Addendum 1 for RFB929000-01

Project Name: DOC FDCF Building C Water Heater Replacement
RFB #: 929000-01
DAS Project #: 9290.00
Date: 7/6/2022

Bids Due: July 28, 2022 at 2:00 p.m.

Changes to Specifications:

00 0110R Table of Contents
- Has been replaced by attached 00 0110R Table of Contents.

22 0500 Common Work Results for Plumbing
- Added entire section.

22 0523 General Duty Valves for Plumbing Piping
- Added entire section.

22 0529 Hangers and Supports for Plumbing, Piping and Equipment
- Added entire section.

22 0443 Identification for Piping and Equipment
- Added entire section.

22 0700 Piping Insulation
- Added entire section.

22 1005 Plumbing Piping
- Added entire section.

22 3000 Plumbing Equipment
- Added entire section.

23 2113 Hydronic Piping
- Added entire section.

END OF ADDENDUM

SECTION 00 0110

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PROCUREMENT AND CONTRACTING REQUIREMENTS

SPECIFICATIONS

END OF SECTION

SECTION 22 0500
COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The work shall include the furnishings of systems, equipment and materials specified in this Division and as called for on the Plumbing Drawings to include supervision, quality control, operation, methods and labor for the fabrication, installation, start-up and tests for the complete plumbing installation. The work shall also include the furnishing of necessary hoisting facilities to set materials and equipment in place and the furnishing of any scaffolding and transportation associated with this work.

B. Examine the project site and become familiar with existing conditions which will affect the work. Review the drawings and specifications of other trades and take note of conditions to be created which will affect the work. All conditions shall be considered in the preparation of bids; no additional compensation will be made on the behalf of this Contractor.

C. Provide labor necessary to demolish the existing plumbing systems as shown on the drawings, as described in Part 3.1, Existing Conditions, or as required.

D. Where noted on the drawings or where called for in other sections of the specification, the Contractor for this division shall install equipment furnished by others, and shall make required service connections. Verify with the supplier of the equipment the requirements for the installation. This contractor shall be responsible for the removal and installation of railings, piping, ductwork, louvers, etc. as required to install new equipment.

1.2 DAMAGE

A. The Contractor shall be responsible for damage to the work of other trades, or to the building and its contents, caused by equipment installation.

1.3 PERMITS AND INSPECTIONS

A. Obtain and furnish necessary permits and inspection certificates for material and labor furnished. Permits and certificates shall be obtained from the proper inspection authorities. The cost of permits, certificates and fees required in connection with the installation shall be borne by the Contractor, unless otherwise noted in the detailed contractual description preceding these specifications. Where applications are required for the procuring of utility services to the building, see that such application is properly filed with the utility, and that information required for such an application is presented to the extent and in the form required by the utility company.

1.4 CODES AND STANDARDS

A. Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated . Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. Applicable provisions of the following codes and standards are hereby imposed on a general basis for the mechanical work in addition to specific applications specified by individual work sections of these specifications.

1. ANSI/ASME Pressure Piping Standards (B31)
2. AWWA Standards
3. ASME BPVC - Boiler and Pressure Vessel Code and State Boiler Code
4. ICC (IECC) - International Energy Conservation Code
5. ICC (IMC) - International Mechanical Code
6. NFPA 70 - National Electrical Code
7. Local and/or State Plumbing, Mechanical and Building Codes
8. Occupational Safety and Health Act (OSHA)
9. State of Iowa Plumbing Code
10. NFPA Codes and Standards

C. Any product used for dispensing potable water shall meet NSF 61 and NSF 372 testing standards. Third party testing shall be required.

D. If any work indicated on the drawings or specified herein conflicts in any way with any of the rules and regulations of the above Authorities, the Contractor shall promptly notify the Architect/Engineer in writing and do so no less than 72 hours before bids are opened. In the event the Contractor fails to notify the Architect/Engineer and changes are required by said conflicts, the Contractor shall make such changes as are required without additional cost to this Owner.

E. Installations must be safe in every respect, and must not create a condition which will be harmful to building occupants; to operating, installing, or testing personnel; to workmen; or to the public. The contractor for each installation shall be solely responsible for providing installations which will meet these conditions. If the Contractor believes that the installation will not be safe for all parties, report these beliefs in writing to the Architect/Engineer before any equipment is purchased or work is installed, giving recommendations. The Architect/Engineer will work out required changes and adjustments in contract price where adjustments are warranted.

1.5 DRAWINGS

A. A complete set of up-to-date Project Drawings and Specifications shall be kept on the site at all times. Prior to installing any of the work, check the drawings for dimensions and see that the work does not interfere with clearance required for ceilings, beams, foundations, finished columns, pilasters, partitions, and electrical equipment as shown on the drawings and details. After work is installed and it develops that interferences occur which have not been called to the Architect/Engineer's attention before the installation, the Contractor shall, at his own expense, make such changes in his work as directed by the Architect/Engineer.

B. The contract drawings for plumbing work are in part diagrammatic, intended to convey the scope of work and indicate general arrangement and approximate sizes and locations of equipment and materials. Where job conditions require reasonable changes in indicated locations and arrangement, the Contractor shall make such changes as directed by the Architect/Engineer, without additional cost to the Owner.

C. Because of the scale of the drawings, certain basic items such as pipe fittings, access panels, and sleeves may not be shown; but where such items are required by other sections of these specifications or where they are required by the nature of the work, they shall be furnished and installed. Rough-in dimensions and locations shall be verified with the supplier of equipment furnished by other trades, or by the Owner, prior to the time of roughing-in.

D. Equipment specification may not deal individually with minute items required such as components, parts, controls, and devices which may be required to produce the equipment performance specified, or as required to meet the equipment warranties. Where such items are required , they shall be included by the supplier of the equipment, whether or not specifically called for.

E. The drawings and the specifications are cooperative and supplementary. It is the intent of both said drawings and specifications to cover all mechanical requirements in their entirety as nearly as possible. The Contractor shall closely check the drawings and specifications for any obvious errors or omissions and bring any such condition to the attention of the Architect/Engineer prior to the receipt of bids, in order to permit clarification by means of a mailed Addendum. If there is no question prior to the bid proposal date, the Architect/Engineer shall assume that the drawings and specifications are complete and correct and will expect the intent of said documents to be complied with, and the installation to be complete in all respects, according to said intent.

F. Locate equipment which must be serviced, operated, or maintained in fully accessible positions. Minor deviations from the contract drawings may be made to allow for better accessibility, but changes of magnitude, or which involve extra cost, shall not be made without prior approval. Ample space shall be allowed for removal of parts that may require replacement or service in the future.

G. All valves, pumps, etc. shall be accessible for maintenance purposes. Locate items carefully and coordinate with other trades so that each valve and piece of equipment is accessible and functional. Items located above a non-accessible ceiling, chase, or soffit shall be accessible through an access door. Coordinate location of access doors with the general contractor.

1.6 RESPONSIBILITY

A. The Contractor's responsibility shall not end with the installation and connecting of the various apparatus. It shall include the services of an experienced superintendent, who shall be constantly in charge of the work, together with the qualified journeymen, helpers and laborers required to properly unload, install, connect, adjust, start, operate and test the work involved, including equipment and materials furnished by other trades or by the Owner, until such time as the entire plumbing installation functions properly in every detail.

1.7 COORDINATION

A. Coordinate the work with other trades prior to installation.

B. No piping or equipment, which is foreign to the electrical equipment, or architectural appurtenances shall be run over the top of any electrical panels or electrical equipment, in accordance with NEC 110.26. This does not prohibit sprinkler protection for the installation.

C. The determination of quantities of material and equipment required shall be made from the drawings. Schedules on the drawings and in the specifications are completed as an aid, but where discrepancies arise, it shall be the Contractor's responsibility to provide the required quantity.

D. Where the specifications state that equipment shall be furnished, installed, or provided, it shall be understood to mean this Contractor shall furnish and install completely, unless it is specifically stated that the equipment is to be furnished and installed by others.

E. The Architect/Engineer reserves the right to determine space priority of the contractors in the event of interference between the piping and equipment of the various contractors. Conflicts between the drawings and specifications, or between requirements set forth for the various trades, shall be called to the attention of the Architect/Engineer. If clarification is not asked for prior to the taking of bids, it will be assumed that none is required, and that the Contractor has submitted his bid in conformance with plans and specifications as issued and that no interference exists.

F. No piping or equipment foreign to an elevator hoistway and machine room shall be run inside the hoistway or machine room in accordance with NEC 620.37 and ASME A17.1 Safety Code for Elevators and Escalators.

1.8 GUARANTEE AND MAINTENANCE

A. Materials and equipment shall be guaranteed to be free from defects and to be new equipment; no secondhand, used or salvaged equipment will be allowed. The Owner's existing equipment which is to be relocated or reinstalled under this contract shall be refurbished, cleaned and repaired, and made subject to the guarantee and maintenance as herein specified, unless specifically noted otherwise.

B. Keep the entire portion of the work in repair, without additional cost to the Owner, so far as defects in workmanship, apparatus, material or construction are concerned for one (1) year from the date of final acceptance, except as otherwise specified herein.

C. Equipment which fails to meet performance ratings as specified and shown on the drawings shall be removed and replaced by new equipment that meets the specified requirements, without additional cost to the Owner.

D. Materials and workmanship shall be subject to the review of the Architect/Engineer, in whose presence various tests shall be made as required by these specifications.

PART 2 PRODUCTS

2.1 SUBMITTALS

A. Submit shop drawings and catalog data for plumbing equipment as called for in Division 01 - General Requirements.

B. Submittal data for plumbing equipment shall consist of shop drawings and/or catalog cuts showing technical data necessary to evaluate the material or equipment to include dimensions, wiring diagrams, performance curves, rating, and other descriptive data necessary to describe fully the item proposed and its operating characteristics. Shop drawings shall be submitted on equipment and materials as required by the specifications.

C. Approval of materials, including alternate or substitute items, shall be obtained in writing from the Architect/Engineer, verbal approval will not be considered binding.

D. Shop drawings shall be submitted and shall have been signed, checked, approved, and initialed by the Contractor prior to submittal to the Architect/Engineer. The Architect/Engineer will review shop drawings to aid in interpreting the plans and specifications, and will in so doing assume that the shop drawings conform to specified requirements set forth in this specification. The approval of the shop drawing by the Architect/Engineer does not relieve the Contractor of the responsibility of complying with elements of the specification. The name of the job, Architect/Engineer , location, and specification section shall appear on all pages of shop drawings. Equipment marks (such as S-1, WH-1) shall be indicated for each item.

E. Near completion of project, before conducting Owner orientation and training sessions and before authorization of final payment, submit to the Owner or their designated Representative for review: three (3) sets of installation and operational information, parts lists, and maintenance instructional manuals. These OMMs shall be organized, formatted and bound in accordance with Division 01 - General Requirements.

F. At the completion of the project, prepare and submit to the Owner record drawings showing the location of piping and valves. Drawing shall give accurate dimensions of such equipment for future use by the Owner. This drawing shall be submitted as soon as work is completed and before authorization of final payment.

2.2 SUBCONTRACTORS AND MATERIALS

A. Submit to the Architect/Engineer for review, when requested, a list of subcontractors, materials and equipment proposed to be used. The list must be reviewed by the Architect/Engineer before this Contractor may enter into any subcontractual agreement. Equipment, materials, and devices, etc. shall be subject to the review of the Architect/Engineer, whether or not said items are herein specified.

2.3 STANDARDS OF MATERIALS AND WORKMANSHIP

A. Materials shall be new, complete with manufacturer's guarantee or warranty, and shall be as listed by Underwriters Laboratories (UL), Inc., American Water Works Association (AWWA), American Gas Association (AGA), etc., **if** a standard has been established by that agency for the type of material.

B. Materials shall also comply with applicable standards of the National Electrical Manufacturer's Association, National Board of Fire Underwriters, National Fire Protection Association, National Safety Council, National Bureau of Standards, the National Electrical Code and the Williams-Steiger Occupational Safety and Health Act of 1970. Such standards are hereby made a part of these specifications.

C. Work shall be performed by workmen skilled in the particular craft, shall be executed in a workmanlike manner, and shall present a neat mechanical appearance when completed. Align, level and adjust equipment for satisfactory operation, and install so that connecting and disconnecting of piping and accessories can be made readily and so that parts are easily accessible for inspection, operation and maintenance. Methods and techniques of installation shall be subject to the review of the Architect/Engineer.

D. Materials shall be the standard product of a reputable manufacturer regularly engaged in the manufacture of the specific product. Materials of the same type of class shall be the products of one manufacturer. For example, faucets shall be from the same manufacturer.

E. Materials shall be protected from damage, and stored indoors or protected from the weather at all times, unless other storage arrangements are approved by the Architect/Engineer.

F. Material and equipment shall be installed in strict accordance with the manufacturer's recommendations.

2.4 MATERIAL SUBSTITUTIONS

A. Proposals as submitted shall be based on the products specifically named in the specification or on the drawings. Material or equipment by manufacturers other than those specified may be used only by permission of the Architect/Engineer. Such permission for substitution must be requested in writing and in accordance with Division 01 - General Requirements.

B. The Architect/Engineer reserves the sole right for the approval of proposed material or equipment, and the phrase, "or approved equivalent", used in these specifications, or on the drawings, shall be interpreted to mean an equivalent approved by the Architect/Engineer.

C. Changes required by alternate equipment shall be made at no additional cost to the Owner; and costs incurred by other trades, public utilities, or the Owner, as a result of the use of such equipment, shall be the responsibility of the Contractor.

D. Furnish to the Architect/Engineer, when requested, samples of proposed material or equipment substitutions. These samples shall remain with the Architect/Engineer as long as needed.

E. Identify the differences in alternate material or equipment as compared to that specified, and indicate the benefits to the project as a result of selecting the alternative.

F. The Architect/Engineer reserves the right to refuse approval of equipment which does not meet the specification, in their opinion, or of equipment for which no local experience of satisfactory service is available. The Architect/Engineer further reserves the right to reject equipment for which maintenance service and the availability of replacement parts is questionable.

2.5 JOINING MATERIALS

A. Refer to individual Division 22 piping sections for special joining materials not listed below.

B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.6 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

1. Available Manufacturers:

a. Capitol Manufacturing Co.

b. Central Plastics Company.

c. Eclipse, Inc.

d. Epco Sales, Inc.

e. Hart Industries, International, Inc.

f. Watts Industries, Inc.; Water Products Div.

g. Zurn Industries, Inc.; Wilkins Div.

h. Engineer Pre-Approved Equivalent

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

A. Examine the existing buildings and grounds or site and become familiar with the conditions as they exist, or that will in any manner affect the work under this contract. No allowance will be made subsequently, in this connection, on behalf of the Contractor for any error or negligence by the Contractor.

B. Existing equipment, such as duct or pipe, in or on the existing building and grounds which is to be replaced, or which interferes in any way with the remodeling of the existing facilities and/or installation of new equipment, shall be removed from the premises or relocated by this Contractor, as directed by the ArchitecUEngineer. Do not remove from the premises any equipment that may have maintenance value to the Owner without permission of the Owner. equipment, duct, or pipe not to be reused shall be removed from the premises, unless otherwise noted herein or shown on the drawings.

C. Where existing equipment is removed or changed, all piping no longer in service shall be removed and stubs plugged as directed by the Architect/Engineer. Building surfaces damaged and openings left by removal of equipment shall be repaired by the proper trades and paid for by this Contractor, unless otherwise noted on the drawings. The cutting and fitting shall be done by this Contractor. The cutting of floor, ceiling or wall surfaces shall be done by this Contractor with extreme care, in order to avoid any disrupting or damage of existing utility services which may be encountered. Coordinate with other trades and with the General Contractor or Construction Manager to minimize the damage to the building in order to reduce the amount of patching required.

D. Where new openings are cut and concealed piping is encountered, such items shall be removed or relocated as required. Where systems to be removed stub through floors, walls or ceilings, openings shall be patched so that no evidence of the former installation remains.

E. Existing active services (water, gas, sewer, electric), when encountered, shall be protected against damage. Do not prevent or disturb operation of active services that are to remain. If active services are encountered which require relocation, make request to authorities with jurisdiction for determination of procedures. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the utility or municipality having jurisdiction.

F. The location, size and elevation of underground utilities shown on the drawings are in accordance with data supplied by the Owner and/or the various utility companies. The Contractor shall verify this data and shall report any discrepancies to the ArchitecVEngineer, in writing, before submitting his bid.

3.2 INTERRUPTION OF SERVICE

A. Changes in service shall be made so as to provide a minimum of interference with the operation of services in the building. When changes require shutdown of building services, notify the proper building authorities no less than 48 hours in advance and obtain approval from these authorities before making changes. Such notices shall give duration and nature of shutdown. Temporary arrangements shall be approved by the ArchitecVEngineer and/or Owner.

B. Any and all interruptions to building services shall be in accordance with Division 01 - General Requirements.

3.3 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Drawing 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 unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

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

G. Install piping to allow application of insulation.

H. Select system components with pressure rating equal to or greater than system operating pressure.

3.4 OPENINGS, CUTTING, AND PATCHING

A. The General Contractor shall coordinate the placing of openings in the new structure, as required for the installation of the plumbing work.

B. Furnish to the General Contractor the accurate locations and sizes for required openings. This shall not relieve this Contractor of the responsibility of checking to assure that proper size openings are provided. When additional patching is required due to this Contractor's failure to inspect this work, this Contractor shall make arrangements for the patching required to properly close the opening, to include patch painting. This Contractor shall pay any additional cost incurred in this respect.

C. When cutting and patching of the structure is made necessary due to this Contractor's failure to install piping, sleeves or equipment on schedule, or due to this Contractor's failure to furnish, on schedule, the information required for the leaving of openings, it shall be this Contractor's responsibility to make arrangements for this cutting and patching. This Contractor shall pay any additional cost incurred in this respect.

D. Provide cutting and patching and patch painting in the existing structure, as required for the installation of the work. Furnish lintels and supports as required for openings. Cutting of structural support members will not be permitted without prior approval of the Architect/Engineer. Extent of cutting shall be minimized. Use core drills, power saws or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and textures and shall be performed by craftsmen skilled in the respective craft required.

3.5 CONCRETE AND MASONRY WORK

A. Concrete bases and pads for mechanical equipment shall be furnished by this Contractor. Size bases to extend minimum of 4" beyond equipment base in any direction, and 4" above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

B. Locate, furnish and install all support, hanger and equipment anchor bolts and related hardware.

3.6 PAINTING

A. The finish of any item that has been marred, scratched or damaged in any way by this Contractor shall be repainted at the expense of this Contractor, and to the satisfaction of the Architect/Engineer and the Owner.

B. Painting and finishing of exposed mechanical systems including piping and duct shall be as shown on the drawings and per Division 9 - Finishes.

3.7 CLEANING

A. Keep the premises clean of all dirt and debris, caused by the work in accordance with Division **1** - General Requirements.

B. Keep the premises clean of all debris caused by the work at all times, and keep materials stored, in areas designated by the Owner, in such a manner as not to interfere with the progress of the work of other Contractors or with the operation of existing facilities.

C. At the conclusion of the construction, the site shall be thoroughly cleaned of all rubble, debris and unused material and shall be left in good order. Closed off spaces shall be cleaned of waste such as material, cartons, and wood frame members used in the construction.

3.8 SUSPENSION FROM WOOD STRUCTURAL MEMBERS

A. In general, concentrated or other loads shall not be suspended directly from the bottom of wood structural members, unless approved by the Architect/Engineer. Loads suspended from open web joists or trusses may be transferred to the bottom chord of the structural member at the panel points. Loads suspended from solid web joists shall be transferred to the joists only through the top flange or web. Suspension systems shall be reviewed by the Architect/Engineer.

3.9 WIRING FOR PLUMBING EQUIPMENT

A. The Division 26 Contractor shall provide power including connection to all electrically powered equipment furnished by the Division 22 Contractor. Where electrical disconnect switches are not explicitly specified to be furnished as part of Division 22 equipment, the Electrical Contractor shall furnish suitable type(s) and properly rated electrical disconnect switches for all said mechanical equipment.

B. Provide integral wiring, alarm wiring, control wiring, temperature control wiring and interlock wiring for equipment furnished, whether or not such wiring is furnished by the equipment vendor.

C. Except as noted otherwise or where other sections call for motor starters to be furnished by manufacturers as part of their equipment, the Division 26 Electrical Contractor shall furnish motor starters as required for motors furnished by this Division 22 Contractor.

D. Furnish shop drawings including but not limited to detailed schedules and wiring diagrams to other interested trades including Division 26 electrical contractor for all electrically powered equipment furnished. Schedules shall include: electrical loads and characteristics, max. overcurrent fuse protection / circuit breaker needs, disconnect requirements, motor starter requirements and motor horsepower(s.) Include drawings as needed to depict locations of electrical and control panels, service clearances, disconnects as well as wiring connection points.

E. The Division 22 Contractor shall be responsible to pay for all additional costs incurred due to equipment substitutions by Division 22 Contractor, which require either larger electrical service or service of a different electrical characteristic than scheduled on the Drawings.

F. Prior to bid submission, this Division 22 Contractor shall review the Electrical Drawings and promptly bring to the attention of the Architect/Engineer, any omissions or errors in the electrical services required for equipment proposed to be furnished.

3.10 PROTECTION

A. Special steps shall be taken as necessary for the protection of equipment and materials furnished under Division 22. Equipment and materials shall be protected by Contractor from any physical damage due to weather elements, dirt, dents, sheet rock installation, and painting until the project is completed. Damage, if incurred, shall be promptly repaired at no additional cost to Owner, as-needed to restore equipment and materials to original as-new condition.

B. Protection of equipment during the finishing (sheet rock, plastering and painting) of the building interior shall be the responsibility of the contractor or contractors performing that work. This shall not relieve this Division 22 Contractor of the ultimate responsibility of checking and ensuring that adequate protection is provided and maintained at all times.

C. Where the installation or connection of equipment requires Division 22 Contractor to work in areas previously finished by other Contractors, the Division 22 Contractor shall be responsible to ensure that such finished areas are adequately protected and are not marred, soiled or otherwise damaged during the course of their said work. If damage occurs this Division 22 Contractor shall be responsible to arrange for the other Contractors to repair and refinish any damaged areas and shall pay for all repair, rework and refinishing required.

D. When heavy materials must be placed upon or transported over the roof deck, sheeting shall be placed to distribute the weight and support such materials. Any damage shall be immediately corrected at no cost to the Owner.

3.11 ASBESTOS IDENTIFICATION AND CONTROL

A. In the event that suspected asbestos containing material (ACM) is encountered during the course of the work, cease operations in the immediate area and promptly notify both the Owner and Architect/Engineer. Suspected materials will then be sampled and analyzed by the Owner's Representative .

B. Should ACM be confirmed, the Owner's Representative shall direct the abatement procedures. This work shall be awarded either by subcontract to the Contractor or under a separate contract.

C. During abatement operations, cease operations in the immediate area of the abatement. Operations in other areas of the project may be performed, but care must be taken to control dust to avoid contamination of air monitoring samples. The Contractors shall coordinate activities with the asbestos abatement contractor as well as the Owner's Representative.

D. Should no ACM be identified, operations in the restricted areas may be resumed. At the discretion of the Owner or Owner's representative, any schedule delays caused by identification, analysis or abatement may be added in the form of an extension of time to the contract via a Change Order.

3.12 NOISE AND VIBRATION

A. Contractor shall install all equipment in a such a manner so as to control the transmission of noise and vibration from any installed equipment, components or systems, so the sound level in any occupied area does not exceed NC-35 levels. Contractor shall correct all objectionable noise levels in any occupied areas and at no additional cost to Owner, which are due to improperly installed or isolated equipment, components, or systems.

3.13 TESTS AND DEMONSTRATIONS

A. Systems shall be tested and placed in proper working order prior to demonstrating systems to the Owner.

B. Prior to acceptance of the plumbing installation, demonstrate to the Owner or his designated representative's essential features and functions of all systems installed, and instruct the Owner in the proper operation and maintenance of such systems.

C. Furnish the necessary trained personnel to perform the demonstrations and instructions, and arrange to have the manufacturer's representatives for the system present to assist with the demonstrations. The Owner and Contractor shall each sign a certification stating that the training has been performed and the Owner accepts same.

3.14 UTILITY REBATE APPLICATIONS

A. This contractor shall be responsible for gathering information necessary for completing local utility rebate applications, and submitting to the proper utility companies for gas and electric rebates. Potential rebates include high efficiency gas boilers, thermostats, timeclocks, motors, and other items furnished by this plumbing contractor.

END OF SECTION

SECTION 22 0523
GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Provide equipment, materials, labor, and supervision necessary to install valves as indicated on drawings and in schedules, and herein specified.

B. Valves of the same type shall be of a single manufacturer.

C. Valves shall conform to ANSI standard dimensions.

D. ASME Compliance:

1. ASME B16.10 for ferrous valve dimensions.
2. ASME B31.9 for building services piping valves.

E. NSF Compliance: NSF/ANSI 61 and/or NSF/ANSI 372 for valve materials for potable-water service. Valves for domestic water must be 3rd Party Certified.

1.2 SUBMITTALS

A. Submit detailed Product Data clearly indicating manufacturer, model, size, dimensions and pressure rating.

B. For records documentation submit valve schedule, indicating valve ID, type, size and intended service and location.

1.3 PACKAGING

A. Valves shall be furnished or provided with protective packaging to prevent damage during shipping or on the job site.

B. Prepare valves for shipping as follows:

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

C. Use the following precautions during storage:

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

D. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

1.4 DEFINITIONS

CWP: Cold working pressure.

EPDM: Ethylene propylene copolymer rubber.

NBR: Acrylonitrile-butadiene , Buna-N, or nitrile rubber.

PTFE: Polytetrafluoroethylene plastic.

SSP - Saturated Steam Pressure

WP - Working Pressure

SWP - Steam Working Pressure

W.O.G. - Water, Oil, Gas Pressure

BR - Bronze

I.B.B.M. - Iron Body, Bronze-Mounted

O.S.&Y. - Outside Screw and Yoke

N.R.S. - Non-Rising Stem

R.S. - Rising Stem

M.S.S. - Manufacturer's Standardization Society of the Valve and Fitting Industry, Inc.

Lead Free: Refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content =0.25% per Safe Drinking Water Act as amended January 4, 2011, Section 1417.

PART 2 PRODUCTS

2.1 GENERAL

A. Materials: Discs, gaskets, packings, seats, diaphragms, and lubricants shall conform to recommendations of the valve manufacturer for the intended use.

B. Body materials, unless otherwise stated:

1. Bronze: 125-150 lbs., ASTM B62
2. High Grade Steam-Metal or Valve-Bronze Alloy: 200-300 lbs., ASTM B61
3. Cast Iron: ASTM A126, Class B
4. Ductile Iron: ASTM A395, A536
5. Cast Steel: ASTM A216

C. Lead Free silicon bronze (ASTM listed) valves shall be made with corrosion-resistant materials. Manufacturer shall provide third party certification tested in accordance with EN ISO 6509 regarding dezincification corrosion resistance and stress corrosion cracking.

D. Bronze Valves: NPS 2 (ON 50) and smaller with threaded or solder ends, unless otherwise indicated.

E. Ferrous Valves: NPS 2-1/2 (ON 65) and larger with flanged ends, unless otherwise indicated.

F. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWAA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.
5. Copper Press: With sockets according to ASME B16.22/ASTMB75.

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

1. Ball Valves : With extended operating handle of non-thermal-conductive material that meets UL 2043 approved for inside air plenum, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.
2. Butterfly Valves : Shall have 2" extended neck for insulation clearance.
3. Gate Valves: With rising stem.

2.2 MANUFACTURERS

A. Subject to compliance with requirements, provide products manufactured by one of the following, as listed for each valve type, or Engineer-approved equivalent.

Valve Type	Approved Manufacturer
Gate, Globe, and Check Valves	Crane, Stockham, Lunkenheimer, Hammond Industrial Series, NIBCO, Milwaukee
Ball Valves	Jamesbury, Apollo, Jenkins, Milwaukee, Watts, Worchester, Powell, or NIBCO
Butterfly Valves	Lined: Keystone, Demeo, Milwaukee, Centerline, Nibco High Performance: Jamesbury, Dezurik, Durco

2.3 GATE VALVES

A. Provide gate valves complying with MSS SP-70 or MSS SP-80. Gate valves shall be as follows unless otherwise indicated on the drawings.

1. 2 in. and Smaller: 125-lb. saturated steam, screwed, solid wedge disc, and all parts ASTM B62 grade bronze except wheel and packing.
2. 2-1/2 in. through 16 in.: 125-lb. saturated steam, O.S.&Y., flanged ends, bronze seats and stem, double-seated solid wedge disc, iron body and bonnet.

B. Equip valves with packing suitable for intended service.

C. Provide gate valves designed such that back seating protects packing and stem threads from fluid when valve is fully opened. Equip valves with gland follower.

D. Gate valves used for ASME Section IV vessel isolation valves shall have adjustable type packing gland.

2.4 GLOBE VALVES

A. Provide globe valves complying with MSS SP-80 or MSS SP-85. Globe valves shall be installed where shown on the drawings for tight shutoff and shall be as follows:

1. 2 in. and smaller: 150-lb. saturated steam, rising stem, bronze body meeting ASTM B62 bronze trim, stainless steel disc and seat, union bonnet with stuffing box.
2. Over 2 in.: 125-lb. saturated steam, flanged iron body and yoke bonnet meeting ASTM A126 Class B, rising stem with stuffing box and yoke bushing.
3. Equip valves with packing suitable for intended service.
4. Provide globe valves such that the back seating protects packing and stem threads from fluid when valve is fully opened. Equip valves with gland follower.

2.5 CHECK VALVES

A. Provide check valves complying with MSS SP-71 or MSS SP-80 for water, steam, and air shall be as follows unless otherwise shown on the drawings:

1. 3 in. and smaller: 200-lb. saturated steam, swing type, threaded, bronze body meeting ASTM B62, pressure tight removable disc, hinge bumper to prevent sticking open, can be mounted horizontally or vertically.
2. Over 3 in.: 125-lb. saturated steam, swing check, flanged iron body meeting ASTM A126 Class B design to prevent disc sticking open, removable disc, bronze trimmed for steam or water, otherwise all iron construction.
3. Non-slam type for pump discharge duty- 2-1/2 in. and larger: I.B.B.M., flanged, class 300, wafer style.
4. Lift check type for boiler feed - 2 in. and smaller: 125-lb. saturated steam, ball cone, check valve with threaded bronze body and spring-loaded seating action.

2.6 BALL VALVES

A. Provide ball valves complying with MSS SP-72 or MSS SP-110. Ball valves shall be as follows unless otherwise indicated on the drawings.

1. 2 in. and smaller: ASTM B584 bronze body, 2-piece, full port stainless steel brass ball, screwed or soldered ends with teflon seats and seals, blow out proof stem, tee or lever handle rated to 150 SWP/600WOG.
2. 2 in. and smaller for medical gas systems: ASTM B62 forged brass or bronze body, 3-piece, full port, stainless steel ball, soldered ends with Teflon seats and seals, lever handle.
3. Over 2 in.: ASTM A2116 carbon semi-steel or ASTM A536 ductile iron body, 2-piece, full port stainless steel brass ball, ANSI rated flanged ends with teflon seats and lever handle rated to 150 SWP/600WOG.

2.7 BUTTERFLY VALVES

A. Lined

1. Disc - Aluminum bronze ASTM B148 Class 9B or ASTM B584 Alloy 876 for chilled, heating and condenser water, air, and fuels

2. Seat:
    a. Buna N hardback type ASTM D735-SB620AABE1E3G for chilled, hot and condenser water, air, fuels.
    b. Hypalon ASTM D2000 for chemically treated water and water -10° **F** to +180° F.
    c. EPT ASTM D2000 for hot water, low-pressure steam +190° **F** to +230° F.
3. Stem - Stainless steel dry journal type 416, ASTM A582.
4. Bodies - Semi-steel; ASTM A126 Class B; cast iron, ASTM 448; ductile iron. ASTM A536; or cast steel, ASTM A216. On insulated piping, butterfly valves shall have extended neck suitable for the associated insulation thickness.
5. Actuators - Lever handle with infinite position lever with positive locking feature on valve sizes 2 in. through 5 in. Geared hand wheel on valve sizes 6 in. and larger. Furnish chain operator for valve 6 inches and larger, and located 8 feet or more above the finished floor in mechanical equipment rooms.
6. General Specifications
    a. Butterfly valves may be of flanged, wafer, or lug type (lugs drilled and tapped). Grooved valve couplings may be used where grooved piping is applied
    b. Elastomer seats shall be bonded to a rigid backup ring, be field replaceable, and of the types listed above.
    c. The disc shall be aluminum bronze of the floating type with no external disc to stem fasteners. Drive is accomplished by a square stem engaging in a broached disc.
    d. Stems shall be stainless steel of the one-piece type, completely sealed from line flow.
    e. Working Pressures: 28 in. vacuum to 250 lb. working pressures, 300 lb. test, with bubble-tight end of line shutoff.
    f. Dead end service at full pressure without the need of a downstream flange.

2.8 DRAIN VALVES (HOSE BIBBS)

A. Soldered or Threaded Ends: Bronze body, screwed bonnet, rising stem, composition disc, 3/4 in. threaded hose outlet connection; 125 psi maximum pressure rating.

2.9 ACTUATORS , HANDWHEELS, OPERATORS, HANDLES, AND WRENCHES

A. Provide suitable handwheels for gate, globe and drain valves.

B. Valve Actuator Types:
    1. Handwheel For valves other than quarter-turn types.
    2. Hand lever: For quarter-turn valves NPS 6 (DN 150) and smaller.

PART 3 EXECUTION

3.1 VALVE LOCATIONS-GENERAL

A. Unless otherwise noted, shutoff valves shall be provided at all equipment connections (supply and return where applicable) for the following piping: pump suction and discharge, water, air, fuel, and gas and drain lines (except on gravity drains from pans). Equipment connections include such items as tanks, pumps, heat exchangers, and similar items.

B. Check valves of the non-slam type shall be installed at the discharge of pumps unless otherwise shown on the drawings.

C. Install isolation valves at each branch off of horizontal mains and vertical risers.

D. All valves 4 in. and larger used for dead end service (future connections) shall be butterfly type (high performance), lugged style with tapped holes in a wafer body.

E. Install chainwheels on operator for ball and gate valves NPS 4 (DN 100) and larger and more than 96 inches (2400 mm) above floor or more than three feet above ceiling. Extend chains to 60 inches (1520 mm) above finished floor or just above ceiling.

3.2 EXAMINATION

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

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

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

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

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

3.3 VALVE INSTALLATION

A. Follow the manufacturer's recommended installation instructions concerning soldering, silver brazing, welding, threading, and installation of flanged valves in order to prevent damage to the valve and assure its maximum efficiency. Additional specific installation requirements are as follows:

1. Thread pipe for threaded valves to standard length only, using new block dies.
2. Put pipe compound on the pipe end, not into the valve threads. Securely screw pipe and valve together.
3. Blow out or otherwise thoroughly clean pipe sections before they are installed.
4. Close valve before installation.
5. Secure and adjust valves for no leaks and for easy operation.
6. Install valves with stems horizontal or vertical above the pipe and square with building construction. Install valves in position to allow full stem movement.
7. Install valves so piping does not place a stress or strain on the valve body. Locate valves for easy access and provide separate support where necessary.

8. Install extended-stem valves where insulation is indicated. Stems shall be extended such that the handle moves freely without contact with the insulation.
9. Install drain valves at low points of piping, at each mechanical equipment item, and elsewhere, where indicated.
10. Locate valves, cock, and hose bibbs to allow easy accessibility for operation, maintenance, and repair.
11. Lugged butterfly valves with rubber-lined seats shall be installed with the disc(s) partially open. Bolts shall be torqued to the manufacturer's recommendations.

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

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

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Lift Check Valves: With stem upright and plumb.

D. When soldering use paste fluxes that are approved by the manufacturer for use with Lead Free Alloys.

3.4 ADJUSTING

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

3.5 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. Drawings indicate valve types to be used. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, Butterfly, or Gate valves.
   a. Piping NPS 2 (DN 50) and smaller: Furnish bronze ball or gate valves.
   b. Piping NPS 2-1/2 (DN 65) and larger: Furnish cast-iron butterfly or gate valves with flanged ends.
2. Throttling - Balancing Service: Globe, Ball, or Butterfly valves.
   a. Piping NPS 2 (DN 50) and smaller: Furnish bronze ball or globe valves.
   b. Piping NPS 2-1/2 (DN 65) and larger: Furnish cast-iron butterfly valves with flanged ends.
3. Hot-Water Piping, Balancing Duty: Memory-stop balancing valves.
4. Drain Duty: Hose-end drain valves.
5. Cast-iron, grooved-end valves may be used with grooved-end piping.
6. Pump-Discharge Check Valves:
   a. NPS 2 (DN 50) and Smaller: Spring-loaded lift valves with nonmetallic disc.
   b. NPS 2-1/2 (DN 65) and Larger for Domestic Water: Center-guided metal-seat check valves.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.
2. Install stop-and-waste drain valves where indicated.

D. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Calibrated balancing valves are specified in Division 22 Section "Domestic Water Piping Specialties."

E. If valves with specified CWP ratings are not available, the same types of valves with CWP ratings may be substituted.

F. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded, Sweat solder, or Press-to-fit ends.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Grooved Mechanical Coupling, Flanged, or Threaded ends .
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Grooved Mechanical Coupling or Flanged ends.

VALVE TYPE	**SERVICE**
Gate - all sizes for applications where ball valves are not suitable	Domestic cold, hot, and recirculating systems; for operation up to 200 psi at 500° **F.**
Globe - all sizes suitable for throttling service	Water, steam, and air for process piping systems.
Check - all sizes	Water, air, and steam for process piping systems.
Ball - all sizes	Domestic cold water, hot, and recirculating systems; for operation up to 200 psi at 500° **F.**
Butterfly - 2 in. And larger (lined)	Domestic cold water, hot, and recirculating systems; for operation up to 500° **F.**
Drain	Domestic water systems.
Boiler and pressure isolation valves for ASME section IV vessel isolation	Stamped pressure vessel shall be gate type with an adjustable-type packing gland.

END OF SECTION

SECTION 22 0529
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Provide equipment, materials, labor and supervision necessary to install pipe hangers and supports.

B. Pipe support systems shall secure pipes in place, prevent pipe vibration, provide vertical adjustment for maintaining required grades, and provide for expansion and contraction.

C. Where supports are attached to concrete or other structural members, care shall be taken to prevent damage or weakening of the structural members.

D. Where concrete inserts are to be used, it shall be this Contractor's responsibility to accurately locate and attach inserts to concrete forms.

1.2 REFERENCE STANDARDS

A. American National Standards Institute, ANSI:

1. ANSI B31.1 Power Piping.
2. ANSI B31.9 Building Services Piping.

B. Manufacturers Standardization Society of the Valve and Fittings Industry, MSS, 1815 North Fort Myer Drive, Arlington, VA 22209.

1. MSS SP-58: Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP-69: Pipe Hangers and Supports - Selection and Application .

C. Anvil International, 2 Holland Way, Exeter, NH 03833, www.anvilintl.com, (603) 418-2800.

1. Pipe Hangers and Supports Catalog (Jan. 2015)

1.3 DEFINITIONS

A. Pipe Hanger: A device normally suspended from structure and is used to carry the piping weight in tension.

B. Pipe Support: A device by which piping is normally carried from beneath and is used to carry the piping weight in compression.

1.4 SUBMITTALS

A. Submit manufacturer's product data on all hangers and support devices. Product data to include, but not be limited to materials, finishes, approvals, load ratings, and dimensional information.

PART 2 PRODUCTS

2.1 HANGERS AND SUPPORTS

A. Hangers and support devices shall be Anvil International Inc., Talco, Fee and Mason, Michigan, B-Line or Engineer approved equivalent. Figure numbers within are based on Anvil International, Inc..

PART 3 EXECUTION

3.1 INSTALLATION - HORIZONTAL PIPE SUPPORTS

A. Hanger rods for steel, wrought iron and brass pipe shall be installed in accordance with MSS SP-69 Tables 3 and 4 and the following schedule:

Pipe Size	Rod Diameter	Maximum Spacing
Up to 1 1/4"	3/8"	7'-0"
1 1/2" and 2"	3/8"	9'-0"
2"	3/8"	10'-0"
2 1/2", 3", and 3 1/2"	1/2"	10'-0"
4" and 5"	5/8"	12'-0"
6"	3/4"	12'-0"
8"	7/8"	14'-0"
10" and 12"	7/8"	16'-0"
14" and 16"	1"	16'-0"
18"	1 1/8"	18'-0"
20" and 24"	1 1/4"	20'-0"

B. Hanger rods for copper pipe and tube shall be installed in accordance with MSS-SP-69 Tables 3 and 4 and the following schedule:

Pipe Size	Rod Diameter	Maximum Spacing
1/2" and 3/4"	3/8"	5'-0"
1"	3/8"	6'-0"
1 1/4"	3/8"	7'-0"
1 1/2"	3/8"	8'-0"
2"	3/8"	8'-0"
2 1/2"	1/2"	9'-0"
3", 3 1/2", and 4"	1/2"	10'-0"
5"	1/2"	13'-0"
6"	5/8"	14'-0"
8"	3/4"	16'-0"

C. Support horizontal cast iron soil pipe with two hangers for each pipe length. Locate hangers close to couplings.

D. In addition to the above specified spacings, install additional hangers at change in pipe direction and at concentrated loads, large valves, and strainers.

E. Where more than one pipe is to be run parallel together, they may be supported on trapeze type hangers. Trapeze bar angles and hanger rods shall be of sufficient size to support the particular group of pipes. Trapeze hanger spacing shall be based on the smallest pipe on the rack. When hanging from light gauge metal trusses, coordinate pipe hanger spacing and hanger rod connection points with the truss manufacturer.

F. For suspending hanger rods from brackets attached to walls, use welded steel brackets: Fig. 194 for loads up to 750 lbs; Fig. 195 for loads up to 1500 lbs; Fig. 199 for loads up to 3000 lbs.

G. Where pipes are to be racked along walls, use " Unistrut" pipe racks or 12 gauge steel strut channel, 1-5/8" x 1-5/8" minimum.

1. Mount pipes to strut channel with two-piece pipe straps to match outside diameter of pipe including insulation.

H. Attach all pipe hangers from support rods using double locknuts tightened to prevent loosening.

3.2 INSTALLATION -VERTICAL PIPE SUPPORTS

A. Support vertical steel, wrought iron, copper and brass pipe at every other floor line.

B. Support vertical cast iron soil pipe at every floor line.

C. In addition to the above, support vertical pipes at base of riser with base fitting set on concrete or brick pier, or by hanger located on horizontal connection close to riser.

D. Where pipe sleeves extend above floor, place pipe clamps at ceiling below and support clamp extensions from inserts or other approved attachment.

3.3 PIPE ATTACHMENTS

A. For horizontal steel and wrought iron pipe, use carbon steel adjustable clevis hanger, Fig. 260. For floor support or support directly above steel beams, use adjustable pipe roll stand, Fig. 177.

B. For horizontal copper pipe and tube, use copper-plated, carbon steel adjustable swivel ring, Fig. CT-69.

C. When thermal expansion for horizontal pipe is in excess of ½" axially, use adjustable steel yoke pipe roll, Fig. 181, or adjustable pipe roll stand, Fig. 177.

D. For horizontal cast iron soil pipe, use carbon steel adjustable clevis hanger, Fig. 260.

E. For vertical steel, wrought iron and cast-iron pipe, use extension pipe or riser clamps, Fig. 261.

F. For vertical copper pipe and tube, use copper-plated, copper plated copper tubing riser pipe clamp, Fig. CT-121.

3.4 INTERMEDIATE ATTACHMENTS

A. Hanger rods: Carbon steel single or double end threaded, Figs. 140, 253 as required. Continuous threaded rod, Fig. 146 may be used wherever possible.

B. Chain wire or perforated strap hangers will not be permitted. One pipe shall not be suspended from another pipe.

3.5 STRUCTURAL ATTACHMENTS

A. For attaching steel or copper plated hanger rods to reinforced concrete, use galvanized malleable iron universal concrete inserts; Fig. 282 for loads up to 1140 lbs.

B. For attaching steel hanger rods to structural steel beams, use malleable iron C-clamps; Fig. 92, Fig. 93 or Fig. 94 with retaining clip Fig. 89 or Fig. 89X for loads up to 500 lbs; Fig. 218 with extension piece for loads up to 1,365 lbs. For copper plated hanger rods, use copper plated malleable iron C-clamps; Fig. CT-138R for loads up to 180 lbs.

C. For attaching steel hanger rods to wood structural members, use malleable iron ceiling flange; Fig. 153 for loads up to 1,270 lbs. For copper plated hanger rods, use copper plated malleable iron ceiling flange: Fig. CT-128R for loads up to 180 lbs.

D. Vertical expansion shields or toggles shall not be used for suspending hanger rods, except with permission in cases where inserts have been omitted or cannot be used. If permitted, use expansion shields; for rod sizes up to ½", 320 lbs. max. load. For hanger rods larger than ½" use attachment plate, Fig. 52, with wedge anchors.

E. Powder actuated anchoring methods shall not be used.

3.6 PIPE COVERING PROTECTION

A. Hangers and supports for insulated piping shall not injure or pierce insulation. Provide insulation protection shields in conjunction with hanger or roll device. Use Fig. 160 and 165, Protection Saddles.

3.7 SUPPLEMENTAL STEEL

A. Provide supplemental steel as required to hang or support plumbing equipment or piping.

END OF SECTION

SECTION 22 0553
IDENTIFICATION FOR PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Provide materials, equipment labor and supervision necessary to install piping identification products.

B. Comply with ANSI A13.1 for lettering size, length or color field, colors, and installed viewing angles of identification devices.

1.2 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2013.

1.3 SUBMITTALS

A. Submit manufacturer's product data.

B. Submit sample of each type of identification product and clearly identify the contents in a schedule.

C. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

D. Schedule:

1. Submit valve schedule for each system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve ID tag number, system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves that are intended for emergency shut-off and similar special uses, by special "flags" in margin of schedule.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Brady Corp., Industrial Safety Supply, Emedco, Seton or Brimar.

B. Engineer approved alternative

2.2 PIPE MARKERS

A. Provide manufacturer's standard preprinted, semi-rigid snap-on or self-sticking, color-coded pipe markers, complying with ANSI A13.1.

B. Provide full-band pipe markers, extending 360° around pipe at each location or self-sticking pipe markers, fastened in the following method:

1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.

2. Secure to piping and install banding tape on both ends of each pipe label.

C. Lettering shall be manufacturer's pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance.

D. Print each pipe marker with arrows indicating direction of flow, integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic or on banding tape.

2.3 EQUIPMENT MARKERS

A. Provide engraved signage nameplates and tags constructed of multi-layered acrylic that has been treated for outdoor use and can withstand temperatures up to 160° F. Nameplates shall have beveled edges with contrasting color core, letters, and border. Minimum size of nameplate shall be 3" high by 6" long. The minimum letter height shall be 3/4". Attachment shall be by double faced 2 mil permanent acrylic adhesive. For equipment that does not allow for direct attachment, furnish sheet metal backing to integrate with equipment such that signage can be read from 5 feet above the finished floor. Unless noted otherwise, signage shall be provided with black lettering, black border, and yellow core. All signage shall include up to 14 characters per line, minimum of 3 lines per tag. Furnish signage for equipment shown in Section 3:

1. All pumps shall include the full name description for system served.

B. All equipment shall be named consistent with the plans and specifications as indicated on the schedules or as directed by the Owner.

2.4 BRASS VALVE TAGS

A. Provide manufacturer's standard brass valve tags with stamped black filled lettering, with piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 3/16" hole for fastener.

B. Provide 1-1/2" round brass tags with black lettering. Seton 250 BL or equal.

2.5 VALVE TAG FASTENERS

A. Manufacturer's standard solid brass chain or solid brass S-hooks of sizes required for proper attachment of tags to valves and manufactured specifically for that purpose.

2.6 VALVE SCHEDULE FRAMES

A. For each page of schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSD-grade sheet glass.

2.7 PIPING AND EQUIPMENT IDENTIFICATION

A. Piping systems that shall be identified by their controls (including directional arrows) on this project shall include, but are not necessarily limited to the following:

1. Domestic cold water, hot water, and hot water recirculation.
2. Heating water supply and return

B. Provide name plates for all equipment scheduled on the drawings. Coordinate nameplate tag with Owner's sequencing system. If the Owner has no preference, the nameplates shall correspond with the equipment schedule. Equipment shall include but is not limited to the following:

1. Pumps.
2. Heat Exchangers
3. Storage Tanks

PART 3 EXECUTION

3.1 INSTALLATION OF MECHANICAL IDENTIFICATION

A. Where identification is to be applied to surfaces that require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

B. Install pipe markers on each system, and include arrows to show normal direction of flow.

C. Locate pipe markers as follows: wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) above lay-in type ceilings and exterior non-concealed locations.

1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures, mark each pipe at branch where there could be question of flow pattern.
3. Near locations where pipes pass through walls or floors/ceilings (both sides) or center non-accessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. At each pipe passage to underground.
7. Spaced intermediately at maximum spacing of 50 feet along each piping run, except reduce spacing to 25 feet in congested areas of piping and equipment.
8. On piping above removable acoustical ceilings, maximum spacing of 10 feet along each piping run.
9. Where self-sticking labels are used, the pipe or its covering surface shall be properly prepared. This consists of removal of loose dirt, oil and grease, loose paint or peeling insulation covering. This can be done with a brush and cloth; washing is not required. Use solvent for removal of oil or grease.
10. Banding tape must be used on both ends of all self-sticking labels. The tape shall encircle the pipe completely and overlap itself so the banding tape can adhere to itself.

D. Provide valve tags for all major valves 1/2" size or larger. Included are all main, zone and branch valves, valves in all equipment rooms, etc. All types of valves, ball, globe, butterfly, cocks, control, regulating, relief, reducing, solenoid, etc. are to be identified except check valves. Do not identify end use point valves for plumbing fixtures, and similar rough-in connections.

E. List each tagged valve in schedule for each system showing function and location. Provide separate charts for mechanical divisions of work. Charts shall be installed on a conspicuous wall in the main mechanical equipment room. Provide unframed copies of valve lists as part of closeout documents.

3.2 ADJUSTING AND CLEANING

A. Relocate any mechanical identification device which has become visually blocked by work of this division or by other divisions.

B. Clean face of identification devices and glass frames of valve schedules.

END OF SECTION

SECTION 22 0700
PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Provide equipment, materials, labor and supervision necessary to install insulation to hot and cold surfaces of piping, tanks, ductwork, fittings and other surfaces.

B. Insulation shall include insulating materials, jackets, adhesive, mastic coatings, tie wire and other materials as required to complete the insulating work.

1.2 CODES AND STANDARDS

A. Insulating materials, jackets and mastics shall meet flame spread, fuel contribution and smoke developed ratings in accordance with NFPA-90A. Flame spread rating in accordance with NFPA 255, ASTM E-84, or UL 723 of not more than 25; smoke developed rating of not more than 50, unless otherwise noted in this section.

B. Insulation that has been treated with a flame-retardant additive to meet the flame spread and smoke developed ratings shown above is not permitted.

C. Insulation materials shall be non-corrosive to the materials they are applied to, including stress corrosion cracking of stainless steel and shall not breed or promote mold, fungus, or bacteria.

D. Insulation shall meet or exceed all requirements of IECC - International Energy Conservation Code.

1.3 QUALIFICATION

A. Insulating materials by Owens-Corning, Armacell, Pittsburgh-Corning, Knauf, Johns Manville, or Engineer approved equivalent.

B. Mastics and adhesives as recommended by insulation manufacturer.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation and jacket. Submit schedule showing manufacturer's product number, flame spread and smoke development rating, k-value, density, temperature limitations , sound absorption coefficients, thickness, and furnished accessories for each mechanical system requiring insulation.

PART 2 PRODUCTS

2.1 INSULATION

A. Description:

1. Type A: Preformed, sectional, heavy density fiberglass insulation, suitable for operating temperatures form - 20° F to +850° F. Equipped with factory-applied, all-service vapor barrier jacket constructed of white Kraft paper bonded to aluminum foil reinforced with fiberglass yarn, with pressure-sensitive, self-sealing longitudinal laps and butt strips. Thermal conductivity of 0.23 BTU-in/hr-ft2- F @ 75° F mean temperature. Water vapor permeance of 0.02 perms. Johns Manville "Micro-Lok HP or Engineer approved equivalent.
2. Type B: Flexible, elastomeric pipe and sheet insulation with closed-cell structure. Shall comply with ASTM C534, Type I, Grade 1 for tubular materials and ASTM C534 Type II, Grade 1 for sheet materials. Suitable for operating temperatures from -40° F to 220° F. Outdoor applications, and where otherwise noted, shall receive a weather-resistant, protective, latex enamel finish. Thermal conductivity of 0.28 BTU-in/hr-ft2-°F @ 75° F mean temperature. Water vapor permeance of 0.08 perms. Insulation shall be equivalent to Armacell AP Armaflex; adhesive equivalent to Armacell Armaflex 520 or Armaflex 520 BLV Low-VOC Contact Adhesive; finish equivalent to Armacell Armaflex WB finish.
3. Type C: Flexible, elastomeric thermal insulation with an expanded, closed-cell structure. Pre-slit tubular form with a pressure-sensitive adhesive strip for closure and vapor sealing of the longitudinal joint. Butt joints, sealed with 3M-471 tape. White color. Suitable for operating temperature of 40° F to 200° F. Thermal conductivity of 0.28 BTU-in/hr-ft2- F mean temperature. Water vapor permeance of 0.20 perms. Insulation shall be Armacell Self-Seal Armaflex 2000 or Engineer approved equivalent.

2.2 PIPE INSULATION SCHEDULE (IECC - INTERNATIONAL ENERGY CONSERVATION CODE)

SERVICE	TYPE	THICKNESS	PIPE SIZES
DOMESTIC COLD WATER	A, B, ORC	1/2"	LESS THAN 1-1/2"
		1"	1-1/2" AND LARGER
DOMESTIC HOT WATER (UP TO 140 DEG F) INCL HW CIRC	A, B, OR C	1"	LESS THAN 1-1/2"
		1-1/2"	1-1/2" AND LARGER
HEATING WATER (141F-201F)	A	1-1/2"	LESS THAN 4"
		2"	4" AND LARGER

2.3 EQUIPMENT INSULATION SCHEDULE (IECC - INTERNATIONAL ENERGY CONSERVATION CODE)

SERVICE	TYPE	THICKNESS
PUMP BODIES (SUBJECT TO A CONDENSATION)	ORB	1-1/2"

2.4 INSULATION JACKETS

A. 20-mil high-impact PVC secured with spray contact adhesive. All PVC jacketing shall meet the 25/50 SDR. Manville "Zeston 2000" or equivalent.

B. 6-oz/sq yd UL listed cotton canvas fabric secured with Childers CP50 lagging adhesive.

C. Fitting and valve jackets shall be premolded PVC with joints and seams sealed with a spray contact adhesive or vapor barrier mastic. Premolded jackets shall be Manville "Zeston 2000" or approved equivalent.

D. Where PVC or metal jackets are used, delete the factory applied ASJ on pipe and equipment operating above 75° **F**.

E. PVC jackets shall be used in the following areas and systems:

1. Premolded PVC at all fittings and valve jackets.

PART 3 EXECUTION

3.1 GENERAL

A. Use only experienced applicators regularly engaged in the trade. Rough work will be rejected. Application details shall be in accordance with the insulation materials supplier's recommendation, except where a higher standard is specified.

B. Install materials after systems have been tested and approved. Material such as rust, scale, dirt and moisture shall be removed from surfaces to be insulated.

C. Insulation shall be kept clean and dry at all times.

D. Where pipes and ducts pass through fire rated walls, floors and partitions, a fire seal shall be provided.

E. When flexible cellular insulation is used, it shall be installed with seams and joints sealed with contact adhesive.

1. Wherever possible, the insulation shall be placed over the pipe before it is installed. Seal the butt joints with Armacell Armaflex 520, or Armaflex 520 BLV Low-VOC Contact Adhesive or equal.

2. Where the insulation cannot be slipped on, cut the insulation longitudinally and apply it to the piping. Seal longitudinal seam and butt joints with Armacell Armaflex 520 adhesive, or Armaflex 520 BLV Low-VOC Contact Adhesive or equal. In all cases, the insulation, equal to Armacell AP, protected with half-round PVC sleeves the length of three times the nominal pipe size, minimum length to be 8 inches.

3.2 **PIPE** INSULATION INSTALLATION

A. Insulate fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints with premolded or mitered segments of same insulating material as for adjacent pipe covering.

B. Pipe insulation shall continue through sleeves and hangers with vapor barrier and/or jacket.

C. Insert to be between support shield and piping but under the finish jacket. Provide an insert at hangars not less than 6 inches long, of same thickness and contour as adjoining insulation , to prevent insulation from sagging at support points. Inserts shall be heavy density insulating material suitable for the planned temperature range. Factory fabricated inserts may be used.

D. Neatly finish insulation at supports, protrusions, and interruptions.

1. On hot systems where fittings are to be left exposed, insulation ends shall be beveled away from bolts for easy access.
2. On cold systems, valve stems shall be sealed with caulking which allows free movement of the stem, but provides a seal against moisture incursion.

E. Wherever piping penetrates a floor or is exposed in a finished area such as kitchens, furnish a floor pipe escutcheon and/or PVC (white) jacket to protect insulation and allow for a smooth finish for cleaning.

END OF SECTION

SECTION 22 1005
PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.

1. Domestic water.

1.2 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.

C. ASTM B32 - Standard Specification for Solder Metal 2020.

D. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.

E. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.

F. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.

G. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.

H. AWWA C651 - Disinfecting Water Mains 2014, with Addendum (2020).

I. NSF 61 - Drinking Water System Components - Health Effects 2021.

J. NSF 372 - Drinking Water System Components - Lead Content 2022.

1.3 SUBMITTALS

A. See Section 01 3300 for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Project Record Documents: Record actual locations of valves.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM 888M), Type K (A), Drawn (H).

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, alloy Sn95 solder.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

G. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

3.3 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

3.4 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed, and clean.

B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form, throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

END OF SECTION

SECTION 22 3000
PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Domestic water heat exchangers.

B. Domestic hot water storage tanks.

C. In-line circulator pumps.

1.2 **REFERENCE** STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2021.

B. ICC (IPC) - International Plumbing Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. See Section 01 3300, for submittals procedures.

B. Product Data:

1. Indicate pump type, capacity, power requirements.

C. Shop Drawings:

1. Indicate heat exchanger dimensions, size of tappings, and performance data.

2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

D. Project Record Documents: Record actual locations of components.

E. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Pump Seals: One of each type and size.

1.4 QUALITY ASSURANCE

A. Certifications:

1. Lead Content: Use low lead under 0.25% content of total system or lead-free materials of construction for surfaces that are in contact with domestic water.

2. Water Tanks: ASME labeled to ASME BPVC-VIII-1.

3. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

C. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.5 WARRANTY

A. See Section 01 7700, for additional warranty requirements.

B. Provide one year manufacturer warranty for in-line circulator and heat exchangers.

C. Storage Tank: 25-year coverage (15 years full, 10 years prorated) for manufacturing or material defects, leaks, the production of rusty water and or chloride stress corrosion cracking. Tank warranty does not require inspection and maintenance of anode rods.

PART 2 PRODUCTS

2.1 DOMESTIC WATER HEAT EXCHANGERS

A. Manufacturers:

1. Armstrong Fluid Technology: www.armstrongfluidtechnology.com/#sle
2. Bell & Gossett, a xylem brand: www.bellgossett.com/#sle
3. Danfoss
4. Engineer Pre-Approved Equivalent

B. Type: Double wall type that separates the potable water from the heat transfer medium with a space vented to the atmosphere in accordance with ICC IPC.

C. Assembly of heat-exchanger plates, permanently brazed together, for using heating hot water to heat domestic water.

D. Working-Pressure Rating: Packaged heater shall be rated for 150 psig minimum at 250°F.

E. Plate Material: 316L Stainless steel plates.

F. Plate Thickness: Not less than 0.024 inch (0.6 mm) combined.

G. Brazing Filler Metal: Copper.

H. AHRI 400: Use heat exchanger certified by AHRI Liquid to Liquid Brazed and Fusion Bonded Plate Heat Exchangers (LLBF) certification program, based on AHRI Standard 400.AHRI 400: Use heat exchanger certified based on AHRI Standard 400.

2.2 DOMESTIC HOT WATER STORAGE TANKS

A. Manufacturers:

1. PVI
2. Engineer Pre-Approved Equivalent

B. Flow Pattern: Standard-flow arrangement, with water from bottom of storage tank circulated across heat-exchanger plates and returned to tank. Include hot-water outlet located at top of tank and temperature sensitive switch in tank. Counter flow arrangement through each heat exchanger for efficient heat transfer.

C. Configuration: Vertical.

D. All tank connections/ fittings shall be nonferrous. Tank design shall include a manway sized access to the tank interior.

E. The storage tank shall be ASME HLW stamped and National Board Registered for a maximum allowable working pressure of 150 psi and pressure tested at 1-1/2 times working pressure.

F. The storage tank shall be an unlined pressure vessel constructed from phase-balanced austenitic and ferritic duplex steel with a chemical structure containing a minimum of 21% chromium to prevent corrosion and mill certified per ASTM A 923Methods A to ensure that the product is free of detrimental chemical precipitation that affects corrosion resistance. The material selected shall be tested and certified to pass stress chloride cracking test protocols as defined in ISO 3651-2 and ASTM G123 - 00(2005) "Standard Test Method for Evaluating Stress-Corrosion Cracking of Stainless Alloys with Different Nickel Content in Boiling Acidified Sodium Chloride Solution."

G. Waterside surfaces shall be welded internally utilizing joint designs to minimize volume of weld deposit and heat input. All heat affected zones (HAZ) shall be processed after welding to ensure the HAZ corrosion resistance is consistent with the mill condition base metal chemical composition. Weld procedures (amperage, volts, welding speed, filler metals and shielding gases) utilized shall result in a narrow range of austenite-ferrite microstructure content consistent with phase balanced objectives for welds, HAZ and the base metal.

H. Materials shall meet ASME Section II material requirements and be accepted by NSF 61 for municipal potable water systems. Storage tank materials shall contain more than 80% postconsumer recycled materials and be 100% recyclable.

I. Water contacting tank surfaces will be non-porous and exhibit 0% water absorption.

J. Lined or plated storage tanks will not be acceptable.

K. The storage tank will not require anodes of any type and none will be used.

L. All internal and external tank surfaces shall undergo full immersion passivation and pickling processing to meet critical temperature, duration and chemical concentration controls required to complete corrosion resistance restoration of pressure vessel surfaces. Other passivation and pickling methods are not accepted. Immersion passivation and pickling certification documents are required and shall be provided with each product.

M. Insulation: Complying with ASHRAE/IESNA 90.1, unless otherwise indicated , and suitable for operating temperature. Surround entire storage tank and nozzle except connections and controls.

N. Dispersion Tubes: installed on both cold and hot water inlet to prevent mixing of hot and cold water inside the tank.

0. Accessories: Tank drain, water inlet and outlet, thermometer range of 40 to 200 degrees F (4 to 93 degrees C), ASME pressure relief valve suitable for maximum working pressure.

2.3 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:

1. Armstrong Fluid Technology: www.armstrongfluidtechnology.com/#sle
2. Bell & Gossett, a xylem brand: www.bellgossett.com/#sle

3. Sterling SIHI GmbH: www.sterlingsihi.com/#sle
4. Grundfos
5. Engineer Pre-Approved Equivalent

B. The pumps shall be a wet rotor inline pump, in cast iron or lead-free stainless-steel body construction specifically designed for quiet operation. Suitable standard operations at 230° F and 175 PSIG working pressure. The pump internals shall be capable of being serviced without disturbing piping connections.

C. The pump internals shall be capable of being serviced without disturbing piping connections.

D. Pump shall be equipped with a water-tight seal to prevent leakage.

E. Pump volute shall be of a cast iron design for heating systems or lead-free stainless steel for domestic water systems. The connection style on the cast iron and stainless-steel pumps shall be flanged.

F. Motor shall be a synchronous, permanent-magnet (PM) motor or ECM and tested with the pump as one unit.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, **if** any.

B. Coordinate with plumbing piping and related electrical work to achieve operating system.

C. Domestic Water Heat Exchangers:

1. Domestic-Water, Heat-Exchanger Mounting: Install domestic-water heat exchangers on concrete base.
2. Install domestic-water heat exchangers level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
3. Install shutoff valves on domestic-water-supply piping to heat exchangers and on domestic-hot-water outlet piping.
4. Install shutoff valves on heating hot-water piping to heat exchangers.
5. Install combination temperature-and-pressure relief valves in water piping for domestic-water heat exchangers without storage. Extend relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
6. Install thermometer on each domestic-water heat-exchanger, inlet and outlet piping, and install thermometer on each domestic-water, heat-exchanger heating-fluid inlet and outlet piping.
7. Install pressure gages on domestic-water, heat-exchanger, heating-fluid piping.
8. Where installing piping adjacent to domestic-water heat exchangers, allow space for service and maintenance of heat exchangers. Arrange piping for easy removal of domestic-water heat exchangers.
9. Train Owner's maintenance personnel to adjust, operate, and maintain domestic-water heat exchangers.

10. Perform tests and inspections.
    a. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
    b. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
    c. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Domestic Water Storage Tanks:
    1. Clean and flush prior to delivery to site. Seal until pipe connections are made.
    2. Install temperature and pressure relief valves in top portion of storage-tank shells of domestic-water heat exchangers with domestic-water storage. Use relief valves with sensing elements that extend into shells. Extend relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Pumps:
    1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION

SECTION 23 2113
HYDRONIC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hydronic system requirements
B. Heating water piping, above grade.
C. Pipe hangers and supports.
D. Unions, flanges, mechanical couplings, and dielectric connections.
E. Valves:
    1. Ball valves.
    2. Butterfly valves.
F. Flow controls.

1.2 **REFERENCE** STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2016.
B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2018.
C. ASME B16.22 -Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2018.
D. ASME B31.9 - Building Services Piping 2020.
E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.
F. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service 2019a.
G. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.
H. ASTM B32 - Standard Specification for Solder Metal 2020.
I. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.
J. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.
K. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications 2007 (Reapproved 2019).
L. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2011 (Amended 2012).
M. AWWA C606 - Grooved and Shouldered Joints 2015.

1.3 SUBMITTALS

A. See Section 01 3300 for submittal procedures.

B. Product Data:

1. Include data on pipe materials, pipe fittings, valves, and accessories.
2. Provide manufacturers catalog information.

C. Project Record Documents: Record actual locations of valves.

1.4 DELIVERY, STORAGHE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal state, and local regulations.

B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:

1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
3. Grooved mechanical joints may be used in accessible locations only.
    a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect/Engineer.
    b. Grooved mechanical connections and joints comply with AWWA C606.
        1) Steel: Comply with ASTM A106/A106M , Grade B or ASTM A53/A53M.
    c. Use rigid joints unless otherwise indicated.
4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated:

1. Provide drain valves where indicated, and if not indicated, provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch (20 mm) gate valves with cap; pipe to nearest floor drain.
2. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
3. In heating water systems, butterfly valves may be used interchangeably with gate and globe valves.

2.2 HEATING WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:

1. Welded Joints: ASTM A234/A234M , wrought steel welding type fittings; AWS D1.1/D1.1M welded.
2. Threaded Joints: ASME B16.3, malleable iron fittings.
3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn, using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
   a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
   b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.
2. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.
3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
4. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, nontoxic synthetic rubber sealing elements.

2.3 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inches (13 to 38 mm): Malleable iron, adjustable swivel, split ring.
3. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
6. Vertical Support: Steel riser clamp.
7. Floor Support for Hot Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
8. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

B. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge-shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.4 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches (50 mm) and Less:

B. Flanges for Pipe 2 Inches (50 mm) and Greater:

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.

1. Dimensions and Testing: In accordance with AWWA C606.
2. Mechanical Couplings: Comply with ASTM F1476.
3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F (minus 34 degrees C) to 230 degrees F (110 degrees C).
4. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
5. When pipe is field grooved, provide coupling manufacturer's grooving tools.

2.5 BALL VALVES

A. Up To and Including 2 Inches (50 mm):

1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

B. Over 2 Inches (50 mm):

1. Ductile iron body, chrome plated stainless steel ball, teflon seat and stuffing box seals, lever handle or gear operated, flanged ends, rated to 800 psi (5515 kPa).

2.6 BUTTERFLY VALVES

A. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck.

B. Disc: Construct of ductile iron with EPDM encapsulation.

C. Operator: 10-position lever handle.

2.7 FLOW CONTROLS

A. Manufacturers:

1. Anvil International: www.anvilintl.com/#sle.
2. Griswold Controls: www.griswoldcontrols.com/#sle.
3. Hays Fluid Controls: www.haysfluidcontrols.com/#sle.
4. ITT Bell & Gossett: www.bellgossett.com/#sle.
5. Shurjoint Piping Products, Inc: www.shurjoint.com/#sle.
6. Taco, Inc: www.taco-hvac.com/#sle.
7. Victaulic Company: www.victaulic.com/#sle.
8. Engineer Pre-Approved Equivalent.

B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

C. Calibration: Control flow within 10 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, minimum pressure 2 psi (13.7 kPa).

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment using jointing system specified.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

F. After completion, fill, clean, and treat systems.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and to avoid interference with use of space.

D. Group piping whenever practical at common elevations.

E. Slope piping and arrange to drain at low points.

F. Grooved Joints:

1. Install in accordance with the manufacturer's latest published installation instructions.
2. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.

G. Pipe Hangers and Supports:

1. Install in accordance with MSS SP-58.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2-inch (13 mm) space between finished covering and adjacent work.
4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
5. Use hangers with 1-1/2 inches (38 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
7. Provide copper plated hangers and supports for copper piping.

H. Install valves with stems upright or horizontal, not inverted.

3.3 SCHEDULES

A. Hanger Spacing for Copper Tubing.

1. 1/2 Inch (15 mm) and 3/4 inch (20 mm): Maximum span, 5 feet (1500 mm); minimum rod size, 1/4 inch (6 mm).
2. 1 Inch (25 mm): Maximum span, 6 feet (1800 mm); minimum rod size, 1/4 inch (6 mm).
3. 1-1/2 Inches (40 mm) and 2 Inches (50 mm): Maximum span, 8 feet (2400 mm); minimum rod size, 3/8 inch (9 mm).
4. 2-1/2 Inches (65 mm): Maximum span, 9 feet (2700 mm); minimum rod size, 3/8 inch (9 mm).

B. Hanger Spacing for Steel Piping.

1. 1/2 Inch (15 mm), 3/4 Inch (20 mm), and 1 Inch (25 mm): Maximum span, 7 feet (2100 mm); minimum rod size, 1/4 inch (6 mm).
2. 1-1/4 Inches (32 mm): Maximum span, 8 feet (2400 mm); minimum rod size, 3/8 inch (9 mm).
3. 1-1/2 Inches (40 mm): Maximum span, 9 feet (2700 mm); minimum rod size, 3/8 inch (9 mm).
4. 2 Inches (50 mm): Maximum span, 10 feet (3.0 m); minimum rod size, 3/8 inch (9 mm).
5. 2-1/2 Inches (65 mm): Maximum span, 11 feet (3.4 m); minimum rod size, 3/8 inch (9 mm).

END OF SECTION