manufacturer's printed instructions.

END OF SECTION

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SECTION 15060 - HANGERS & SUPPORTS FOR MECHANICAL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes hangers and supports for mechanical systems piping and equipment.

1.2 DEFINITIONS

A. Terminology used in this section is defined in MSS SP-90.

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

1.4 QUALITY ASSURANCE

A. Qualify welding processes and welding operators according to AWS D1.1, Structural Welding Code-Steel.

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

B. NFPA Compliance: Comply with NFPA 13 for hangers and supports used as components of fire protection systems.

C. International Plumbing and Mechanical Codes Compliance: Comply with International Plumbing and Electrical Codes for hanger spacing.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

A. Hangers, Supports and Components: Factory-fabricated according to MSS SP-58.

1. Components include galvanized coatings where installed for piping and equipment that will not have a field-applied finish.
2. Pipe attachments include nonmetallic coating for electro-lytic protection where attachments are in direct contact with copper tubing.

B. Thermal-Hanger Shield Inserts: 100-psi average compressive strength, waterproofed calcium silicate, encased with sheet metal shield. Insert and shield cover entire circumference of pipe and are of length indicated by manufacturer for pipe size and thickness of insulation.

2.2 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes and bars, black and galvanized.

B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex-head, track bolts and nuts.

C. Washers: ASTM F 844, steel, plain, flat washers.

D. Grout: ASTM C 1107, Grade B, non-shrink, nonmetallic.

1. Characteristics include post-hardening, volume-adjusting, dry, hydraulic-cement-type grout that is non-staining, non-corrosive, non-gaseous and is recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Water: Potable.
4. Packaging: Premixed and factory-packaged.

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 specification sections.

3.2 HANGER AND SUPPORT INSTALLATION

A. General: Comply with MSS SP-69 and SP-89. Install hangers, supports, clamps and attachments as required to properly support piping for building structure.

B. Arrange for grouping of parallel runs of horizontal piping supported together on field-fabricated, heavy-duty trapeze hangers where possible.

C. Install supports with maximum spacings complying with MSS SP-69 and table below.

1.

Nominal Pipe Or Tube Size	STD WT STEEL PIPE				COPPER TUBE			
	WATER SERVICE		VAPOR SERVICE		WATER SERVICE		VAPOR SERVICE	
	Ft	M	Ft	M	Ft	M	Ft	m
¼	7	2.1	8	2.4	5	1.5	5	1.5
3/8	7	2.1	8	2.4	5	1.5	6	1.8
½	7	2.1	8	2.4	5	1.5	6	1.8
¾	7	2.1	9	2.7	5	1.5	7	2.1
1	7	2.1	9	2.7	6	1.8	8	2.4
1 ¼	7	2.1	9	2.7	6	2.1	9	2.7
1 ½	9	2.7	12	3.7	8	2.4	10	3.0
2	10	3.0	13	4.0	8	2.4	11	3.4
2 ½	11	3.4	14	4.3	9	2.7	13	4.0
3 & Up	12	3.7	15	4.6	10	3.0	14	4.3

2. Fiberglass Reinforced: Follow pipe manufacturer's recommendations for material and service condition.
3. Plastic: Follow pipe manufacturer's recommendations for material and service condition.
4. Cast Iron Soil: 10ft Max spacing; min. of one (1) hanger per pipe section close to joint on the barrel, also at change of direction and branch connections.
5. Ductile Iron Pipe: 20ft. Max spacing; min. of one (1) hanger per pipe section close to the joint behind the bell and at change of direction and branch connections. For pipe sizes six (6) inches and under, installed on ANSI B31 projects, that are subjected to loadings other than weight of pipe and contents, the span should be limited to the maximum spacing for water service steel pipe.
6. Follow requirements of the National Fire Protection Association.

D. Where pipes of various sizes are supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

E. Install building attachments within concrete or to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert to forms. Install reinforcing bars through openings at top of inserts.

F. Install concrete inserts in new construction prior to placing concrete.

G. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install according to fastener manufacturer's written instructions. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches thick.

H. Support fire protection systems piping independent of other piping.

I. Install hangers and supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so that maximum pipe deflections allowed by ASME B31.9, Building Services Piping, is not exceeded.

L. Insulated Piping: Comply with the following installation requirements.

1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.
2. Saddles: Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
3. Shields: Install MSS Type 40, protective shields on cold piping with vapor barrier. Shields span an arc of 180 degrees and have dimensions in inches not less than the following:

NPS (Inches)	LENGTH	THICKNESS
1/4 to 3-1/2	12	0.048
4	12	0.060
5 and 6	18	0.060
8 to 14	24	0.075
16 to 24	24	0.105

4. Pipes 8 inches and Larger: Include wood inserts.
5. Insert Material: Length at least as long as the protective shield.
6. Thermal-Hanger Shields: Install with insulation of same thickness as piping.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor.

B. Grouting: Place grout under supports for equipment and make a smooth bearing surface.

3.4 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slop of pipe.

3.5 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint and paint exposed areas immediately after erection of hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

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SECTION 15081 - MECHANICAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes pipe, duct and equipment insulation.

1.2 DEFINITIONS

A. Hot Surfaces: Normal operating temperatures of 100 degrees F or higher.

B. Dual-Temperature Surfaces: Normal operating temperatures that vary from hot to cold.

C. Cold Surfaces: Normal operating temperatures less than 75 degrees F.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification.

B. Product data for each type of mechanical insulation identifying k-value, thickness and accessories.

1.4 QUALITY ASSURANCE

A. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements and adhesives, when tested according to ASTM E-84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.

1. Interior Insulation: Flame spread rating of 25 or less and a smoke developed rating of 50 or less.
2. Exterior Insulation: Flame spread rating of 75 or less and a smoke developed rating of 150 or less.

B. Install insulation per guidelines published by the Midwest Insulation Contractors Association.

1.5 SEQUENCING AND SCHEDULING

A. Schedule insulation application after testing piping and ducting systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

1. Glass Fiber:
   CertainTeed Corporation
   Manville
   Owens-Corning Fiberglass Corporation
   USG Interiors, Inc. - Thermafiber Division
2. Calcium Silicate:
   Manville
   Owens-Corning Corporation

2.2 GLASS FIBER

A. Material: Inorganic glass fibers, bonded with a thermosetting resin.

B. Jacket: All-purpose, factory-applied, laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil having self-sealing lip.

C. Board: ASTM C 612, Class 2, semi-rigid jacketed board.

1. Thermal Conductivity: 0.26 average maximum at 75 degrees F mean temperature.
2. Density: 12 pcf average maximum.

D. Blanket: ASTM C 553, Type II, Class F-1, jacketed flexible blankets.

1. Thermal Conductivity: 0.32 average maximum at 75 degrees F mean temperature.

E. Preformed Pipe Insulation: ASTM C 547, Class 1, rigid pipe insulation, jacketed.

1. Thermal Conductivity: 0.26 average maximum at 75 degrees F mean temperature.
2. Density: 10 average maximum.

F. Adhesive: Produced under the UL Classification and Follow-up service.

1. Type: Non-flammable, solvent-based.
2. Service Temperature Range: Minus 20 to 180 degrees F.

G. Vapor Barrier Coating: Waterproof coating recommended by insulation manufacturer for outside service.

2.3 CALCIUM SILICATE

A. Material: ASTM C 533, Type I; inorganic, hydrous calcium silicate, non-asbestos fibrous reinforcement; incombustible.

B. Form: Molded flat block, curbed block, grooved block, and preformed pipe sections as appropriate for surface.

C. Thermal Conductivity: 0.60 at 500 degrees F.

D. Dry Density: 15.0 pcf maximum.

E. Compressive Strength: 60 psi minimum at 5 percent deformation.

F. Fire Performance Characteristics: Provide materials identical to those whose fire performance characteristics have been determined, per test method indicated below, by UL or other testing and inspecting organization acceptable to authorities having jurisdiction.

1. Test Method: ASTM E 84.
2. Flame Spread: 0.
3. Smoke Developed: 0.

2.4 INSULATING CEMENTS

A. Mineral Fiber: ASTM C 195.

1. Thermal Conductivity: 1.0 average maximum at 500 degrees F mean temperature.

2. Compressive Strength: 10 psi at 5 percent deformation.

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

1. Thermal Conductivity: 1.2 average maximum at 400 degrees F mean temperature.
2. Compressive Strength: 100 psi at 5 percent deformation.

2.5 ADHESIVES

A. Flexible Elastomeric Cellular Insulation Adhesive: Solvent-based, contact adhesive recommended by insulation manufacturer.

B. Lagging Adhesive: MIL-A-3316C, non-flammable adhesive in the following Classes and Grades:

1. Class 1, Grade A for bonding glass cloth and tape to unfaced glass fiber insulation, sealing edges of glass fiber insulation, and bonding lagging cloth to unfaced glass fiber insulation.
2. Class 2, Grade A for bonding glass fiber insulation to metal surfaces.

2.6 JACKETS

A. General: ASTM C 921, Type 1, except as otherwise indicated.

B. PVC Jacketing: High-impact, ultra-violet-resistant PVC, 20-mils thick, roll stock ready for shop or field cutting and forming to indicated sizes.

1. Adhesive: As recommended by insulation manufacturer.

C. PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil-thick, high-impact, ultra-violet-resistant PVC.

1. Adhesive: As recommended by insulation manufacturer.

2.7 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Woven glass fiber fabrics, plain weave, pre-sized a minimum of 8 ounces per square yard.

1. Tape Width: 4 inches
2. Cloth Standard: MIL-C-20079H, Type I.
3. Tape Standard: MIL-C-20079H, Type II.

B. Bands: ¾ inches wide, in one of the following materials compatible with jacket:

1. Stainless Steel: Type 304, 0.020 inches thick.
2. Galvanized Steel: 0.005 inches thick.
3. Aluminum: 0.007 inches thick.
4. Brass: 0.01 inches thick.

C. Wire: 14-gauge nickel copper alloy, 16-gauge, soft-annealed stainless steel, or 16-gauge, soft annealed galvanized steel.

D. Corner Angles: 28-gauge, 1 inch by 1 inch aluminum adhered to 2 inch by 2 inch kraft paper.

E. Anchor Pins: Capable of supporting 20 pounds each. Provide anchor pins and speed washers of sizes and diameters as recommended by the manufacturer for insulation type and thickness.

2.8 SEALING COMPOUNDS

A. Vapor Barrier Compound: Water-based, fire-resistive composition.

1. Water Vapor Permeance: 0.08 perm maximum.
2. Temperature Range: Minus 20 to 180 degrees F.

B. Weatherproof Sealant: Flexible-elastomer-based, vapor-barrier sealant designed to seal metal joints.

1. Water Vapor Permeance: 0.02 perm maximum.
2. Temperature Range: Minus 50 to 250 degrees F.
3. Color: Aluminum.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean, dry, and remove foreign materials such as rust, scale and dirt.

B. Mix insulating cements with clean potable water. Mix insulating cements contacting stainless-steel surfaces with demineralized water.

1. Follow cement manufacturer's printed instructions for mixing and portions.

3.2 INSTALLATION, GENERAL

A. Refer to schedules at the end of this section for materials, forms, jackets and thicknesses required for each mechanical system.

B. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften or otherwise attack the insulation or jacket in either the wet or dry state.

C. Install vapor barriers on insulated pipes, ducts and equipment having surface operating temperatures below 60 degrees F.

D. Apply insulation material, accessories and finishes according to the manufacturer's printed instructions.

E. Install insulation with smooth, straight and even surfaces.

F. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier.

G. Seal penetrations for hangers, supports, anchors and other projections in insulation requiring a vapor barrier.

H. Seal Ends: Except for flexible elastomeric insulation, taper ends at 45 degree angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive.

I. Apply adhesives and coatings at manufacturer's recommended coverage-per-gallon rate.

J. Keep insulation materials dry during application and finishing.

K. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials and equipment:

1. Fibrous glass ducts
2. Metal ducts with duct liner
3. Factory-insulated flexible ducts
4. Factory-insulated plenums, casings, terminal boxes and filter boxes and sections
5. Flexible connectors for ducts and pipes
6. Vibration control devices
7. Testing laboratory labels and stamps
8. Nameplates and data plates
9. Access panels and doors in air distribution systems
10. Fire protection piping systems
11. Sanitary drainage and vent piping
12. Drainage piping located in crawl spaces, unless indicated otherwise
13. Below grade cold water piping
14. Chrome-plated pipes and fittings except for plumbing fixtures for the disabled
15. Piping specialties including air chambers, unions, strainers, check valves, plug valves and flow regulators

3.3 PIPE INSULATION INSTALLATION, GENERAL

A. Tightly butt longitudinal seams and end joints. Bond with adhesive.

B. Stagger joints on double layers of insulation.

C. Apply insulation continuously over fittings, valves and specialties except as otherwise indicated.

D. Apply insulation with a minimum number of joints.

E. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Cover circumferential joints with butt strips, at least 3 inches wide, and of same material as insulation jacket. Secure with adhesive and outward clinching staples along both edges of butt strip and space 4 inches on center.
3. Longitudinal Seams: Overlap seams at least 1½ inches. Apply 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 on center.

    a. Exception: Do not staple longitudinal lamps on insulation applied to piping systems with surface temperatures at or below 35 degrees F.

4. Vapor Barrier Coatings: Where vapor barriers are indicated, apply on seams and joints, over staples, and at ends butt to flanges, unions, valves and fittings.
5. At penetrations in jackets for thermometers and pressure gauges, fill and seal voids with vapor barrier coating.
6. Repair damaged insulation jackets, except metal jackets, by applying jacket material around damaged jacket. Adhere, staple, and seal. Extend patch at least 2 inches in both directions beyond damaged insulation jacket and around the entire circumference of the pipe.

F. Roof Penetrations: Apply insulation for interior applications to a point even with the top of the roof flashing. Seal with vapor barrier coating. Apply insulation for exterior applications butted tightly to interior insulation ends. Extend metal jacket for exterior insulation outside roof flashing at least 2 inches below top of roof flashing. Seal metal jacket to roof flashing with vapor barrier coating.

G. Interior Walls and Partitions Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions. Apply an aluminum jacket with factory-applied moisture barrier over insulation. Extend 2 inches from both surfaces of wall or partition. Secure aluminum jacket with metal bands at both ends. Seal ends of jacket with vapor barrier coating. Seal around penetration with joint sealer. Refer to Division 7 Section, Joint Sealants.

H. Fire-Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire-rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with fire stopping or fire-resistant joint sealer. Refer to Division 7 for fire stopping and fire-resistant joint sealers.

I. Floor Penetrations: Terminate insulation underside of floor assembly and at floor support at top of floor.

J. Flanges, Fittings and Valves-Interior Exposed and Concealed: Coat pipe insulation ends with vapor barrier coating. Apply pre-molded, precut or field-fabricated segments of insulation around flanges, unions, valves and fittings. Make joints tight. Bond with adhesive.

1. Use same material and thickness as adjacent pipe insulation.
2. Overlap nesting insulation by 2 inches or 1-pipe diameter, whichever is greater.
3. Apply materials with adhesive, fill voids with mineral fiber insulating cement. Secure with wire or tape.
4. Insulate elbows and tees smaller than 3 inches pipe size with pre-molded insulation.
5. Insulate elbows and tees 3 inches and larger with pre-molded insulation or insulation material segments. Use at least three segments for each elbow.
6. Cover insulation, except for metal jacketed insulation, with PVC fitting covers and seal circumferential joints with butt strips.

K. Hangers and Anchors: Apply insulation continuously through hangers and around anchor attachments. Install saddles, shields and inserts as specified in Division 15 Section, Supports and Anchors. For cold surface piping, extend insulation on anchor legs a minimum of 12 inches and taper and seal insulation ends.

1. Inserts and Shields: Cover hanger inserts and shields with jacket material matching adjacent pipe insulation.

3.4 BELOW GROUND PIPE INSULATION INSTALLATION

A. General: The following are additional requirements for insulation applied to piping installed below ground.

B. Coat bare surfaces of insulation materials with insulating cement of type recommended by insulation manufacturer. Apply enough cement to fill surface cells. Do not use adhesives for this coating.

C. Secure insulation with a minimum of two stainless-steel bands for each section of insulation.

D. Secure insulation with a minimum of two reinforced tape bands for each section of insulation.

E. Terminate insulation at anchor blocks.

F. Apply insulation continuously through sleeves and manholes, except as specified above for exterior wall penetrations.

G. Finishing: Apply three coats of asphaltic mastic to a finish thickness of 3/16 inch over insulation materials. Apply 10x10 mesh glass cloth between coats. Overlap edges of glass cloth by 2 inches.

3.5 GLASS FIBER PIPE INSULATION INSTALLATION

A. Bond insulation to pipe with lagging adhesive.

B. Seal exposed ends with lagging adhesive.

C. Seal seams and joints with vapor barrier compound.

3.6 CALCIUM SILICATE PIPE INSULATION INSTALLATION

A. Secure insulation with stainless-steel bands spaced at 12 inch intervals.

B. Apply two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 16-gauge soft-annealed stainless-steel wire spaced at 12 inch intervals. Secure outer layer with stainless-steel bands at 12 inch intervals.

C. Finishing: Apply a skim coat of mineral fiber, hydraulic-setting cement to surface of installed insulation. When dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or glass tape. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth finish.

3.7 EQUIPMENT INSULATION INSTALLATION, GENERAL

A. Install board and block materials with a minimum dimension of 12-inches and a maximum dimension of 48-inches.

B. Groove and score insulation materials as required to fit as closely as possible to the equipment and to fit contours of equipment. Stagger end joints.

C. Insulation Thicknesses Greater than 2 inches: Install insulation in multiple layers with staggered joints.

D. Bevel insulation edges for cylindrical surfaces for tight joint.

E. Secure sections of insulation in place with wire or bands spaced at 9 inch centers, except for flexible elastomeric cellular insulation.

F. Protect exposed corners with corner angles under wires and bands.

G. Manholes, Handholes and Information Plates: Bevel and seal insulation ends around manholes, handholes, ASME stamps and nameplates.

3.8 DUCT INSULATION

A. Install block and board insulation as follows:

1. Adhesive and Band Attachment: Secure block and board insulation tight and smooth with at least 50 percent coverage of adhesive. Install bands spaced 12 inches apart. Protect insulation under bands and at exterior corners with metal corner angles. Fill joints, seams and chipped edges with vapor barrier compound.
2. Speed Washers Attachment: Secure insulation tight and smooth with speed washers and welded pins. Space anchor pins 18 inches apart each way and 3 inches from insulation joints. Apply vapor barrier coating compound to insulation in contact, open joints, breaks, punctures and voids in insulation.

B. Blanket Insulation: Install tight and smooth. Secure to ducts having long sides or diameters as follows:

1. Smaller than 24 inches: Bonding adhesive applied in 6 inch wide transverse strips on 12 inch centers.
2. Twenty-four inches and Larger: Anchor pins spaced 12 inches apart each way. Apply bonding adhesive to prevent sagging of the insulation.
3. Overlap joints 3 inches.
4. Seal joints, breaks and punctures with vapor barrier compound.

3.9 JACKETS

A. Foil and Paper Jackets (FP): Install jackets drawn tight. Install lap or butt strips at joints with material same as jacket. Secured with adhesive. Install jackets with 1½ inch laps at longitudinal joints and 3 inch wide butt strips at end joints.

1. Seal openings, punctures, and breaks in vapor barrier jackets and exposed with vapor barrier compound.

3.10 APPLICATIONS

A. General: Materials and thicknesses are specified in schedules at the end of this section.

B. Interior Piping Systems: Unless otherwise indicated, insulate the following piping systems:

1. Domestic cold water
2. Storm water. Insulate only roof drain bodies and horizontal rainwater leaders of storm water piping.
3. Domestic hot water
4. Re-circulated hot water
5. Sanitary drains for fixtures accessible to the disabled
6. Heating hot water supply & return
7. Snow melt supply & return
8. Cooling Coil Condensate
9. Chilled water supply and return
10. Steam
11. Steam Condensate
12. Pumped Steam Condensate
13. Boiler Feed piping

C. Duct Systems: Unless otherwise indicated, insulate the following:

1. Interior outside air ductwork
2. Interior concealed supply and return ductwork
3. Interior exposed supply and return ductwork
3. Sound absorbers
4. Relief air ductwork
5. Outside air ductwork.

3.11 PIPING INSULATION SCHEDULES

A. General: Abbreviations used in the following schedules include:

1. Field-Applied Jackets: K - Foil and Paper.
2. Piping Sizes: NPS - Nominal Pipe Size

B.

INTERIOR COOLING COIL CONDENSATE

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD-APPLIED JACKET
ALL	GLASS FIBER	1/2	YES	NONE

INTERIOR HYDRONIC (100 TO 250º F)
EXPOSED AND CONCEALED

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD-APPLIED JACKET
1/2 TO 2	GLASS FIBER	1	NO	NONE
3 TO 10	GLASS FIBER	1½	NO	NONE

INTERIOR HYDRONIC (35° - 55°F)

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD-APPLIED JACKET
ALL	GLASS FIBER	1	YES	NONE

EXTERIOR HYDRONIC (35° - 55°F)

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD-APPLIED JACKET
ALL	POLYSTYRENE	1½	YES	ALUMINUM

INTERIOR REFRIGERANT SUCTION
(35 TO 100°F) EXPOSED AND CONCEALED

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD-APPLIED JACKET
ALL	FLEXIBLE ELAST.	3/4	YES	NONE

EXTERIOR REFRIGERANT SUCTION (35 – 100°) EXPOSED AND CONCEALED

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD-APPLIED JACKET
ALL	GLASS FIBER	3/4	YES	PVC

STEAM AND CONDENSATE, BOILER FEED, PUMPED CONDENSATE (450° AND LOWER) EXPOSED AND CONCEALED

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD-APPLIED JACKET
½ TO 4	GLASS FIBER	1	NO	NONE
ABOVE 4	GLASS FIBER	1½	NO	NONE

3.12 DUCT SYSTEMS INSULATION SCHEDULE

INTERIOR CONCEALED HVAC SUPPLY DUCT AND PLENUMS

MATERIAL	FORM	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD-PPLIED JACKET
FIBER FIBERGLASS	BLANKET	1-1/2	YES	NONE

INTERIOR EXPOSED HVAC SUPPLY AND RETURN DUCTS AND PLENUMS IN MECHANICAL ROOMS AND UNCONDITIONED SPACES.

MATERIAL	THICKNESS FORM	VAPOR IN INCHES	FIELD-BARRIER REQ'D	APPLIED JACKET
FIBER FIBERGLASS	BOARD-RECT.	1-1/2	YES	NONE

INTERIOR EXPOSED OUTSIDE AIR DUCTS, RELIEF AIR DUCTS, AND PLENUMS

MATERIAL	FORM	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD-APPLIED JACKET
FIBERGLASS	BLANKET	2	YES	NONE

INTERIOR CONCEALED OUTSIDE AIR DUCTS, RELIEF AIR DUCTS, AND PLENUMS

MATERIAL	FORM	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD-APPLIED JACKET
FIBERGLASS	BLANKET	2	YES	NONE

* EXTERNAL INSULATION NOT REQUIRED FOR EXPOSED DUCTS LOCATED IN CONDITIONED SPACES.

3.13 STEAM BOILER FEED SYSTEM, STEAM BOILER BLOWDOWN TANK, STEAM CONDENSATE TANK, FLASH TANK, BOILER EXPANSION TANK, AND AIR SEPARATOR

A. Cover the entire surface (except handholes and nameplates) with a 1½ inch thick blanket of high temperature fiberglass insulation with a density of 6.00 lb./cu. ft. Wire insulation in place prior to covering the glass cloth using fire retardant adhesive. Apply a second coat of adhesive to provide a smooth surface for painting.

3.14 CHILLER EXPANSION TANKS, BUFFER TANK AND AIR SEPARATORS

A. Cover the entire surface (except nameplates) with two layers of ¾-inch flexible elastomeric thermal insulation. Use manufacturer’s recommended adhesive. Seal longitudinal seams and end joints.

3.15 CHILLED WATER PUMPS

A. Cover the entire surface (pump housing only) with two layers of ¾-inch flexible elastomeric thermal insulation. Use manufacturer’s recommended adhesive. Seal longitudinal seams and end joints.

3.16 BOILER BREACHING

A. Insulate the entire breaching (including all flanges) from the unit with 1½ inch thick block (or flexible board) type calcium silicate insulation with a .016-inch aluminum jacket. Double walled broiler breaching does not require insulation.

END OF SECTION

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SECTION 15110 - VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general duty valves common to several mechanical piping systems.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Special purpose valves are specified in Division 15 piping system Sections.

1.2 SUBMITTALS

A. Product Data for each valve type. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions. Include list indicating valve and its application.

B. Maintenance data for valves to include will be in the operation and maintenance manual specified in Division 1. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

1.3 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

B. MSS Compliance: Comply with the various MSS Standard Practice documents referenced.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set globe and gate valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store indoors and maintain valve temperature higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use a sling to handle large valves. Rig to avoid damage to exposed parts. Do not use handwheels and stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Gate Valves:

a. Apollo
b. Crane Company; Valves and Fitting Division.
c. Hammond Valve Corporation
d. Milwaukee Valve Corporation
e. NIBCO Inc.
f. Powell Valve Company

2. Ball Valves:

a. Apollo
b. Conbraco Ind., Inc. Apollo Div
c. Hammond Valve Corporation
d. Jamesbury
e. Milwaukee
f. Rube
g. Worchester
h. Watts

3. Plug Valves: (Non-Lubricated Eccentric Type)

a. Apollo
b. DeZurik
c. Keystone Valve Company
d. Homestead

4. Globe Valves:

a. Apollo
b. Crane Company; Valves and Fitting Division.
c. Hammond Valve Corporation
d. Milwaukee Valve Corporation
e. NIBCO Inc.
f. Powell Valve Company

5. Butterfly Valves: (Resilient Seated)

a. Apollo
b. Center Line, (Crane Company)
c. DeZurik
d. Tyco/Grinnell Corporation
e. Hammond Valve Corporation
f. Keystone
g. Milwaukee Valve Corporation

6. Butterfly Valves (High Performance)

a. Apollo

b. Jamesbury Series 815 (150 Cl) or Series 830 (300 Cl)
c. DeZurik BHP 150Cl or 300Cl
d. Keystone Series 362 (150 Cl) or 372 (300 Cl)

7. Check Valves - Swing Type

a. Crane Company, Valves and Fitting Division
b. Hammond
c. Milwaukee
d. NIBCO, Inc
e. Powell Valve Company

8. Check Valves - Wafer Silent Type

a. Cla-Val Company
b. Gulf Valve Company
c. Hammond Valve Company
d. Key stone
e Metraflex
f. Val-Matic Valve & Mfg. Co.

2.2 BASIC, COMMON FEATURES

A. Design: Rising stem or rising outside screw and yoke stems, except as specified below.

1. Non-rising stem valves may be used only where headroom prevents full extension of rising stems.

B. Pressure and Temperature Ratings: As indicated in the "Application Schedule" of Part 3 of this Section and as required to suit system pressures and temperatures.

C. Sizes: Same size as upstream pipe, unless otherwise indicated.

D. Operators: Use specified operators and handwheels, except provide the following special operator features:

1. Handwheels: For valves other than quarter turn.
2. Lever Handles: For quarter-turn valves 6 inches and smaller, except for plug valves, which shall have square heads. Furnish Owner with 1 wrench for every 1 0 plug valves.
3. Chain-Wheel Operators: For valves 4 inches and larger, installed 96 inches or higher above finished floor elevation.
4. Gear-Drive Operators: For quarter-turn valves 8 inches and larger.

E. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

F. Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections.

G. Threads: ASME Bl.20.1.

H. Flanges: ASME B16.1 for cast iron, ASME B16.5 for steel, and ASME B16.24 for bronze valves.

I. Solder Joint: ASME Bl 6.18.

1. Caution: Where soldered end connections are used, use solder having a melting point below 840 deg F for gate, globe, and check valves; below 421 deg for ball valves.

2.3 GATE VALVES

A. Gate Valves, 2 1/2 Inches and Larger: MSS SP-70, Class 125, 200-psi CWP, ASTM A 126 cast-iron body and bonnet, solid cast-iron wedge, brass-alloy stem, outside screw and yoke, no asbestos packing with 2-piece packing gland assembly, flanged end connections; and with cast-iron handwheel.

2.4 BALL VALVES

A. Ball Valves, 2 inches and Smaller: MSS SP-1 1 0, Class 150, 600-psi CWP, ASTM B 584 bronze body and bonnet, 2-piece construction; chrome-plated brass ball, standard port, blowout proof stem; Teflon seats and seals; threaded or soldered end connections. Valves shall have lever handles and shall have stem extensions for insulation where required.

B. Ball Valves 2-1/2 inches and Larger: 150 PSI WP, carbon steel Body, stainless steel ball, reinforced Teflon seats and seals; standard bore with flanged connections, Valves 2 ½ inches through 4 inches shall have lever handles and valves 6 inches and larger to have gear operators

2.5 PLUG VALVES (Non-Lubricated Eccentric Type)

A. Plug Valves: MSS SP-78, 175-psi CWP, ASTM A 126 cast-iron body and bonnet, cast-iron plug, Buna N or Viton plug facing, Teflon packing, flanged or grooved end connections.

B. Valves through 4 inches shall have square heads and one wrench per valve. Valves 6 inches and larger shall be gear operated.

2.6 GLOBE VALVES

A. Globe Valves, 2 Inches and Smaller: MSS SP-80; Class 125, 200-psi CWP, or Class 150, 300-psi CWP; ASTM B 62 cast-bronze body and screwed bonnet, rubber, bronze, or Teflon disc, silicon bronze-alloy stem, non asbestos packing with bronze nut, threaded or soldered end connections; and with aluminum or malleable-iron handwheel.

B. Globe Valves, 2 1/2 Inches and Larger: MSS SP-85, Class 125, 200-psi CWP, ASTM A 126 cast-iron body and bolted bonnet with bronze fittings renewable bronze seat and disc, brass-alloy stem, outside screw and yoke, non asbestos packing with cast-iron follower, flanged end connections; and with cast iron handwheel.

2.7 BUTTERFLY VALVES (Resilient Seated)

A. Butterfly Valves: MSS SP-67, 200-psi CWP, 150-psi pressure differential, ASTM A 126 cast-iron body, wafer or lug style, extended neck, stainless-steel stem, EPDM or Buna N seats and stem seals, discs shall be aluminum bronze or stainless steel. For dead end service valves shall be lug type and not be derated by the manufacturer. Valves 2 inches thru 4 inches shall have 10 position lever handles and valves 6 inches and larger gear operators with position indicators.

2.8 BUTTERFLY VALVES (High Performance)

A Butterfly, 2 1/2 inch and larger: ANSI 150 or 300 (as required) carbon steel body, wafer or lug type as designated, stainless steel disc, filled Teflon seats and seals. Valves shall be of the double off set shaft and disc design. Valves 2-1/2 inches thru 4 inches shall have lever handles and valves 6 inches and larger gear operators.

2.9 CHECK VALVES

A. Swing Check Valves, 2-1/2 Inches and Smaller: MSS SP-80; Class 125, 200psi CWP, or Class 150, 300-psi CWP; horizontal swing, Y-pattern, ASTM B 62 cast-bronze body, bronze disc with composition seat, threaded or soldered end connections:

B. Swing Check Valves, 3 Inches and Larger: MSS SP-71, Class 125, 200-psi CWP, ASTM A 126 cast-iron body and bolted cap, horizontal-swing bronze disc, flanged end connections.

C. Wafer Check Valves: Class 125, 200-psi CWP, ASTM A 126 cast-iron body, aluminum bronze disc/plates, stainless-steel pins and springs, Buna N or EPDM seals, installed between flanges.

D. Lift Check Valves: Class 125, ASTM B 62 bronze body and cap (main components), horizontal or vertical pattern, lift-type, bronze disc or Buna N rubber disc with stainless steel holder threaded or soldered end connections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION

A. Install valves as indicated, according to manufacturer's written instructions.

B. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.

C. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.

D. Locate valves for easy access and provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the center of the pipe.

F. Install valves in a position to allow full stem movement.

G. For chain-wheel operators, extend chains to 60 inches above finished floor elevation.

H. Installation of Check Valves: Install for proper direction of flow as follows:

1. Swing Check Valves: Horizontal position with hinge pin level.
2. Wafer Check Valves: Horizontal or vertical position, between flanges.
3. Lift Check Valve: With stem upright and plumb.

3.3 SOLDERED CONNECTIONS

A. Cut tube square and to exact lengths.

B. Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket.

C. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.

D. Open gate and globe valves to fully open position.

E. Remove the cap and disc holder of swing check valves having composition discs.

F. Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to ensure even distribution of the flux.

G. Apply heat evenly to outside of valve around joint until solder melts on contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.

3.4 THREADED CONNECTIONS

A. Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.

B. Align threads at point of assembly.

C. Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.

D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.5 FLANGED CONNECTIONS

A. Align flange surfaces parallel.

B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

C. For dead-end service, butterfly valves require lug type bodies. Butterfly valves shall not be derated by the manufacturer.

3.6 VALVE END SELECTION

A. Select valves with the following ends or types of pipe/tube connections:

1. Copper Tube Size, 2-1/2 Inches and Smaller: Solder ends, except provide threaded ends for heating hot water and low-pressure steam service.

2. Steel Pipe Sizes, 2-1/2 Inches and Smaller: Threaded or grooved end.
3. Steel Pipe Sizes, 3 Inches and Larger: Grooved end or flanged.

3.7 APPLICATION SCHEDULE

A. General Application: Use gate, ball, and butterfly valves for shutoff duty; globe, ball, and butterfly for throttling duty. Refer to piping system Specification Sections for specific valve applications and arrangements.

B. Domestic Water Systems: Use the following valve types:

1. Ball Valves: Class 150, 600-psi CWP, bronze, with stem extension.
2. Plug Valves: BUNA-N faced plug; BUNA N packing.
3. Globe Valves: Class 125, bronze or cast-iron body to suit piping system, and bronze or teflon disc.
4. Bronze Swing Check: Class 125, with rubber seat.
5. Check Valves: Class 125, swing or wafer type as indicated.

C. Heating Water Systems: Use the following valve types:

1. Gate Valves: Class 150, bronze or cast-iron body to suit piping system.
2. Ball Valves: Class 150, 600-psi CWP, bronze with stem extension and memory stop.
3. Plug Valves: Eccentric type; EPDM or BUNA-N plug facing
4. Globe Valves: Class 150, bronze or cast-iron body to suit piping system, and bronze disc.
5. Butterfly Valves: Aluminum bronze disc, EPDM or Buna N sleeve and stem seals.
6. Bronze Swing Check: Class 150, with composition seat.
7. Check Valves: Iron swing, wafer, or lift type, as indicated. Swing check shall be Class 150 with bronze seat ring.

D. Low-Pressure Steam and Condensate Return Systems: Use the following valve types:

1. Gate Valves: Class 150, bronze body; or Class 125, cast-iron body.
2. Ball Valves: C. I. Body w/ C.I. Teflon Fused Ball, handles w/stem extension.
3. Globe Valves: Class 150, bronze body with teflon disc; or Class 125, cast-iron body.
4. Check Valves: Class 150, bronze body swing check with composition seat; Class 150, cast-iron body swing check with bronze seat ring; or Class 125, cast iron body wafer check.

E. Chilled-Water Systems: Use the following valve types:

1. Gate Valves: Class 150, bronze body; or Class 125, cast-iron body.
2. Ball Valves: Class 150, 600-psi CWP, with stem extension and memory stop.
3. Plug Valves: Buna N plug facing and packing.
4. Globe Valves: Class 125, bronze body with bronze or teflon disc; or Class 125, cast-iron body.
5. Butterfly Valves: Aluminum bronze disc; EPDM sleeve and stem seals.
6. Check Valves: Class 125, bronze body swing check with rubber seat; Class 125, cast-iron body swing check; Class 125, cast-iron body wafer check; or Class 125, cast-iron body lift check.

F. Condenser Water Systems: Use the following valve types:

1. Gate Valves: Class 125, bronze body; or Class 125, cast-iron body.
2. Ball Valves: Class 150, 600-psi CWP, with memory stop.
3. Plug Valves: Buna N plug facing and packing.

4. Globe Valves: Class 125, bronze body with bronze or teflon disc; or Class 125, cast-iron body.
5. Butterfly Valves: Aluminum bronze disc; EPDM sleeve and stem seals.
6. Check Valves: Class 125, bronze body swing check with rubber seat; Class 125, cast-iron body swing check; Class 125, cast-iron body wafer check; or Class 125, cast-iron body lift check.

G. High-Pressure Steam Piping: Use the following valve types:

1. Angle Valves, NPS 2 and Smaller: Type 2, Class 200, bronze.
2. Angle Valves, NPS 2½ and Larger: Type II, Class 250, cast iron.
3. Ball Valves, NPS 2 and Smaller: Three-piece, 400-psig CWP rating, copper alloy.
4. Ball Valves, NPS 2½ and Larger: Class 300, ferrous alloy.
5. High-Pressure Butterfly Valves, NPS 3 and Larger: Single-flange, Class 300.
6. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 200, bronze.
7. Swing Check Valves, NPS 2½ and Larger: Type II, Class 250, gray iron.
8. Gate Valves, NPS 2 and Smaller: Type 3, Class 200, bronze.
9. Gate Valves, NPS 2½ and Larger: Type I, Class 250, OS&Y, bronze-mounted cast iron.
10. Globe Valves, NPS 2 and Smaller: Type 1, Class 200, bronze.
11. Globe Valves, NPS 2½ and Larger: Type 1, Class 250, bronze-mounted cast iron.

H. Steam Condensate Piping: Use the following valve types:

1. Ball Valves, NPS 2 and Smaller: Three-piece, 400-psig CWP rating, copper alloy.
2. Ball Valves, NPS 2½ and Larger: Class 300, ferrous alloy.
3. High-Pressure Butterfly Valves, NPS 3 and Larger: Flangeless, Class 300.
4. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 200, bronze.
5. Swing Check Valves, NPS 2½ and Larger: Type II, Class 250, gray iron.
6. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type IV, Class 200.
7. Spring-Loaded, Lift-Disc Check Valves, NPS 2½ and Larger: Type III, Class 250, cast iron.
8. Gate Valves, NPS 2 and Smaller: Type 3, Class 200, bronze.
9. Gate Valves, NPS 2½ and Larger: Type I, Class 250, OS&Y, bronze-mounted cast iron.
10. Globe Valves, NPS 2 and Smaller: Type 2, Class 200 bronze.
11. Globe Valves, NPS 2½ and Larger: Type I, Class 250, bronze-mounted cast iron.

3.8 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 15 sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install chainwheel operators on valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor elevation.

G. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.

2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.

3.9 ADJUSTING

A. Adjust or replace packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if leak persists.

END OF SECTION

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SECTION 15181 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes piping, special-duty valves, and hydronic specialties for hot-water heating, chilled-water cooling, and condenser water systems; makeup water for these systems; blowdown drain lines; and condensate drain piping.

1.2 SUBMITTALS

A. Product Data: For each type of special-duty valve indicated. Include flow and pressure drop curves based on manufacturer's testing for diverting fittings, calibrated balancing valves, and automatic flow-control valves.

B. Maintenance Data: For hydronic specialties and special-duty valves to include in maintenance manuals specified in Division 1.

C. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.3 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. 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 the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

C. International Mechanical Code: Comply with applicable sections.

1.4 COORDINATION

A. Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate pipe sleeve installations for foundation wall penetrations.

C. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.

D. Coordinate pipe fitting pressure classes with products specified in related Sections.

E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.

F. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 15 Section "Basic Mechanical Materials and Methods" for fire and smoke wall and floor assemblies.

1.5 EXTRA MATERIALS

A. Water Treatment Chemicals: Furnish sufficient chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Calibrated Balancing Valves:

a. Armstrong Pumps, Inc.
b. Flow Design, Inc.
c. Griswold Controls.
d. ITT Bell & Gossett; ITT Fluid Technology Corp.
e. Taco, Inc.

2. Pressure-Reducing Valves:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Conbraco Industries, Inc.
d. ITT Bell & Gossett; ITT Fluid Technology Corp.
e. Spence Engineering Company, Inc.
f. Watts Industries, Inc.; Watts Regulators.

3. Safety Valves:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Conbraco Industries, Inc.
d. ITT McDonnell & Miller Div.; ITT Fluid Technology Corp.
e. Kunkle Valve Division.
f. Spence Engineering Company, Inc.

4. Automatic Flow-Control Valves:

a. Flow Design, Inc.
b. Griswold Controls.

5. Expansion Tanks:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. ITT Bell & Gossett; ITT Fluid Technology Corp.
d. Taco, Inc.

6. Air Separators and Air Purgers:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. ITT Bell & Gossett; ITT Fluid Technology Corp.

2.2 PIPING MATERIALS

A. General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

2.3 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. Wrought-Copper Fittings: ASME B16.22.

D. Wrought-Copper Unions: ASME B16.22.

E. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.

F. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (silver).

2.4 STEEL PIPE AND FITTINGS

A. Steel Pipe, NPS 2 and Smaller: ASTM A 53, Type S (seamless) or Type F (furnace-butt welded), Grade A, Schedule 40, black steel, plain ends.

B. Steel Pipe, NPS 2-1/2 through NPS 12: ASTM A 53, Type E (electric-resistance welded), Grade A, Schedule 40, black steel, plain ends.

C. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250.

D. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.

E. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.

F. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced.

G. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

H. 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.

I. Flexible Connectors: Stainless steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment. (2) grooved mechanical joint fittings my be used in lieu of flexible connector. Install per manufacturer's recommendations for flexible connectors.

J. Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

K. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

2.5 VALVES

A. Gate, globe, check, ball, and butterfly valves are specified in Division 15 Section "Valves."

B. Refer to Part 3 "Valve Applications" Article for applications of each valve.

C. Calibrated Balancing Valves, NPS 2 and Smaller: Bronze body, ball or plug type, 125-psig working pressure, 250 deg F maximum operating temperature, and having threaded ends. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.

D. Calibrated Balancing Valves, NPS 2-1/2 and Larger: Cast-iron or steel body, ball or plug type, 125-psig working pressure, 250 deg F maximum operating temperature, and having flanged or grooved connections. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.

E. Pressure-Reducing Valves: Diaphragm-operated, bronze or brass body with low inlet pressure check valve, inlet strainer removable without system shutdown, and non-corrosive valve seat and stem. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory set at operating pressure and have capability for field adjustment.

F. Safety Valves: Diaphragm-operated, bronze or brass body with brass and rubber, wetted, internal working parts; shall suit system pressure and heat capacity and shall comply with the ASME Boiler and Pressure Vessel Code, Section IV.

G. Automatic Flow-Control Valves: Gray-iron body, factory set to maintain constant flow with plus or minus 5 percent over system pressure fluctuations, and equipped with a readout kit including flow meter, probes, hoses, flow charts, and carrying case. Each valve shall have an identification tag attached by chain, and be factory marked with the zone identification, valve number, and flow rate. Valve shall be line size and one of the following designs:

1. Gray-iron or brass body, designed for 175 psig at 200 deg F with stainless-steel piston and spring.
2. Brass or ferrous-metal body, designed for 300 psig at 250 deg F with corrosion-resistant, tamperproof, self-cleaning, piston-spring assembly easily removable for inspection or replacement.
3. Combination assemblies, including bronze ball valve and brass alloy control valve, with stainless-steel piston and spring, fitted with pressure and temperature test valves, and designed for 300 psig at 250 deg F.

H. Pump Discharge Valves; 175 psig working pressure, 300 F maximum operating temperature, cast-iron body, bronze disc and seat, stainless steel stem and spring and Teflon packing. Valves shall have flanged connections and straight or angle pattern as indicated. Features shall include non-slam check valve with spring loaded weighted disc and calibrated adjustment feature to permit regulation of pump discharge flow and shutoff.

2.6 HYDRONIC SPECIALTIES

A. Manual Air Vent: Bronze body and nonferrous internal parts; 150-psig working pressure; 225 deg F operating temperature; manually operated with screwdriver or thumbscrew; with NPS 1/8 discharge connection and NPS 1/2 inlet connection. Drain may also be used, see Section 3.3.

B. Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150-psig working pressure; 240 deg F operating temperature; with NPS 1/4 discharge connection and NPS 1/2 inlet connection.

C. Expansion Tanks: Welded carbon steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Separate air charge from system water to maintain design expansion capacity by a flexible bladder securely sealed into tank. Include drain fitting and taps for pressure gage and air-charging fitting. Support vertical tanks with steel legs or base; support horizontal tanks with steel saddles. Factory fabricate and test tank with taps and supports installed and labeled according to the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

D. Tangential-Type Air Separators: Welded black steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg F maximum operating temperature; perforated stainless-steel air collector tube designed to direct released air into expansion tank; tangential inlet and outlet connections; threaded connections for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger; threaded blowdown connection. Provide units in sizes for full-system flow capacity.

E. Y-Pattern Strainers: 125-psig working pressure; cast-iron body (ASTM A 126, Class B), flanged ends for NPS 2-1/2 and larger, threaded connections for NPS 2 and smaller, bolted cover, perforated stainless-steel basket, and bottom drain connection.

F. Flexible Connectors: Stainless steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged- or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot, Chilled Water, and Boiler Drain Piping, NPS 2 and Smaller: Aboveground, use Type L drawn-temper copper tubing with soldered joints, use Schedule 40 steel pipe with threaded joints. Below ground or within slabs, use Type K annealed-temper copper tubing with soldered joints. Use the fewest possible joints belowground and within floor slabs.

B. Hot and Chilled Water, NPS 2-1/2 and Larger: Schedule 40 steel pipe with welded and flanged joints.

C. Cooling Coil Condensate Drain Lines: Type L drawn-temper copper tubing with soldered joints.

3.2 VALVE APPLICATIONS

A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:

1. Shutoff Duty: Ball and butterfly valves.
2. Throttling Duty: Globe, ball, and butterfly valves.

B. Install shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, unless only one piece of equipment is connected in the branch line. Install throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.

C. Install calibrated balancing valves in the return water line of each heating or cooling element and elsewhere as required to facilitate system balancing.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves on hot-water generators and elsewhere as required by the ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to floor. Comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves on hot-water generators and elsewhere as required to regulate system pressure.

G. Install pump discharge valves where indicated on drawings. Check valve not required where pump discharge valve is used.

3.3 PIPING INSTALLATIONS

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements.

B. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

C. 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.

D. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

E. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

F. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.

G. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install minimum NPS 3/4 nipple and ball valve in blowdown connection of strainers.

H. Anchor piping for proper direction of expansion and contraction.

I. Install other hydronic specialties of types and in locations indicated on drawings.

J. Install condensate drain lines for all cooling coil drain pans and condensing gas-fired heating equipment. Provide drain traps designed per manufacturers' instructions and to allow proper drainage. Extend piping the same size as the equipment connection to nearest floor drain, mop sink, or safe-waste.

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 15 Section "Hangers and Supports." Comply with requirements below for maximum spacing of supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than NPS 6.
2. Adjustable roller hangers and spring hangers for individual horizontal piping NPS or larger.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs and horizontal piping first (3) hangers adjacent to vibrating equipment.

C. 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.
8. NPS 6: Maximum span, 17 feet; minimum rod size, 1/2 inch.
9. NPS 8: Maximum span, 19 feet; minimum rod size, 5/8 inch.

D. 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.

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for joint construction requirements for soldered and brazed joints in copper tubing; threaded, welded, and flanged joints in steel piping.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above floor. Install feeder in bypass line, off main, using ball or butterfly valves on each side within 12 inches of feeder and in the main between bypass connections. Pipe drain, with ball valve, to nearest equipment drain.

3.7 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.

3. Flush system with clean water. Clean strainers.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
3. Check expansion tanks to determine that they are not air bound and that system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure.
   Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

3.8 PRE - CLEANING

A. Flush hydronic piping systems with clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.

3.9 ADJUSTING

A. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

B. Perform these adjustments before operating the system:

1. Open valves to fully open position. Close coil bypass valves.
2. Check pump for proper direction of rotation.
3. Set automatic fill valves for required system pressure.
4. Check 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. Check operation of automatic bypass valves.
7. Check and set operating temperatures of boilers, chillers, and cooling towers to design requirements.
8. Lubricate motors and bearings.

END OF SECTION

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SECTION 15185 – HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of HVAC pumps for hydronic systems:

1. Inline circulators.
2. Flexible-Coupled, end-suction pumps

1.2 PERFORMANCE REQUIREMENTS

A. Pump Pressure Ratings: At least equal to system's maximum operating pressure at point where installed, but not less than specified.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data including certified performance curves and rated capacities of selected models, weights (shipping, installed and operating), furnished specialties, and accessories. Indicate pump's operating point on curves.

C. Wiring diagrams detailing wiring for power, signal and control systems, and differentiating between manufacturer-installed wiring and field-installed wiring.

D. Maintenance data for pumps to be included in the operation and maintenance manual specified in Division 1. Include startup instructions.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with provisions of the following:

1. ASME B31.9, Building Services Piping, for piping materials and installation.
2. Hydraulic Institute's Standards for Centrifugal, Rotary and Reciprocating Pumps, for pump design, manufacture, testing and installation.
3. UL 778, Standard for Motor Operated Water Pumps, for construction requirements. Include UL listing and labeling.
4. NEMA MG 1, Standard for Motors and Generators, for electric motors. Include NEMA listing and labeling.
5. NFPA 70, National Electrical Code, for electrical components and installation.

B. Single-Source Responsibility: Obtain each category of pumps from one source and by a single manufacturer.

C. Product Options: Drawings indicate sizes, profiles, connections and dimensional requirements of pumps and are based on the specific types and models indicated. Other manufacturers' pumps with equal performance characteristics may be considered.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store pumps in dry location.

B. Retain shipping flange protective covers and protective coatings during storage.

C. Protect bearings and couplings against damage from sand, grit and other foreign matter.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work are limited to the following to match existing at the facility:

1. Inline Circulators and flexible-coupled, end-suction pumps:

a. ITT Fluid Technology Corporation – Bell & Gossett
b. Taco, Inc.
c. Armstrong

2.2 PUMPS, GENERAL

A. General: Factory-assembled and tested.

B. Include pump casings that allow removal and replacement of impellers without disconnecting piping.

C. Types, Sizes, Capacities and Characteristics: As indicated.

D. Motors: NEMA MG-1, general purpose, continuous duty, Design B, except Design C where required for high starting torque. Furnish single-, multiple- or variable-speed motors with type of enclosures and electrical characteristics as indicated. Include built-in thermal-overload protection and grease-lubricated ball bearings. Select each motor to be nonover-loading over full range of the pump performance curve.

E. Factory Finish: Manufacturer's standard paint applied to factory-assembled and tested units before shipping.

2.3 INLINE CIRCULATORS

A. Description: Horizontal in-line, centrifugal, single-stage, bronze fitted, radially split case design, rated for 125 psig minimum working pressure and a continuous water temperature of 225F. Include the following:

1. Casing: Cast iron, with threaded companion flanges for piping connections smaller than 2-1/2" and threaded gage tappings at inlet and outlet connections.
2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, overhung, single-suction and keyed to shaft.
3. Shaft and Sleeve: Steel shaft with oil-lubricated copper sleeve.
4. Seals: Mechanical type. Include carbon-steel rotating ring, stain-less steel spring, ceramic seat, and flexible bellows and gasket.
5. Pump Bearings: Oil-lubricated, bronze journal and thrust type.
6. Motor Bearings: Oil-lubricated, sleeve type.
7. Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
8. Motor: Resiliently mounted to pump casing.

2.4 FLEXIBLE-COUPLED, END-SUCTION PUMPS

A. Description: Base-mounted, centrifugal, flexible-coupled, end-suction, single-stage, bronze-fitted, back-pull-out, radially split case design; rated for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.

1. Casing: Cast iron, with flanged piping connections, drain plug at low point of volute, threaded gage tappings at inlet and outlet connections, and integral feet or other means on volute to support weight of casing and attached piping. Casing shall allow removal and replacement of impeller without disconnecting piping.
2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, overhung, single suction, keyed to shaft, and secured by locking cap screw.
3. Wear Rings: Replaceable, bronze casing ring.
4. Shaft and Sleeve: Steel shaft with bronze sleeve.
5. Seals: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.
6. Coupling: Flexible-spacer type, capable of absorbing torsional vibration and shaft misalignment; with flange and sleeve section that can be disassembled and removed without removing pump or motor.
7. Coupling Guard: Steel, removable, and attached to mounting frame.
8. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate for mounting pump casing, coupling guard, and motor. Field-drill motor-mounting holes for field-installed motors.

    a. Option: Cast-iron frames are acceptable.

9. Motor: Secured to mounting frame, with adjustable alignment.

2.6 PUMP SPECIALTY FITTINGS

A. Include the following pump specialty fittings with end connections matching pump and piping, where indicated:

1. Suction Diffuser: Angle or straight pattern, 175 psig pressure rating, cast-iron body and end cap, pump-inlet fitting.

    Include bronze startup and bronze or stainless steel permanent strainers; bronze or stainless steel straightening vanes; drain plug; and factory- or field-fabricated support.

2. Triple-Duty Valve: Angle or straight pattern, 175 psig pressure rating, cast-iron body, pump discharge fitting. Include drain plug and bronze fitted shutoff, balancing, and check valve features.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment foundations and conditions, with installer present, for compliance with requirements for installation and other conditions affecting performance of pumps.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

D. Do not proceed until unsatisfactory conditions have been corrected.

3.2 CONCRETE

A. Install concrete bases of dimensions indicated for pumps. Refer to Division 3 Section, Cast-in-Place Concrete, and Division 15 Section, Basic Mechanical Materials and Methods.

3.3 INSTALLATION

A. Install pumps according to manufacturer's written installation and alignment instructions.

B. Install pumps in locations and arranged to provide access for periodic maintenance, including removal of motors, impellers, couplings and accessories.

C. Support pumps and piping separately so that piping is not supported by pumps.

D. Suspend inline pumps using continuous-thread hanger rod and vibration isolation hangers of sufficient size to support the weight of the pump independent of piping system.

3.4 ALIGNMENT

A. Align pump and motor shafts and piping connections after setting on foundations, after grout has been set and foundation bolts have been tightened, and after piping connections have been made.

B. Comply with pump & coupling manufacturer written instructions.

C. Adjust alignment of pump and motor shafts for angular and parallel alignment by one of two methods specified in the H.I.'s Standard for Centrifugal, Rotary and Reciprocating Pumps, Instructions for Installation, Operation and Maintenance.

D. After alignment is correct, tighten the foundation bolts evenly, but not too firmly. Fill the base plate completely with non-shrink, nonmetallic grout, with metal blocks and shims or wedges in place. After grout has cured, fully tighten foundation bolts.

E. Alignment Tolerances: To manufacturer recommendations.

3.5 CONNECTIONS

A. General: Install shutoff valve and strainer on pump suction and check valve and shutoff valve on pump discharge, except where other arrangement is indicated.

B. Connect piping to pumps as indicated. Install valves that are the same size as piping connecting to pumps.

C. Install suction and discharge pipe sizes equal to or greater than the diameter of the pump nozzles.

D. Install thermometers where indicated.

E. Install pressure gages on pump suction and discharge. Install at integral pressure gage tappings where provided.

3.6 FIELD QUALITY CONTROL

A. Check suction piping connections for tightness to avoid drawing air into pumps.

B. Clean strainers.

C. Set pump controls.

3.7 COMMISSIONING

A. Final Checks before Start-Up: Perform the following preventative maintenance operations and checks before start-up:

1. Lubricate bearings.
2. Remove grease-lubricated bearing covers, flush bearings with kerosene and clean thoroughly. Fill with new lubricant according to manufacturer's recommendations.
3. Disconnect coupling and check motor for proper rotation that matches direction marked on pump casing.
4. Check that pumps are free to rotate by hand. Pumps for handling hot liquids shall be free to rotate with pump hot and cold. Do not operate the pump if it is bound or even drags slighting until cause of trouble is determined and corrected.
5. Check that pump controls are correct for required application.

B. Starting procedure for pumps with shutoff power not exceeding the safe motor power.

1. Prime pumps, opening suction valve, closing drains and preparing pumps for operation.
2. Open cooling water supply valves in cooling water supply to bearings, where applicable.
3. Open the cooling water supply valves if stuffing boxes are water-cooled.
4. Open sealing liquid supply valves if pumps are so fitted.
5. Open warm-up valves of pumps handling hot liquids if pumps are not normally kept at operating temperature.
6. Open circulating line valves if pumps should not be operated against dead shutoff.
7. Start motors.
8. Open discharge valves slowly.
9. Observe leakage from stuffing boxes and adjust sealing liquid valve for proper flow to ensure lubrication of packing. Let the packing "run in" before reducing leakage through stuffing boxes; then tighten glands.
10. Check general mechanical operation of pumps and motors.
11. Close circulating line valves once there is sufficient flow through pumps to prevent overheating.

C. When pumps are to be started against closed check valves with discharge shutoff valves open, steps are the same, except that discharge valves are opened some time before motors are started.

D. Refer to Division 15 Section, Testing, Adjusting and Balancing, for detailed requirements for testing, adjusting and balancing hydronic systems.

END OF SECTION

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SECTION 15194 - FUEL GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes piping, specialties, and accessories for natural gas systems within building and to gas meters.

B. This Section includes piping, specialties, and accessories for natural gas systems within building and to point indicated.

1.3 DEFINITIONS

A. Low-Pressure Natural Gas Piping: Operating pressure of 0.5 psig or less.

B. Gas Service: Pipe from gas main or other source to gas point of delivery for building being served. Piping includes gas service piping, gas valve, service pressure regulator, meter bar or meter support, and gas meter.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Minimum Working-Pressure Ratings: Except where otherwise indicated, minimum pressure requirements are as follows:

1. Low-Pressure Natural Gas Piping: 0.25 psig.

B. Approximate values of natural gas supplied for these systems are as follows:

1. Heating Value: 1000 Btu/cu. ft.
2. Specific Gravity: 0.6.
3. Service Line Pressure: 15 to 20 psig.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of natural gas specialty and special-duty valve. Include pressure rating, rated capacity, and settings of selected models.

C. Coordination Drawings for natural gas piping, including required clearances and relationship to other services for same work areas.

D. Test reports specified in "Field Quality Control" Article in Part 3.

E. Maintenance data for natural gas specialties and special-duty valves to include in the operation and maintenance manual specified in Division 1 Section "Contract Closeout."

1.6 QUALITY ASSURANCE

A. Comply with NFPA 54, "National Fuel Gas Code," for gas piping materials and components; installations; and inspecting, testing, and purging.

B. Comply with NFPA 70, "National Electrical Code," for electrical connections between wiring and electrically operated control devices.

C. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and legally dispose of liquids from drips in existing gas piping. Handle cautiously to avoid spillage and ignition. Notify gas supplier. Handle flammable liquids used by Installer with proper precautions and do not leave on premises from end of one day to beginning of next day.

1.8 SEQUENCING AND SCHEDULING

A. Notification of Interruption of Service: Notify each affected user when gas supply will be turned off.

B. Work Interruptions: Leave gas piping systems in safe condition when interruptions in work occur during repairs or alterations to existing gas piping systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

1. Gas Stops, 2-Inch NPS and Smaller:

a. Hammond Valve Corp.
b. Jomar International, Ltd.
c. Maxitrol Co.
d. McDonald: A.Y. McDonald Mfg. Co.
e. Milwaukee Valve Co., Inc.
f. Mueller Co.
g. National Meter.

2. Gas Valves, 2-1/2-Inch NPS and Larger:

a. Core Industries, Inc.; Mueller Steam Specialty Div.
b. Huber: J.M. Huber Corp.; Flow Control Div.
c. Milliken Valve Co., Inc.
d. Nordstrom Valves, Inc.
e. Olson Technologies, Inc.
f. Xomox Corp.

3. Gas Pressure Regulators:

a. American Meter Co.
b. Fisher Controls International, Inc.
c. Equimeter, Inc.
d. Maxitrol Co.
e. National Meter.
f. Richards Industries, Inc.; Jordan Valve Div.
g. Schlumberger Industries; Gas Div.

2.2 PIPES AND TUBES

A. Steel Pipe: ASTM A 53; Type E, electric-resistance welded or Type S, seamless; Grade B; Schedule 40; black.

2.3 PIPE AND TUBE FITTINGS

A. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends conforming to ASME B1.20.1.

B. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends conforming to ASME B1.20.1.

C. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250.

2.4 JOINING MATERIALS

A. Common Joining Materials: Refer to Division 15 Section "Basic Mechanical Materials and Methods" for joining materials not included in this Section.

B. Joint Compound and Tape: Suitable for natural gas.

C. Gasket Material: Thickness, material, and type suitable for natural gas.

2.5 VALVES

A. Manual Valves: Conform to standards listed or, where appropriate, to ANSI Z21.15.

B. Gas Stops, 2-Inch NPS and Smaller: AGA-certified, bronze-body, plug type with bronze plug, ball type with chrome-plated brass ball, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal, for 2 psig or less natural gas. Include AGA stamp, flat or square head or lever handle, and threaded ends conforming to ASME B1.20.1.

1. Locking Device: Include locking (tamperproof) feature.

C. Gas Valves, 2-1/2-Inch NPS and Larger: MSS SP-78, Class 125 or Class 175 WOG, nonlubricated-plug type with polytetrafluoroethylene (PTFE) lining or sleeve, semisteel body, wrench operated, with flanged ends.

1. Locking Device: Include locking (tamperproof) feature.

2.6 PIPING SPECIALTIES

A. Gas Pressure Regulators: ANSI Z21.18, single-stage, steel-jacketed, corrosion-resistant pressure regulators. Include atmospheric vent, elevation compensator, with threaded ends conforming to ASME B1.20.1 for 2-inch NPS and smaller and flanged ends for 2-1/2-inch NPS

and larger. Regulator pressure ratings, inlet and outlet pressures, and flow volume in cubic feet per hour of natural gas at specific gravity are as indicated.

1. Line Gas Pressure Regulators: Inlet pressure rating not less than system pressure.
2. Appliance Gas Pressure Regulators: Inlet pressure rating not less than system pressure, with capacity and pressure setting matching appliance.
3. Gas Pressure Regulator Vents: Factory- or field-installed corrosion-resistant screen in opening when not connected to vent piping.

B. Flexible Connectors: ANSI Z21.24, copper alloy.

C. Strainers: Y pattern, full size of connecting piping. Include stainless-steel screens with 3/64-inch perforations, except where other screens are indicated.

1. Pressure Rating: 125-psig minimum steam or 175-psig WOG working pressure, except where otherwise indicated.
2. 2-Inch NPS and Smaller: Bronze body, with threaded ends conforming to ASME B1.20.1.
3. 2-1/2-Inch NPS and Larger: Cast-iron body, with flanged ends.
4. Screwed screen retainer with centered blow-down and pipe plug.

2.7 PROTECTIVE COATING

A. Furnish pipe and fittings with factory-applied, corrosion-resistant polyethylene coating for use in corrosive atmosphere. Coating properties include the following:

1. Applied to pipe and fittings treated with compatible primer before applying tape.
2. Overall Thickness: 20 mils, synthetic adhesive.
3. Water-Vapor Transmission Rate: Maximum 0.10 gal./100 sq. in.
4. Water Absorption: 0.02 percent maximum.

PART 3 - EXECUTION

3.1 PREPARATION

A. Close equipment shutoff valves before turning off gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section.
B. Comply with NFPA 54 Paragraph "Prevention of Accidental Ignition."

3.2 SERVICE ENTRANCE PIPING

A. Extend natural gas piping and connect to gas distribution system (gas service) piping in location and size indicated for gas service entrance to building.

1. Gas distribution system piping, service pressure regulator, and gas meter will be provided by gas utility.

B. Install shutoff valve, downstream from gas meter, outside building at gas service entrance.

3.3 PIPING APPLICATIONS

A. General: Flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating may be used in applications below, except where otherwise indicated.

B. Low-Pressure, 0.5 psig or Less, Natural Gas Systems: Use the following:

1. 2-Inch NPS and Smaller: Steel pipe, malleable-iron threaded fittings, and threaded joints.
2. 2-Inch NPS and Larger: Steel pipe, butt-welding fittings, and welded joints.

C. Underground Natural Gas Systems, All Pressures: Steel pipe, butt-welding fittings, and welded joints. Encase gas carrier piping in containment conduits.

D. Underground Containment Conduits: Steel pipe, butt-welding fittings, and welded joints.

3.4 VALVE APPLICATIONS

A. Use gas stops for shutoff to appliances with 2-inch NPS or smaller low-pressure gas supply.

B. Use gas valves for shutoff to appliances with 2-1/2-inch NPS or larger low-pressure gas supply and all sizes for medium-pressure gas supply.

C. Use gas valves of sizes indicated for gas service piping, meters, mains, and where indicated.

3.5 PIPING INSTALLATIONS

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements.

B. Concealed Locations: Except as specified below, install concealed gas piping in airtight conduit constructed of Schedule 40, seamless, black steel pipe with welded joints. Vent conduit to outside and terminate with screened vent cap.

1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves in such spaces.
2. In Floors: Gas piping with welded joints and protective wrapping specified in "Protective Coating" Article in Part 2 may be installed in floors, subject to approval of authorities having jurisdiction. Surround piping cast in concrete slabs with minimum of 1-1/2 inches of concrete.
   Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
3. In Floor Channels: Gas piping may be installed in floor channels, subject to approval of authorities having jurisdiction. Channels must have cover and be open to space above cover for ventilation.
4. In Partitions: Do not install concealed piping in solid partitions. Protect tubing from physical damage when installed inside partitions or hollow walls.

   a. Exception: Tubing passing through partitions or walls.

5. In Walls: Gas piping with welded joints and protective wrapping specified in "Protective Coating" Article in Part 2 may be installed in masonry walls, subject to approval of authorities having jurisdiction.
6. Prohibited Locations: Do not install gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.

   a. Exception: Accessible above-ceiling space specified above.

C. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of gas meters. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate would be subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.

D. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels, except where indicated to be exposed to view.

E. Install gas piping at uniform grade of 0.1 percent slope upward toward risers.

F. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

G. Connect branch piping from top or side of horizontal piping.

H. Install unions in pipes 2-inch NPS and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

I. Install strainers on supply side of each control valve, gas pressure regulator, solenoid valve, and elsewhere as indicated.

J. Install dielectric fittings (unions and flanges) with ferrous and brass or bronze end connections, separated by insulating material, where piping of dissimilar metals is joined.

K. Install dielectric fittings (unions and flanges) with 2 ferrous end connections, separated by insulating material, at outlet from gas meter and, where indicated, for ferrous piping.

L. Install flanges on valves, specialties, and equipment having 2-1/2-inch NPS and larger connections.

M. Anchor piping to ensure proper direction of piping expansion and contraction. Install expansion joints, expansion loops, and pipe guides as indicated.

N. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.

O. Install containment conduits for gas piping below slabs, within building, in gastight conduits extending minimum of 4 inches outside building, and vented to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end. Prepare and paint outside of conduits with coal-tar epoxy-polyamide paint according to SSPC-Paint 16.

3.6 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

3.7 VALVE INSTALLATION

A. Install valves in accessible locations, protected from damage. Tag valves with metal tag indicating piping supplied. Attach tag to valve with metal chain.

1. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for valve tags.
2. Refer to Division 15 Section "Mechanical Identification" for valve tags.

B. Install gas valve upstream from each gas pressure regulator. Where 2 gas pressure regulators are installed in series, valve is not required at second regulator.

C. Install pressure relief or pressure-limiting devices so they can be readily operated to determine if valve is free; test to determine pressure at which they will operate; and examine for leakage when in closed position.

3.8 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices.

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. 1/2-Inch NPS: Maximum span, 72 inches; minimum rod size, 3/8 inch.
2. 3/4- and 1-Inch NPS: Maximum span, 96 inches; minimum rod size, 3/8 inch.
3. 1-1/4-Inch NPS: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. 1-1/2- and 2-Inch NPS: Maximum span, 108 inches; minimum rod size, 3/8 inch.
5. 2-1/2- to 3-1/2-Inch NPS: Maximum span, 10 feet; minimum rod size, 1/2 inch.
6. 4-Inch NPS and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

C. Install hangers for horizontal drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
1. 3/8-Inch NPS: Maximum span, 48 inches; minimum rod size, 3/8 inch.
2. 1/2- and 5/8-Inch NPS: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. 3/4- and 7/8-Inch NPS: Maximum span, 84 inches; minimum rod size, 3/8 inch.
4. 1-Inch NPS: Maximum span, 96 inches; minimum rod size, 3/8 inch.

D. Support vertical pipe and tube at each floor.

3.9 CONNECTIONS

A. Install gas piping next to equipment and appliances using gas to allow service and maintenance.

B. Connect gas piping to equipment and appliances using gas with shutoff valves and unions. Install gas valve upstream from and within 72 inches of each appliance using gas. Install union or flanged connection downstream from valve. Include flexible connectors when indicated.

C. Sediment Traps: Install tee fitting with capped nipple in bottom forming drip, as close as practical to inlet for appliance using gas.

D. Electrical Connections: Wiring is specified in Division 16 Sections.

3.10 ELECTRICAL BONDING AND GROUNDING

A. Install aboveground portions of natural gas piping systems that are upstream from equipment shutoff valves, electrically continuous, and bonded to grounding electrode according to NFPA 70.

B. Do not use gas piping as grounding electrode.

3.11 FIELD QUALITY CONTROL

A. Inspect, test, and purge piping according to NFPA 54, Part "Gas Piping Inspection, Testing, and Purging" and requirements of authorities having jurisdiction.

B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

C. Report test results promptly and in writing to Architect and authorities having jurisdiction.

D. Verify capacities and pressure ratings of regulators, valves, and specialties.

E. Verify correct pressure settings for pressure regulators.

F. Verify that specified piping tests are complete.

3.12 ADJUSTING

A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

END OF SECTION

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SECTION 15512 - CONDENSING BOILERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes gas-fired, water-tube, floor-mounted condensing boilers, trim, and accessories for generating hot water.

B. Two (2) removed existing boilers are to be replaced with two (2) high efficiency, 399 MBH (input) condensing boilers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for boilers.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings: For boilers, boiler trim, and accessories.

1. Include plans, elevations, sections, and mounting details.
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.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and sections, drawn to scale and coordinated with each other, using input from installers of the items involved.

B. Source quality-control reports.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

E. Product Certificates:

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period. Where "prorated" is indicated, the boiler manufacturer will cover the indicated percentage of cost of replacement parts. With "prorated" type, covered cost decreases as age of equipment increases.

1. Warranty Period for Floor-Mounted Water-Tube Condensing Boilers:

a. Heat Exchanger and Tank: Free from defects in material and workmanship.
b. Warranty Coverage: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 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 ASME Boiler and Pressure Vessel Code.

C. ASHRAE/IES 90.1 Compliance: Boilers shall have minimum efficiency in accordance with Table 6.8.1-6 and other requirements in Ch. 6 of ASHRAE/IES 90.1.

D. Mounting Base: For securing boiler to concrete base.

2.2 FLOOR-MOUNTED, WATER-TUBE CONDENSING BOILERS

A. MANUFACTURERS

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

a. VISSMANN
b. AERCO
c. LOCHINVAR
d. FULTON
e. WEIL-MCLAIN

B. Description: Factory-fabricated, -assembled, and -tested, water-tube, forced-draft, condensing boiler with heat exchanger sealed pressure tight, built on a steel base, including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls. Units are to be for water-heating service only.

C. Heat Exchanger: Stainless steel primary and secondary heat exchangers.

D. Combustion Chamber: Stainless steel, sealed.

E. Burner: Natural gas, forced draft drawing from gas-premixing valve.

F. Blower: Centrifugal fan to operate during each burner-firing sequence and to prepurge and postpurge the combustion chamber.

1. Motors: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 15055 "Motors"

    a. Motor Sizes: Large enough so driven load will not require motor to operate in service factor range above 1.0.

G. Gas Train: Combination gas valve with manual shutoff and pressure regulator.

H. Ignition: Direct-spark ignition or silicone carbide hot-surface ignition with 100 percent main-valve shutoff and electronic flame supervision.

I. Integral Circulator: Cast-iron body and stainless steel impeller sized for minimum flow required in heat exchanger.

J. Casing:

1. Jacket: Sheet metal, with snap-in or interlocking closures.
2. Control Compartment Enclosures: NEMA 250, Type 1A.
3. Finish: Powder-coated protective finish.
4. Insulation: Minimum 1-inch-thick, mineral-fiber insulation surrounding the heat exchanger.
5. Combustion-Air Connections: Inlet and vent duct collars.

K. Capacities and Characteristics:

1. Heating Medium: Refer to schedules on plans
2. Minimum Efficiency AFUE: 95 percent.
3. Minimum Thermal Efficiency: 97 percent.
4. Minimum Combustion Efficiency: 95 percent.

2.3 TRIM - FOR HOT-WATER BOILERS

A. Aquastat Controllers: Operating, firing rate, and high limit with automatic reset.

B. Safety Relief Valve: ASME rated.

C. Pressure and Temperature Gauge: Minimum 3-1/2-inch-diameter, combination water-pressure and -temperature gauge. Gauges shall have operating-pressure and -temperature ranges, so normal operating range is about 50 percent of full range.

D. High and low gas-pressure switches.

E. Alarm bell with silence switch.

F. Boiler Air Vent: Automatic

G. Drain Valve: Minimum NPS 3/4 hose-end gate valve.

H. Circulation Pump: Nonoverloading, in-line pump with split-capacitor motor having thermal-overload protection and lubricated bearings; designed to operate at specified boiler pressures and temperatures. P-5 and P-6 on plans.

2.4 CONTROLS

A. Boiler to be provided with new BACnet Gateway for compatibility with existing BMS system.

B. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.

1. High Cutoff: Manual reset stops burner if operating conditions rise above maximum boiler design temperature.
2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manual-reset type.
3. Blocked Inlet Safety Switch: Manual-reset pressure switch factory mounted on boiler combustion-air inlet.
4. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.

C. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.

1. Hardwired Points:

a. Monitoring: On/off status, low-water-level alarm
b. Control: On/off operation, hot-water-supply temperature set-point adjustment

2. A BACnet communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. All monitoring and control features, which are available at the local boiler control panel, shall also be available at the remote operator workstation through the building automation system.

2.5 ELECTRICAL POWER

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are shown on Drawings and specified in electrical Sections.

B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

1. House in NEMA 250, Type 1 enclosure.
2. Wiring shall be numbered and color coded to match wiring diagram.
3. Install factory wiring outside of an enclosure in a metal raceway.
4. Field power interface shall be to non-fused disconnect switch.
5. Provide branch power circuit to each motor and to controls with a disconnect switch.
6. Provide each motor with overcurrent protection.

2.6 VENTING KITS

A. Kit: Complete system, ASTM A959, Type 29-4C stainless steel pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap and dilution tank, and sealant.

B. Combustion-Air Intake: Complete system, stainless steel pipe, vent terminal with screen, inlet air coupling, and sealant.

2.7 CONDENSATE-NEUTRALIZATION UNITS

A. Description: Factory-fabricated and -assembled condensate-neutralizing capsule assembly of corrosion-resistant plastic material with threaded or flanged inlet and outlet pipe connections.

Device functions to prevent acidic condensate from damaging grain system. It is to be piped to receive acidic condensate discharged from condensing boiler and neutralize it by chemical reaction with replaceable neutralizing agent. Neutralized condensate is then piped to suitable drain.

B. Capsule features:

1. All corrosion-resistant material.
2. Suitable for use on all natural gas and propane boilers.
3. Includes initial charge of neutralizing agent.
4. Neutralizing agent to be easily replaceable when exhausted.
5. Inlet and outlet pipe connections.

C. Capsule Configuration:

1. Low-profile design for applications where boiler condensate drain is close to the floor.
2. Easily removed and opened for neutralizing agent replacement.
3. Multiple units may be used for larger capacity.

D. Tank Configuration:

1. Utilized where boiler is elevated or where tank is installed in a pit with tank top flush with floor.
2. Top easily removed for neutralizing agent replacement.
3. Internal baffles to channel flow for complete neutralization.
4. Integral bypass to prevent condensate backflow into appliance.
5. Multiple units may be used for larger capacity.

2.8 SOURCE QUALITY CONTROL

A. UL Compliance: Test gas-fired boilers having input of more than 400,000 Btu/h for compliance with UL 795. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

B. UL Compliance, Gas-Fired: Test gas-fired boilers for compliance with UL 2764. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

C. Performance Testing: Test and label boilers for efficiency to comply with AHRI 1500.

D. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

E. Test and inspect factory-assembled boilers, before shipping, in accordance with 2017 ASME Boiler and Pressure Vessel Code. Factory test boilers for safety and functionality; fill boiler with water, and fire throughout firing range, to prove operation of all safety components.

F. Contact Architect 14 days in advance of testing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting performance of the Work.

1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where boilers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BOILER INSTALLATION

A. Equipment Mounting:

1. Install floor-mounted boilers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations.
2. Comply with requirements for vibration isolation devices.

B. Install gas-fired boilers according to NFPA 54.

C. Assemble and install boiler trim.

D. Install electrical devices furnished with boiler but not specified to be factory mounted.

E. Install control wiring to field-mounted electrical devices.

3.3 PIPING CONNECTIONS

A. Comply with requirements for hydronic piping specified in Section 15181 "Hydronic Piping."

B. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service. Flexible connectors and their installation are specified in Section 15181.

C. Drawings indicate general arrangement of piping, fittings, and specialties.

D. When installing piping adjacent to boiler, allow space for service and maintenance of condensing boilers. Arrange piping for easy removal of condensing boilers.

E. Install condensate drain piping to condensate-neutralization unit and from neutralization unit to nearest floor drain. Piping shall be at least full size of connection. Install piping with a minimum of 2 percent downward slope in direction of flow.

F. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas-train connection. Provide a reducer if required.

G. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve, and union or flange at each connection.

H. Install piping from safety relief valves to nearest floor drain.

3.4 DUCT CONNECTIONS

A. Boiler Venting:

1. Field fabricate and install boiler vent and combustion-air intake.
2. Utilize vent and intake duct material, size, and configuration as indicated in boiler manufacturer's instructions and to comply with UL 1738.
3. Comply with all boiler manufacturer's installation instructions.

3.5 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.6 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring in accordance with "Control-Voltage Electrical Power Cables."

C. Install nameplate for each control connection, indicating field control panel designation and I/O control designation feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative:

B. Tests and Inspections:

1. Perform installation and startup checks in accordance with manufacturer's written instructions.
2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Boiler will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers. Refer to Section "Demonstration and Training."

1. Instructor shall be factory trained and certified.
2. Train personnel in operation and maintenance and to obtain maximum efficiency in plant operation.
3. Provide instructional videos showing general operation and maintenance that are coordinated with operation and maintenance manuals.
4. Obtain Owner sign-off that training is complete.
5. Owner training shall be held at Project site.

END OF SECTION

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SECTION 15990 - TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies the requirements and procedures for total mechanical systems testing, adjusting and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

B. Test, adjust, and balance the following new mechanical systems:

1. Supply air systems, all pressure ranges.
2. Return air systems.
4. Hydronic systems.
5. Verify temperature control system operation.

C. Test, adjust and balance existing systems to the extent required to assure proper operation of all new equipment (or as indicated).

1. Balance the following existing systems:

a. Supply air systems, all pressure ranges.
b. Return air systems.
c. Hydronic systems.
d. Verify existing temperature control system operation.

2. Read total fluid flow to all existing equipment before and after balance of existing systems to verify that flow to existing equipment has not changed.
3. Existing pumps and fans shall be sped up as required, including sheave changes, to achieve required flow to all new and existing equipment.
4. Report to Architect/Engineer any discrepancies found.

D. Test systems for proper sound and vibration levels.

E. This Section does not include:

1. Testing boilers and pressure vessels for compliance with safety codes.
2. Specifications for materials for patching mechanical systems.
3. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.
4. Requirements and procedures for piping and ductwork systems leakage tests.

1.2 SUBMITTALS

A. Certified Reports: Submit testing, adjusting and balancing reports bearing the seal and signature of the Test and Balance Engineer.

The reports shall be certified proof that the systems have been tested, adjusted and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

1. Draft reports: Upon completion of testing, adjusting and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual and legible. Organize and format draft reports in the same manner specified for the final reports. Submit two complete sets of draft reports. Only one complete set of draft reports will be returned.
2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit two complete sets of final reports.
3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:

    a. General Information and Summary
    b. Air Systems
    c. Hydronic Systems
    d. Temperature Control Systems
    e. Special Systems
    f. Sound and Vibration Systems

4. Report Contents: Provide the following minimum information, forms and data:

    a. General Information and Summary: Inside cover sheet to identify testing, adjusting and balancing agency, Contractor, Owner, Architect, Engineer and Project. Include addresses and contact names and telephone numbers. Also include a certification sheet containing the seal and name, address, telephone number and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.
    b. The remainder of the report shall contain the appropriate forms containing, as a minimum, the information indicated on the standard report form prepared by the AABC and NEBB, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.

B. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

1.3 QUALITY ASSURANCE

A. Agency Qualifications:

1. Employ the services of an independent testing, adjusting and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust and balance the building mechanical systems identified above to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.
2. An independent testing, adjusting and balancing agency certified by Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project, and having at least one Professional Engineer registered in the state in which the services are to be performed, certified by AABC as a Test and Balance Engineer.

B. Codes and Standards:

1. AABC: National Standards for Total System Balance.
2. NEBB: Procedural standard for testing, adjusting, and balancing of environmental systems.
3. ASHRAE: ASHRAE Handbook, 1984 Systems Volume, Chapter 37, Testing, Adjusting and Balancing.

C. Pre-Balancing Conference: Prior to beginning of the testing, adjusting and balancing procedures, schedule and conduct a conference with the representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting and balancing.

1.4 PROJECT CONDITIONS

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

1.5 SEQUENCING AND SCHEDULING

A. Test, adjust and balance the air systems before hydronic and refrigerant systems.

B. Test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 5 degrees F wet bulb temperature of maximum summer design condition, and within 10 degrees F dry bulb temperature of minimum winter design condition. Take final temperature readings during seasonal operation.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

A. Before operating the system, perform these steps:

1. Obtain design drawings and specifications including addendums and bulletins and become thoroughly acquainted with the design intent.
2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return and exhaust) and temperature control diagrams.
3. Compare design to installed equipment and field installations.
4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.
5. Check filters for cleanliness.
6. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
7. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlets factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.
8. Determine best locations in main and branch ductwork for most accurate duct traverses.
9. Place outlet dampers in the full open position.
10. Prepare schematic diagrams of system as-built ductwork and piping layouts to facilitate reporting.
11. Lubricate all motors and bearings.

12. Check fan belt tension.
13. Check fan rotation.

3.2 PRELIMINARY PROCEDURES FOR HYDRONIC SYSTEM BALANCING

A. Before operating the system, perform these steps:

1. Open valves to full open position. Close coil bypass valves.
2. Remove and clean all strainers.
3. Examine hydronic systems and determine if water has been treated and cleaned.
4. Check pump rotation.
5. Clean and set automatic fill valves for required system pressure.
6. Check expansion tanks to determine that they are not air bound and that the system is completely full of water.
7. Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or to bleed air completely (manual type).
8. Set temperature controls so all coils are calling for full flow.
9. Check operation of automatic bypass valves.
10. Check and set operating temperatures of chillers to design requirements.
11. Lubricate all motors and bearings.

3.3 MEASUREMENTS

A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments meeting the specifications of the referenced standards.

C. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until two consecutive identical values are obtained.

D. Take measurements in the system where best suited to the task.

3.4 PERFORMING TESTING, ADJUSTING AND BALANCING

A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.

B. Cut insulation and patch, ductwork and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.

C. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

D. Retest, adjust and balance systems subsequent to significant system modifications, and resubmit test results.

3.5 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans: 0 to plus 10 percent.
2. Air Outlets and Inlets: Plus 10 to minus 10 percent

3. Water Flow Rate: Plus 10 to minus 10 percent.

3.6 TESTING FOR SOUND AND VIBRATION

A. Test and adjust mechanical systems for sound and vibration in accordance with the detailed instructions of the referenced standards.

3.7 RECORD AND REPORT DATA

A. Record all data obtained during testing, adjusting and balancing in accordance with and on the forms recommended by the referenced standards, and as approved on the sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

3.8 DEMONSTRATION

A. Training:

1. Train the Owner's maintenance personnel on troubleshooting procedures and testing, adjusting and balancing procedures. Review with the Owner's personnel, the information contained in the Operating and Maintenance Data specified in Division 1 and Section 15010.
2. Schedule training with Owner through the Architect/Engineer with at least seven days prior notice.

END OF SECTION