SECTION 22 01 00
PLUMBING GENERAL PROVISIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A The Contractor shall provide all materials, equipment and labor necessary to install and set into operation a complete plumbing system as shown on the engineering drawings and as specified herein.

1.02 QUALITY ASSURANCE

A See the General and Supplementary General Conditions.

B All work shall be in accordance with State Code and Underwriter's Regulations. Minimum requirements shall be the State Plumbing Code.

C Wherever the words "Approved", "Approval", or "Approved Equal" appear, it is intended that items other than the model numbers specified shall be subject to the approval of the Engineer.

D "Provide" as used herein shall mean that the Contractor responsible shall furnish and install said item or equipment. "Furnish" as used herein shall mean that the Contractor responsible shall acquire and make available said item or equipment and that installation shall be by others. "Install" as used herein shall mean that the Contractor responsible shall make installation of items or equipment furnished by others.

E Boiler Inspection Certificate (If applicable): It shall be the responsibility of the Contractor to complete the installation of fired or unfired pressure vessels and their safety devices in accordance with the requirements of the latest edition of the North Carolina Department of Labor, "Boiler Inspection Law, Rules and Regulations". The Contractor shall be responsible for notifying the Bureau of Boiler Inspection in writing at least two weeks prior to the date of completion of all equipment requiring inspection. Certificates furnished by the Bureau of Boiler Inspection shall be in a frame having a removable glass cover and posted near the pressure vessel. Certificates shall be installed before requesting final inspection of the completed project. The pressure vessel is NOT to be operated before it is inspected and approved.

1.03 SUBMITTALS

A See General and Supplementary General Conditions.

B Within ten days after notification of the award of the Contract and written notice to begin work, the Contractor shall submit to the Architect/Engineer for approval a detailed list of equipment and material that he proposes to use. Items requiring submittal data for approval will be noted at this time.

C The Contractor shall provide an electronic pdf copy of the submittal data on the products, methods, etc. proposed for use on the project. The submittal shall contain complete submittal data on all products, methods, etc. proposed for use on the project.

D Each submittal shall bear the approval of the Contractor indicating that he has reviewed the data and found it to meet the requirements of the specifications as well as space limitations and other project conditions. The submittals shall be clearly identified showing project name, manufacturer's catalog numbers, and all necessary performance and fabrication data.

E The Contractor shall submit to the Engineer a set of accurately marked-up plans indicating all changes encountered during the construction. Final payment will be contingent upon receipt of these as-built plans.

F The Contractor shall furnish an electronic copy of maintenance and operating instructions.

G The Contractor shall submit to the Owner all certificates required for operating the system in compliance with the plans and specifications.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A All material and equipment shall be delivered and unloaded by the Contractor within the project site as noted herein or as directed by the Owner.

B The Contractor shall protect all material and equipment from breakage, theft, or weather damage. No material or equipment shall be stored on the ground.

C The material and equipment shall remain the property of the Contractor until the project has been completed and turned over to the Owner.

1.05 WORK CONDITIONS AND COORDINATION

A The Contractor shall review the electrical plans to establish points of connection and the extent of electrical work to be provided in his Contract. All electrical work shall be performed by a licensed electrician.

B This Contractor shall be responsible for the final electrical connections to all equipment installed as part of his Contract.

C Electrical work shall be in accordance with State codes, and as specified in Division 26 contained herein.

D Pipe, conduit and duct chases required for installation of work shall be provided by the General Contractor unless otherwise noted. This Contractor shall be responsible for coordinating the location of all required chases.

E All work shall be coordinated with other trades. Cutting of new work and subsequent patching shall be at the Contractor's expense at no extra cost to the Owner.

1.06 GUARANTEE

A See the General and Supplementary General Conditions.

B Where extended warranties or guarantees are available from the manufacturer, the Contractor shall prepare the necessary Contract Documents to validate these warranties as required by the manufacturer and present them to the Architect/Engineer.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A Materials and equipment shall be new, unless noted otherwise, of the highest grade and quality and free from defects or other imperfections. Material and equipment found defective shall be removed and replaced at the Contractor's expense.

B The Contractor shall provide nameplates for identification of all equipment, switches, panels, etc. The nameplates shall be laminated phenolic plastic, black front and back with white core, white engraved letters (1/4" minimum) etched into the white core. Nameplates shall be fastened with pan head tapping screws.

PART 3 EXECUTION

3.01 INSPECTION

A This Contractor shall examine the areas of completed work and shall insure that no defects or errors are present which would result in the poor application or installation of subsequent work.

3.02 INSTALLATION

A All work shall be performed in a manner indicating proficiency in the trade.

B All conduit, pipes, ducts, etc. shall be either parallel to building walls or plumb where installed in a vertical position and shall be concealed when located in architecturally finished areas.

C Any cutting or patching required for installation of this Contractor's work shall be kept to a minimum. Written approval shall be required by the Architect/Engineer if cutting of primary structure is involved.

D All patching shall be done in such a manner as to restore the areas or surfaces to match existing finishes.

E The Contractor shall lay out and install his work in advance of pouring concrete floors or walls. He shall furnish all sleeves to the General Contractor for openings through poured masonry floors or walls, above grade, required for passage of all conduits, pipes, or ducts required to support his equipment.

F All fixtures shall be accurately roughed in according to the manufacturer's installation dimensions so that no offset adapters, flexible connections or other improvisations are necessary. All incorrect work shall be torn out and corrected and walls and floors patched.

G Horizontal drainage and waste pipe shall have a minimum slope or fall of 1/8 inch per foot. All change of horizontal directions in soil waste pipe shall be made with long radius fittings with "Y" branches and 1/8 or 1/16 bends.

H All fixtures, floor drains, flush valves and traps shall be set plumb and level.

I Connections to cold water, soil and waste lines shall be made at locations shown on the Drawings.

J All material and equipment shall be installed following the manufacturer’s installation directions.

3.03 PERFORMANCE

A The Contractor shall perform all excavation and backfill operations necessary for installation of his work.

B Rock excavation shall be defined in the Supplementary General Conditions, Division 1 or Division 2. A unit price for each rock excavation shall be required in the bid. Plumbing Contractor shall provide the unit price per cubic yard for rock excavation. Construction Manager will establish an allowance for trench rock.

3.04 ERECTION

A All support steel, angles, channels, pipes or structural steel stands and anchoring devices that may be required to rigidly support or anchor material and equipment shall be provided by this Contractor.

3.05 FIELD QUALITY CONTROL

A The Contractor shall conform to the requirements of Division 03 for concrete testing.

B All testing required for compliance with the contract shall be as stated in subsequent sections.

3.06 ADJUST AND CLEAN

A All equipment and installed materials shall be thoroughly clean and free of all dirt, oil, grit, grease, etc.

B Factory painted equipment shall not be repainted unless damaged areas exist. These areas shall be touched up with a material suitable for intended service. In no event shall nameplates be painted.

C At a scheduled meeting, the Contractor shall instruct the Owner or the Owner's representative in the operation and maintenance of all equipment installed under his Contract.

3.07 MAINTENANCE AND OPERATING MANUAL

A The Contractor shall prepare an electronic submission of a manual describing the proper maintenance and system operation. This manual shall not consist of standard factory printed data intended for dimension or design purposes (although these may be included), but shall be prepared to describe this particular job. This manual shall include the following:

1. Data on all equipment as listed on the fixture and equipment schedules on the plans, including but not limited to model numbers, input and output capacities, and selected options for each piece of equipment.
2. Manufacturer’s operation and maintenance manuals for each piece of equipment furnished as part of this project, and including but not limited to a check list for periodic maintenance of all equipment.
3. A check list for seasonal shutdown.
4. Maintenance and spare parts data for all equipment.
5. As-Built wiring and control diagrams for equipment containing these.
6. Name and address and phone number of at least one service agency for each piece of equipment.
7. A complete narrative of how each system is intended to operate.
8. Name and address of designer of record, contractors, subcontractors, and equipment suppliers.

B The manuals shall be dated and signed by the Contractor when completed.

C The operating and maintenance manuals shall be submitted to the Engineer for approval. When the manuals are considered complete by the Engineer, they will be turned over to the Owner for their permanent use.

END OF SECTION 22 01 00 22 01 00

SECTION 22 05 16
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A Flexible pipe connectors.
B Expansion joints and compensators.
C Pipe loops, offsets, and swing joints.

1.02 REFERENCE STANDARDS

A ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
B ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.
C ASME B16.11 - Forged Fittings, Socket-Welding and Threaded; 2021.
D ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.
E EJMA (STDS) - EJMA Standards; Tenth Edition.
F FM (AG) - FM Approval Guide; Current Edition.
G ITS (DIR) - Directory of Listed Products; current edition.
H UL (DIR) - Online Certifications Directory; Current Edition.

1.03 SUBMITTALS

A Product Data:
1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

B Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.
C Maintenance Data: Include adjustment instructions.
D Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A Comply with UL (DIR) requirements.

2.02 EXPANSION JOINTS - STAINLESS STEEL BELLOWS TYPE

A Manufacturers:
1. Flex-Weld, Inc
2. Mercer Rubber Company
3. The Metraflex Company

B Pressure Rating: 125 psi and 400 degrees F.
C Maximum Compression: 1-3/4 inches.
D Maximum Extension: 1/4 inch.
E Joint: As specified for pipe joints.
F Size: Use pipe sized units.
G Application: Steel piping 4 inches and under.

2.03 EXPANSION JOINTS AND LOOPS - HOSE AND BRAID

PART 3 EXECUTION

3.01 INSTALLATION

A Install in accordance with manufacturer's instructions.
B Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.
C Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

D Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

F Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

END OF SECTION 22 05 16

SECTION 22 05 17
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A Pipe sleeves.

B Pipe sleeve-seals.

1.02 RELATED REQUIREMENTS

A Section 07 84 00 - Firestopping.

B Section 09 91 13 - Exterior Painting: Preparation and painting of exterior piping systems.

C Section 09 91 23 - Interior Painting: Preparation and painting of interior piping systems.

D Section 22 05 23 - General-Duty Valves for Plumbing Piping.

E Section 22 05 53 - Identification for Plumbing Piping and Equipment: Piping identification.

F Section 22 07 16 - Plumbing Equipment Insulation.

G Section 22 07 19 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS

A ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.

B ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

C FM (AG) - FM Approval Guide; Current Edition.

D UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A See Section 01 30 00 - Administrative Requirements for submittal procedures.

B Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

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

1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B Installer Qualifications: Company specializing in performing work of the type specified this section.

C Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

A Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.07 WARRANTY

A See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A Manufacturers:

1. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com/#sle.

2.02 PIPE-SLEEVE SEALS

A Manufacturers:

1. Advance Products & Systems, LLC; Innerlynx: www.apsonline.com/#sle.
2. American Polywater Corporation; PGKD Modular Seals: www.polywater-haufftechnik.com/#sle.
3. Flexicraft Industries; PipeSeal: www.flexicraft.com/#sle.

B Sealing Compounds:

1. Provide packing and sealing compound to fill pipe to sleeve thickness.
2. Combined packing and sealing compounding to match partition fire-resistance hourly rating.

PART 3 EXECUTION

3.01 PREPARATION

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

B Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

A Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B Install piping to conserve building space, to not interfere with use of space and other work.

C Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

E Manufactured Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

F When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

END OF SECTION 22 05 17

SECTION 22 05 19
METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A Positive displacement meters.
B Flow meters.
C Pressure gauges and pressure gauge taps.
D Thermometers and thermometer wells.
E Static pressure gauges.
F Filter gauges.

1.02 REFERENCE STANDARDS

A ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.
B ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014 (Reapproved 2020).
C ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).
D AWWA C700 - Cold-Water Meters -- Displacement Type, Metal Alloy Main Case; 2020.
E AWWA C701 - Cold-Water Meters -- Turbine Type, for Customer Service; 2019.
F AWWA C702 - Cold-Water Meters -- Compound Type; 2019.
G AWWA M6 - Water Meters -- Selection, Installation, Testing, and Maintenance; 2012, with Addendum (2018).
H UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.
B Project Record Documents: Record actual locations of components and instrumentation.
C Operation and Maintenance Data: For Closeout.
D Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. Extra Pressure Gauges: One of each type and size.

1.04 FIELD CONDITIONS

A Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 POSITIVE DISPLACEMENT METERS (LIQUID)

2.02 LIQUID FLOW METERS

A Manufacturers:
    1. E-Mon
    2. Onicon Model F-1230
    3. SeaMetrics
B Water Flow Meter shall be Dual Turbine Flow Meter with local mounted display module with digital display, complete with installation of all hardware necessary to enable insertion and removal of the meter without system shutdown.
    1. The flow meter shall be hand-insertable without system shutdown.
    2. The flow meter shall have dual turbines with jewel bearing systems, electronic impedance-based sensing and an averaging circuit to reduce measurement errors due to swirl and flow profile distortion.
    3. Wetted metal components shall be nickel-plated brass.
    4. The standard model maximum operating temperature shall be 180°F, 200°F peak, with ambient temperature range of -5°F to 160°F.
    5. Maximum operating pressure shall be 400 psi.
    6. Pressure drop shall be less than 1 psi at 20 ft/s in 2-1/2” pipe, decreasing in larger pipes and lower velocities.

7. Each flow meter shall be individually wet-calibrated against a primary volumetric standard traceable to NIST. The manufacturer's certificate of calibration shall be provided with each flow meter.
8. Accuracy shall be within ± 0.5% of rate at the calibrated velocity, within ± 1% of rate over a 10:1 turndown (3.0 to 30 ft/s) and within ± 2% of rate over a 50:1 turndown (from 0.4 to 20ft/s).
9. Electrical requirement 120/24, provide with control transformer.
10. The flow meter shall include integral digital output, isolated solid state dry contact, 100mA, 50V divided output.
11. The flow meter shall be covered by the manufacturer's two year warranty.
12. Provide standard electrical connection, 10' of 5-wire cable with 3/4-in. NPT conduit connection.

C Display Module shall be digital, converting the results of the insertion flow meter to display flow rate and total volume.

1. Housing shall be 6" x 6" x 4" NEMA 4 steel enclosure, wall mount.
2. Electrical requirement shall be 120/1/60.
   a. Output voltage (nominal): +24 VDC at 200mA.
3. Indicators include multi-functioning LCD(s) with two buttons for mode selection, total reset, and programming, providing 6-digit rate and 8-digit totalization. (Total reset switch can be disabled via programming.)
4. Programming is set at factory for particular flow meter and pipe size. Field programming is possible.
5. Non volatile EEPROM memory retains all programming parameters in the event of power loss.
6. Input is 0-15V pulse output from insertion flow meter.

2.03 PRESSURE GAUGES

A Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com.
2. Moeller Instrument Co., Inc: www.moellerinstrument.com.
3. Omega Engineering, Inc: www.omega.com.

B Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. Case: Steel with brass bourdon tube.
2. Size: 4-1/2 inch diameter.
3. Mid-Scale Accuracy: One percent.
4. Scale: Psi.

2.04 PRESSURE GAUGE TAPPINGS

A Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

2.05 STEM TYPE THERMOMETERS

A Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com.
2. Omega Engineering, Inc: www.omega.com.
3. Weksler Glass Thermometer Corp: www.wekslerglass.com.

B Thermometers - Fixed Mounting: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish.

1. Size: 9 inch scale.
2. Window: Clear Lexan.
3. Accuracy: 2 percentper ASTM E77.
4. Calibration: Degrees F.

C Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

1. Size: 9 inch scale.
2. Window: Clear Lexan.
3. Accuracy: 2 percentper ASTM E77.
4. Calibration: Degrees F.

2.06 THERMOMETER SUPPORTS

A Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

2.07 TEST PLUGS

A Test Plug: 1/4 inch or 1/2 inch stainless steel fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with Nordel core for temperatures up to 350 degrees F.

B Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gauges, one gauge adapters with 1/8 inch probes, two 1 inch dial thermometers.

2.08 STATIC PRESSURE GAUGES

A Manufacturers:

1. Dwyer Instruments, Inc; _____: www.dwyer-inst.com/#sle.
2. Omega Engineering, Inc; _____: www.omega.com/#sle.
3. Weksler Glass Thermometer Corp; _____: www.wekslerglass.com/#sle.

PART 3 EXECUTION

3.01 INSTALLATION

A Install in accordance with manufacturer's instructions.

B The Contractor shall set the flow metering system in service to operating conditions as a part of this contract.

C Store all components prior to installation in clean, dry place to protect them from construction dirt, water etc. Handle with care to avoid damaging finish or internal components.

D Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.

E Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

F Coil and conceal excess capillary on remote element instruments.

G Provide instruments with scale ranges selected according to service with largest appropriate scale.

H Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

I Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

J Locate test plugs adjacent thermometers and thermometer sockets.

END OF SECTION 22 05 19

SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A Applications
B General requirements
C Angle valves
D Ball valves
E Butterfly valves
F Check valves
G Globe valves
H Plug valves

1.02 ABBREVIATIONS AND ACRONYMS

A CWP: Cold working pressure.
B EPDM: Ethylene propylene copolymer rubber.
C NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
D NRS: Non-rising stem.
E OS&Y: Outside screw and yoke.
F PTFE: Polytetrafluoroethylene.
G RS: Rising stem.
H SWP: Steam working pressure.
I TFE: Tetrafluoroethylene.
J WOG: Water, oil, and gas.

1.03 REFERENCE STANDARDS

A ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).
B ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
C ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.
D ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2022, with Errata (2023).
E ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
F ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2020.
G ASME B31.9 - Building Services Piping; 2020.
H ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.
I ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.
J ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).
K ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).
L ASTM B61 - Standard Specification for Steam or Valve Bronze Castings; 2015 (Reapproved 2021).
M ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.
N AWWA C606 - Grooved and Shouldered Joints; 2022.
O MSS SP-45 - Drain and Bypass Connections; 2020.
P MSS SP-67 - Butterfly Valves; 2022.
Q MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends; 2011.
R MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.
S MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.
T MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends; 2011.
U MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.
V MSS SP-85 - Gray Iron Globe and Angle Valves, Flanged and Threaded Ends; 2011.
W MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .
X NSF 61 - Drinking Water System Components - Health Effects; 2022, with Errata.

Y NSF 372 - Drinking Water System Components - Lead Content; 2022.

1.04 SUBMITTALS

A Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

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

C Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

D Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.

1.05 QUALITY ASSURANCE

A Manufacturer:

1. Obtain valves for each valve type from single manufacturer.
2. Company must specialize in manufacturing products specified in this section, with not less than 10 years of documented experience.

B Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.06 DELIVERY, STORAGE, AND HANDLING

A Prepare valves for shipping as follows:

1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
2. Protect valve parts exposed to piped medium against rust and corrosion.
3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
5. Secure check valves in either the closed position or open position.
6. Adjust butterfly valves to closed or partially closed position.

B Use the following precautions during storage:

1. Maintain valve end protection and protect flanges and specialties from dirt.
   a. Provide temporary inlet and outlet caps.
   b. Maintain caps in place until installation.
2. Store valves in shipping containers and maintain in place until installation.
   a. Store valves indoors in dry environment.
   b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

1.07 EXERCISE THE FOLLOWING PRECAUTIONS FOR HANDLING:

A Handle large valves with sling, modified to avoid damage to exposed parts.

B Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.01 APPLICATIONS

A See drawings for specific valve locations.

B NOTE - Gate Valves are not approved for use without specific prior approval from the engineer.

C Balancing Valves (cicuit setters) shall be Thermostatic Balancing Valves with Service/Shutoff Ball Valves at either end, inline strainer, and T&P Ports on either side of valve such as Cicuit Solver by ThermOmegaTech Model CSUAS or approved equal.

D Provide the following valves for the applications if not indicated on drawings:

1. Shutoff: Ball valve required except may be Butterfly on 2-1/2" piping and larger
2. Dead-End: Single-flange butterfly (lug) type.
3. Throttling: Provide ball.
4. Swing Check (Pump Outlet):
   a. 2 NPS and Smaller: Bronze swing check valves with bronze disc.
   b. 2-1/2 NPS and Larger for Domestic Water: Iron swing check valves with closure control or center-guided, metal or resilient seat check valves.
   c. 2-1/2 NPS and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

E Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

F Required Valve End Connections for Non-Wafer Types:
1. Steel Pipe:
   a. 2 NPS and Smaller: Threaded ends.
   b. 2-1/2 NPS to 4 NPS: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
   c. 5 NPS and Larger: Grooved or flanged ends.
   d. Grooved-End Copper Tubing and Steel Piping: Grooved.
2. Copper Tube:
   a. 2 NPS and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
   b. 2-1/2 NPS to 4 NPS: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
   c. 5 NPS and Larger: Grooved or flanged ends.

G Domestic, Hot and Cold Water Valves:
1. 2 NPS and Smaller:
   a. Bronze: Provide with solder-joint or press-fitting ends.
   b. Bronze Angle: Class 125, bronze disc.
   c. Ball: Two piece, full port, brass or bronze with stainless-steel trim.
   d. Bronze Swing Check: Class 125, bronze disc.
2. 2-1/2 NPS and Larger:
   a. Iron, 2-1/2 NPS to 4 NPS: Provide with flanged ends.
   b. Iron Ball: Class 150.
   c. Iron Single-Flange Butterfly: 200 CWP, EPDM seat, aluminum-bronze disc.
   d. Iron Grooved-End Butterfly: 175 CWP.
   e. Iron Center-Guided Check: Class 125, compact-wafer, metal seat.

H Sanitary Waste, Storm Drainage, and Force-Main Piping Water Valves:
1. 2 NPS and Smaller:
   a. Bronze: Provide with solder-joint or threaded.
   b. Bronze Angle: Class 125, bronze disc.
   c. Ball: One piece, full port, brass or bronze with stainless-steel trim.
   d. Bronze Swing Check: Class 125, bronze disc.
2. 2-1/2 NPS and Larger:
   a. Iron, 2-1/2 NPS to 4 NPS: Provide with threaded or flanged ends.
   b. Iron Ball: Class 150.
   c. Iron Swing Check with Closure Control: Class 125, lever and spring.
   d. Lubricated Plug: Class 125, regular gland.

2.02 GENERAL REQUIREMENTS

A Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B Valve Sizes: Match upstream piping unless otherwise indicated.

C Valve Actuator Types:
1. Gear Actuator: Quarter-turn valves 8 NPS and larger.
2. Handwheel: Valves other than quarter-turn types.
3. Hand Lever: Quarter-turn valves 6 NPS and smaller except plug valves.
4. Wrench: Plug valves with square heads.

D Valves in Insulated Piping: With 2 NPS stem extensions and the following features:
1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
2. Butterfly Valves: Extended neck.

3. Memory Stops: Fully adjustable after insulation is installed.

E Valve-End Connections:

1. Threaded End Valves: ASME B1.20.1.
2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
3. Pipe Flanges and Flanged Fittings 1/2 NPS through 24 NPS: ASME B16.5.
4. Press Fittings: Owner preferred, provide Pro-Press where possible.

F General ASME Compliance:

1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
2. Solder-joint Connections: ASME B16.18.
3. Building Services Piping Valves: ASME B31.9.

G Valve Materials for Potable Water: NSF 61 and NSF 372.

H Bronze Valves:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

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

J Source Limitations: Obtain each valve type from a single manufacturer.

2.03 BRONZE ANGLE VALVES

A Class 125: CWP Rating: 200 psig:.

1. Comply with MSS SP-80, Type 1.
2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
3. Ends: Threaded
4. Stem: Bronze
5. Disc: Bronze
6. Packing: Asbestos free
7. Handwheel: Bronze or aluminum

2.04 BRONZE BALL VALVES

A Two Piece, Full Port with Stainless Steel Trim:

1. Comply with MSS SP-110
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Bronze.
5. Ends: Threaded.
6. Seats: PTFE.
7. Stem: Stainless steel
8. Ball: Stainless steel, vented

2.05 IRON BALL VALVES

A Class 125, Full Port, Stainless Steel Trim:

1. Comply with MSS SP-72.
2. CWP Rating: 200 psig.
3. Body: ASTM A536 Grade 65-45-12, ductile iron.
4. Ends: Flanged
5. Seats: PTFE
6. Stem: Stainless steel
7. Ball: Stainless steel
8. Operator: Lever, with locking handle.

2.06 IRON, SINGLE FLANGE BUTTERFLY VALVES

A Lug type: Bi-directional dead-end service without use of downstream flange.

1. Comply with MSS SP-67, Type I.
2. CWP Rating: 200 psig.
3. Body: ASTM A126, cast iron or ASTM A536, ductile iron.
4. Stem: One or two-piece stainless steel.

5. Seat: EPDM
6. Disc: Stainless steel

2.07 IRON, GROOVED-END BUTTERFLY VALVES

A CWP Rating: 175 psig (1200 kPa).
1. Comply with MSS SP-67, Type I.
2. Body: Coated ductile iron
3. Stem: Two-piece stainless steel
4. Disc: Coated ductile iron
5. Disc Seal: EPDM

2.08 BRONZE LIFT CHECK VALVES

A Class 125:
1. Comply with MSS SP-80, Type 1, Metal Disc to Metal Seat and Type 2, Nonmetallic Disc to Metal Seat.
2. CWP Rating: 200 psig.
3. Design: Vertical flow
4. Body: Comply with ASTM B61 or ASTM B62, bronze
5. Ends: Threaded as indicated
6. Disc (Type 1): Bronze.

2.09 BRONZE SWING CHECK VALVES

A Class 125: CWP Rating: 200 psig (1380 kPa).
1. Comply with MSS SP-80, Type 3
2. Design: Horizontal flow
3. Body: Bronze, ASTM B62
4. Ends: Threaded as indicated
5. Disc: Bronze

2.10 IRON SWING CHECK VALVES

A Class 125:
1. Comply with MSS SP-71, Type I.
2. CWP Rating: 200 psig.
3. Design: Clear or full waterway.
4. Body: ASTM A126, gray iron with bolted bonnet.
5. Ends: Flanged as indicated.
6. Trim: Bronze.
7. Seat Ring and Disc Holder: Bronze.
8. Disc: PTFE.
9. Gasket: Asbestos free.

2.11 IRON GROOVED-END SWING CHECK VALVES

A 300 CWP:
1. CWP Rating: 300 psig.
2. Body: ASTM A536, Grade 65-45-12 ductile iron.
3. Seal: EPDM
4. Disc: Stainless steel
5. Coating: Black, non-lead paint

2.12 IRON CENTER-GUIDED CHECK VALVES

A Class 125, Compact-Wafer:
1. Comply with MSS SP-125.
2. CWP Rating: 200 psig.
3. Body: 316 stainless steel.
4. Metal Seat: Stainless steel.

B Class 150, Compact-Wafer:
1. Comply with MSS SP-125.

2. CW P Rating: 300 psig.
3. Body: 316 Stainless steel.
4. Metal Seat: Stainless steel.

2.13 LUBRICATED PLUG VALVES

A Regular Gland and Cylindrical with Threaded Ends:
1. Comply with MSS SP-78, Type II.
2. Class 125: CWP Rating: 200 psig.
3. Class 250: CWP Rating: 400 psig.
4. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
5. Pattern: Regular or short.
6. Plug: Cast iron or bronze with sealant groove.

PART 3 EXECUTION

3.01 EXAMINATION

A Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.

B Verify valve parts to be fully operational in all positions from closed to fully open.

C Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

A Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

D Provide the Owner with a valve chart indicating location, valve number, size, manufacturer, purpose, etc. Frame valve chart under glass.

E Provide brass or stainless steel valve tags on all valves. Refer to Identification for Plumbing Piping and Equipment Specification for further information.

F Provide access panel, minimum 18” square, where valves are located above gypsum board ceiling. Access panel shall have fire rating to match ceiling rating, if ceiling is rated. Access panel shall be painted to match ceiling.

G Provide dot on ceiling grid where valves are located above lay-in ceiling. Refer to Identification for Plumbing Piping and Equipment Specification for further information.

H The Contractor shall set in service all valves to operating conditions as part of his Contract. Where valves with manual settings are required, valves shall be calibrated by plumbing contractor for a balanced flow.

I All valve stems shall be accessible and in no case shall valve stems be installed below horizontal.

J All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

K In no case shall raised face flanges be bolted to flat face flanges.

L All flanged connections shall be gasketed.

M All elastomers used for seals and seats shall be UL Classified in accordance with NSF-61/NSF-372 for potable water service

N Install check valves where necessary to maintain direction of flow as follows:
1. Lift Check: Install with stem plumb and vertical.
2. Swing Check: Install horizontal maintaining hinge pin level.
3. Orient center-guided into horizontal or vertical position, between flanges.

END OF SECTION 22 05 23

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A Support and attachment components for equipment, piping, and other plumbing work for a completely and properly supported plumbing system.

1.02 REFERENCE STANDARDS

A ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.

D ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

F ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

G ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

H ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

I ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

J MFMA-4 - Metal Framing Standards Publication; 2004.

K MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

L NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Contractor is responsible for reviewing complete construction document package and determining, prior to the start of work, which portions of the above grade structural slabs are hard rock concrete and/or lightwieght insulating concrete and shall review the structural engineer's requirements for attachment to slabs. Unistrut or other forms of support required to span multiple joists or beams shall be part of the contractors bid price. No additional monies will be given for support steel or other members required where piping may not be allowed to be supported by the concrete deck above.

B Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.04 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, post-installed concrete and masonry anchors, thermal

insulated pipe supports, and all devices required for a complete hanger and support system.

B Approved Manufacturers: Eaton / Cooper B-Line, Thomas & Betts Corporation, nVent Caddy (Erico), Unistrut, or prior Engineer Approved Equal

C Furnish all support materials, associated fittings, accessories, and hardware produced by a single manufacturer.

1.05 QUALITY ASSURANCE

A Comply with applicable building code.

B Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

D Installer Qualifications for Field-Welding: As specified in Section 05 50 00.

E Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A General Requirements:

1. Comply with MSS SP-58.
2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
3. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
   a. Indoor Dry Locations: Use zinc-plated steel or galvanized steel, or epoxy plated steel unless otherwise indicated.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
   c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
   d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B Metal Channel (Strut) Framing Systems:

1. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
2. Comply with MFMA-4.
3. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
4. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.

C Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

1. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2 inch diameter.
   b. Piping up to 1 inch (27 mm) nominal: 1/4 inch diameter.
   c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch diameter.
   d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.

D Pipe Supports:

1. Liquid Temperatures Up To 122 degrees F:
   a. Overhead Support: MSS SP-58 Types 1, 3 through 12.

b. Support From Below: MSS SP-58 Types 35 through 38.

E Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
1. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
2. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

F Riser Clamps:
1. Provide copper plated clamps for copper tubing support.
2. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.

G Offset Pipe Clamps: Double-leg design two-piece pipe clamp.

H Strut Clamps: Two-piece pipe clamp.

I Insulation Clamps: Two bolt-type clamps designed for installation under insulation.

J Pipe Hangers: For a given pipe run, use hangers of the same type and material.
1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
2. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

K Intermediate Pipe Guides: Use pipe clamps with oversize pipe sleeve that provides clearance around pipe.
1. Pipe Diameter 6 inches and Smaller: Provide minimum clearance of 0.16 inch.
2. Pipe Diameter 8 inches: Provide U-bolts with double nuts providing minimum clearance of 0.28 inch.
3. Pipe Diameter 8 inches: 0.625 inch U-bolt.
4. Pipe Diameter 10 inches: 0.75 inch U-bolt.
5. Pipe Diameter 12 to 16 inches: 0.875 inch U-bolt.
6. Pipe Diameter 18 to 30 inches: 1 inch U-bolt.

L Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

M Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
3. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
4. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

N Anchors and Fasteners:
1. Manufacturers - Mechanical Anchors:
   a. Hilti, Inc
   b. ITW Red Head, a division of Illinois Tool Works, Inc
   c. Powers Fasteners, Inc
   d. Simpson Strong-Tie Company Inc
   e. nVent CADDY (Erico).
2. Manufacturers - Powder-Actuated Fastening Systems:
   a. Hilti, Inc
   b. ITW Ramset, a division of Illinois Tool Works, Inc
   c. Powers Fasteners, Inc
   d. Simpson Strong-Tie Company Inc
3. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
4. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
5. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
6. Hollow Masonry: Use toggle bolts.
7. Hollow Stud Walls: Use toggle bolts.

8. Steel: Use beam clamps, machine bolts, or welded threaded studs.
9. Sheet Metal: Use sheet metal screws.
10. Wood: Use wood screws.
11. Plastic and lead anchors are not permitted.
12. Powder-actuated fasteners are permitted only as follows:
    a. Where approved by Architect.
    b. Use only threaded studs; do not use pins.
13. Hammer-driven anchors and fasteners are permitted only as follows: Wood Frame Construction
14. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.
    c. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch minimum base metal thickness.
    d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
15. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that field measurements are as indicated.

B Verify that mounting surfaces are ready to receive support and attachment components.

C Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A Install products in accordance with manufacturer's instructions.

B Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

D Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G Equipment Support and Attachment:
1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

I Secure fasteners according to manufacturer's recommended torque settings.

J Remove temporary supports.

K The actual arrangement of the piping shall follow the general locations shown on the Drawings, such that clearances, line drainage, etc. shall be maintained.

L In no case shall this Contractor be allowed to cut or reduce the specified covering to allow the application of a smaller hanger than required.

M Hangers supporting vertical and horizontal copper piping, sized 1 ½" in diameter and larger, shall be spaced on not more than 10-foot centers and 30" of each change or direction.

N Hangers supporting vertical and horizontal copper piping, sized 1 ¼" in diameter and smaller, shall be spaced on not more than 6-foot centers and 30" of each change of direc-tion.

O Hangers supporting vertical and horizontal PVC piping of any size shall be spaced on not more than 4-foot centers and 30" of each change of direction.

P Hangers supporting vertical and horizontal CPVC piping 1 ¼" in diameter and larger shall be spaced on not more than 4-foot centers and 30" of each change of direction.

Q Hangers supporting vertical and horizontal CPVC piping 1" in diameter and smaller shall be spaced on not more than 3-foot centers and 30" of each direction.

R Hangers supporting horizontal cast iron piping of any size shall be spaced not more than 5-foot centers and 30" of each change of direction, with a minimum of two hangers per sec-tion.

S Hangers supporting vertical cast iron piping of any size shall be spaced on not more than 10-foot centers and 30" of each change of direction, with a minimum of two hangers per section.

T Rigid support sway bracing shall be provided at changes in direction greater than 45 de-grees for all pipe sizes 4" and larger.

U Vertical risers shall be supported at each floor, 5-feet on center, and/or at changes in direc-tion of pipe.

V Sleeves shall be provided wherever pipes pass through walls, floors and ceilings. Sleeves shall be Schedule 40, black steel, ½" in diameter larger than the pipe or insulation on the pipe. Sleeves through walls and ceilings shall be flush. Sleeves through floors shall extend one inch above finished floor. Sleeves in exterior walls shall be caulked and made water-tight.

3.03 FIELD QUALITY CONTROL

A Inspect support and attachment components for damage and defects.

B Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 22 05 29

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A Nameplates.
B Tags.
C Pipe markers.
D Ceiling tacks.
E Valve Tags

1.02 REFERENCE STANDARDS

A ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.
B ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.03 SUBMITTALS

A List: Submit list of wording, symbols, letter size, and color coding for plumbing identification.
B Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
C Product Data: Provide manufacturers catalog literature for each product required.
D Manufacturer's Installation Instructions: Indicate special procedures, and installation.
E Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A Control Panels: Nameplates.
B Heat Transfer Equipment: Nameplates.
C Major Control Components: Nameplates.
D Piping: Tags.
E Pumps: Nameplates.
F Small-sized Equipment: Tags.
G Tanks: Nameplates.
H Valves: Tags and ceiling tacks where located above lay-in ceiling.
I Water Treatment Devices: Nameplates.

2.02 NAMEPLATES

A Manufacturers:
1. Brimar Industries, Inc.
2. Kolbi Pipe Marker Co.
3. Preferred Utilities Mfg. Corp.
4. Seton Identification Products
5. Brady Corporation.

B Description: Laminated three-layer plastic with black engraved letters on light contrasting background.
1. Letter Color: Black.
2. Letter Height: 1/4 inch.
3. Background Color: light, contrasting background.
4. Plastic: Comply with ASTM D709.

2.03 TAGS

A Manufacturers:
1. Brady Corporation
2. Brimar Industries, Inc.
3. Craftmark Pipe Markers
4. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com
5. Seton Identification Products:

B Metal Tags: Aluminum with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

A Manufacturers:
1. Brady Corporation: www.bradycorp.com.
2. Carlton Industries, Inc.
3. Brimar Industries, Inc.: www.pipemarker.com.
4. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
5. Seton Identification Products: www.seton.com.

B Comply with ASME A13.1.

C Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D Color: Standard colors for selected plumbing piping, attached at end of Section.

E Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

F Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service. Message must repeat within a maximum of 40". Printed legend shall be indicative of type of underground line. Underground gas lines shall have insulated copper tracer wire, minimum 18 AWG with insulation suitable for direct burial and ends shall terminate above grade.

2.05 CEILING MARKERS

A Manufacturers:
1. Craftmark Pipe Markers; _____: www.craftmarkid.com/#sle.
2. MSI.
3. Seton.

B Description: Steel with 3/4 inch diameter color coded head.

C Install label on ceiling grid in proximity to device above ceiling. Indicate type of device and associated service on label. (e.g. "CW-21"). Next to label, on ceiling grid, provide round dot.

D Provide custom printed labels, either of vinyl suitable for indoor/outdoor applications or of polypropylene for each device. Utilize portable printer equal to Brady HandiMark Portable Industrial Labeling System.

E Maximum height of label is one inch. Black lettering on white tape. Font size 18.

F Color code as follows unless Owner has their own standard - Contractor to verify prior to start of work:
1. Cold Water: Blue dot
2. Hot Water: Green dot
3. Hot Water Return: Green dot
4. All other valves: Black Dot

PART 3 EXECUTION

3.01 PREPARATION

A Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B Install tags with corrosion resistant chain.

C All exposed piping in mechanical rooms, boiler rooms, on and above mezzanine levels, both insulated and uninsulated, shall be either painted or color coded using 0.030" PVC jacketing by the Plumbing Contractor and labeled by the Contractor as per the following schedule:
1. Domestic Cold Water: Blue
2. Domestic Hot Water: Red
3. Makeup Water: Green
4. Fuel Gas: Yellow
5. Non-Potable Water: Purple

D All non-potable water outlets shall include a phenolic sign with yellow background and black letters 1/2" high stating: “NON-POTABLE WATER – NOT SAFE FOR DRINKING”

E Install plastic pipe markers in accordance with manufacturer's instructions.

F Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

G Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

H Use tags on piping 3/4 inch diameter and smaller.

1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

I Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

J Identify water heaters, with plastic nameplates. Small devices may be identified with tags.

K Identify control panels, manual motor starters, combination motor starters, disconnects, emergency shutoff switches, water heater override switches, water heater emergency switches and major control components outside panels with plastic nameplates.

L Identify aquastats or temperature sensors relating to water heaters or valves with nameplates.

M Identify valves in main and branch piping with valve tags.

N Tag automatic controls, instruments, and relays. Key to control schematic.

O Identify water heaters with plastic nameplates indicating unit number and area served.

P Identify pumps with plastic nameplates indicating pump number and system served.

3.03 SCHEDULES

A Standard Color Identification for Plumbing Piping unless Owner has their own standard - Contractor to verify prior to start of work (all labels shall be provided with flow arrows):

1. Domestic Cold Water: White Lettering/Green Background
2. Domestic Hot Water: Black Lettering/Yellow Background
3. Domestic Hot Water Return: Black Lettering/Yellow Background
4. Fuel Gas Piping: Black Lettering/Yellow Background
5. Compressed Air: White Lettering/Blue Background
6. Roof Drain: Black Lettering/White Background
7. Overflow Roof Drain: Black Lettering/White Background
8. Condensate Drain: Black Lettering/White Background
9. Non-Potable Water: Black Lettering/Yellow Background

B All medical gas piping shall conform to NFPA 99 marking standards.

END OF SECTION 22 05 53

SECTION 22 05 63
ELECTRICAL WORK

PART 1 GENERAL

1.01 DIVISION OF WORK

A This Contractor shall be responsible for the final electrical and the entire control connections and wiring to all equipment installed as part of his contract.

B Contractor shall review the electrical plans, where applicable, to establish points of connection and the extent of his electrical work to be provided in his contract.

C Unless otherwise noted, this Contractor shall wire from his equipment to disconnect switches, junction boxes, or panelboard circuit breakers as provided by the Electrical Contractor or as required by the existing conditions.

D All power and control wiring shall be in conduits. Refer to Division 26 specifications for conduit and conduit fittings.

E All electrical work shall be performed by a licensed electrician.

F All electrical work shall be in accordance with the State Building Code and all its supplements, the latest adopted edition of the National Electrical Code and the electrical specifications.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A All motor starters, disconnects, switches, relays, conduits, conductors, etc. that are required for a complete electrical power and/or control system shall conform to the requirements set forth by NEC.

B Refer to the plans for the type, size and electrical characteristics of the starters, disconnects, switches, relays, conductor and conduits.

C All conductors and conduits shall be sized as noted on the plans or as required per NEC.

D All individual motor starters for plumbing equipment (i.e., pumps, etc.) shall be furnished and installed under Division 22.

E All relays, actuators, timers, seven-day clocks, alternators, pressure, vacuum, float, flow, aquastats, freezestats, line and low voltage thermostats, thermals, remote selector switches, remote push-button stations, emergency break-glass stations, interlocking, disconnect switches beyond termination point, and other appurtenances associated with equipment under Division 22 shall be furnished, installed and wired under Division 22.

F “Built-in” disconnect switches shall be installed in a NEMA 3R enclosure, it must be appropriately horsepower rated, and it must be third-party listed for the application.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A All motor starters, disconnects, and switches shall be installed on or as close to the equipment they are serving as possible, or where shown on the plans.

B Electrical connection to equipment subject to vibration which develops objectionable noises shall be made from the conduit system with short lengths of flexible "Liquid-Tite" conduit. Connection to other equipment shall be made with rigid conduit.

C Conduits shall be run in a concealed space such as wall cavities, ceiling cavities, etc. except in the mechanical rooms where conduit may be run exposed.

END OF SECTION 22 05 63 22 05 63

SECTION 22 05 70
PLUMBING COORDINATION DRAWINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A The Plumbing Contractor shall be responsible for providing 1/4" scale coordination drawings for the entire project, format shall be as stated below.

B The drawings shall cover above ceiling space, mechanical rooms, electrical rooms and service yards.

PART 2 EXECUTION

2.01 COORDINATION (REVIT)

A The Plumbing Contractor shall obtain the architectural, structural, and MEP REVIT models from the Architect. The models will be in REVIT 2022.

B The Plumbing Contractor shall produce drawings that indicate all piping, including underground piping, and equipment on ¼ scale drawings. All items shall be drawn to scale, dimensioned and be easily identified. The drawings shall indicate a bottom of pipe.

C The Plumbing Contractor shall provide the Mechanical Contractor a file compatible with Navisworks that indicates all piping and plumbing equipment.

D The overall coordination drawings shall be completed prior to any plumbing, mechanical and electrical work beginning. Start of work, including underground work, without completed Coordination Drawings is at the Contractor's risk.

END OF SECTION 22 05 70 22 05 70

SECTION 22 07 16
PLUMBING EQUIPMENT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A Flexible elastomeric cellular insulation.
B Flexible removable and reusable blanket insulation.
C Flexible glass fiber insulation.
D Rigid glass fiber insulation.
E Jacketing and accessories.

1.02 REFERENCE STANDARDS

A ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).
B ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).
C ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
D ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.
E ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
F ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.
G ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
H ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.
I ASTM C1695 - Standard Specification for Fabrication of Flexible Removable and Reusable Blanket Insulation for Hot Service; 2022.
J ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
K ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
L SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.
M UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A See Section 01 30 00 - Administrative Requirements for submittal procedures.
B Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.
C Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE

A Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with not less than three years of documented experience.
B Applicator Qualifications: Company specializing in performing the type of work specified in this section and approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
B Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 FIELD CONDITIONS

A Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 FLEXIBLE GLASS FIBER INSULATION

A Manufacturers:
1. CertainTeed Corporation
2. Johns Manville Corporation
3. Knauf Insulation
4. Owens Corning Corporation

B Insulation: ASTM C553; flexible, noncombustible.
1. K Value: 0.36 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
2. Maximum Service Temperature: 450 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C Vapor Barrier Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
1. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
2. Secure with self-sealing longitudinal laps and butt strips.

D Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E Vapor Barrier Lap Adhesive: Compatible with insulation.

F Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.03 FLEXIBLE REMOVABLE AND REUSABLE BLANKET INSULATION

A Insulation: ASTM C553 Type V; flexible, noncombustible.
1. Comply with ASTM C1695.
2. K Value: 0.37 at 100 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
3. Minimum Service Temperature: 32 degrees F.
4. Maximum Service Temperature: 500 degrees F.
5. Maximum Water Vapor Absorption: Less than 5.0 percent by weight.

2.04 RIGID GLASS FIBER INSULATION

A Manufacturers:
1. CertainTeed Corporation
2. Johns Manville Corporation
3. Knauf Insulation
4. Owens Corning Corporation

B Insulation: ASTM C612 or ASTM C592; rigid, noncombustible.
1. K Value: 0.25 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent by weight.
4. Maximum Density: 8.0 pcf.

C Vapor Barrier Jacket:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with self-sealing longitudinal laps and butt strips.

D Vapor Barrier Lap Adhesive: Compatible with insulation.

E Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.05 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A Manufacturers:
1. Aeroflex USA, Inc

2. Armacell LLC
3. K-Flex USA LLC

B Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

C Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.06 JACKETING AND ACCESSORIES

A Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire-retardant lagging adhesive.
1. Lagging Adhesive: Compatible with insulation.

B Aluminum Jacket:
1. Thickness: 0.016 inch sheet.
2. Finish: Embossed.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

C Reinforced Tape:
1. All Service Jacket tape suitable for continuous spiral wrapping of insulated pipe bends and fittings resulting in a tight, smooth surface without wrinkles.
2. Comply with UL 723, SAE AMS3779, and ASTM C1423.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that equipment has been tested before applying insulation materials.

B Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A Install in accordance with manufacturer's instructions.

B Factory Insulated Equipment: Do not insulate.

C Exposed Equipment: Locate insulation and cover seams in least visible locations.

D Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

E Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

F Insulated equipment containing fluids below ambient temperature: Insulate entire system.

G For fiberglass insulated equipment containing fluids below ambient temperature, provide vapor barrier jackets, factory-applied or field-applied, and finish with glass cloth and vapor barrier adhesive.

H Inserts and Shields:
1. Application: Equipment 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between hangers and inserts.
3. Insert location: Between support shield and equipment and under the finish jacket.
4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

I Finish insulation at supports, protrusions, and interruptions.

J Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.

K Exterior Applications:
1. Provide vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement.
2. Cover with aluminum.

L Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.

M Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

3.03 SCHEDULES

A Plumbing Systems:

1. Domestic Hot Water Storage Tanks:
   a. Glass Fiber, Flexible Insulation: 1.5 inches thick.
   b. Glass Fiber, Rigid Insulation: 1.5 inches thick.

B Heating Systems:

1. Expansion Tanks: 1.5 inches

END OF SECTION 22 07 16

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A Flexible elastomeric cellular insulation.
B Glass fiber insulation.
C Jacketing and accessories.

1.02 REFERENCE STANDARDS

A ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
B ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).
C ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.
D ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.
E ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.
F ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
G ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
H ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2022.
I ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2022.
J ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2018).
K ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber; 2020.
L ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
M ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
N UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.04 QUALITY ASSURANCE

A Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
B Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.06 FIELD CONDITIONS

A Maintain ambient conditions required by manufacturers of each product.
B Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723

2.02 GLASS FIBER INSULATION

A Manufacturers:
1. CertainTeed Corporation
2. Johns Manville Corporation

3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation
4. Owens Corning Corporation

B Insulation: ASTM C547and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
1. K Value: ASTM C177, 0.23 at 75 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

C Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm inch.

D Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E Vapor Barrier Lap Adhesive: Compatible with insulation.

F Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

G Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd weight.

H Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A Manufacturers:
1. Aeroflex USA, Inc
2. Armacell LLC
3. K-Flex USA LLC

B Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

C Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.04 JACKETING AND ACCESSORIES

A Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive. (INTERIOR)
1. Lagging Adhesive: Compatible with insulation.

B Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet. (EXTERIOR)
1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
2. Thickness: 0.016 inch sheet.
3. Finish: Smooth.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that piping has been tested before applying insulation materials.

B Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A Install in accordance with manufacturer's instructions.

B Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C All valve handles on insulated piping shall be extended beyond the surface of the insulation using approved listed valve stem handle extensions made by same manufacturer of the valves.

D Exposed Piping in Mechanical Spaces and Exposed to Public View Piping (open ceiling): Shall be covered with eight-ounce canvas jacket, pasted in place and glue sized twice for painting - locate insulation and cover

seams in least visible locations. Canvas shall be coated twice with Foster fireproof lagging to assure flame and smoke spread ratings. Coordinate sequencing with painting schedule and finishes - refer to architecture documents for painting requirements at Open-to-View ceilings.

E All waste piping above slab carrying cold condensate, for instance roof drain piping carrying cold condensate from rooftop mechanical units, including traps and floor drain bodies, except in a crawl space, shall be fully insulated as specified herein within the thermal envelope.

F All horizontal storm drain piping above slab on grade and all vertical risers up to, and including, elbows and roof drain bodies, shall be fully insulated as specified herein.

G Closed cell insulation, may be used in lieu of fiberglass on all water pipes - especially in block walls. All Closed cell insulation shall be jacketed with canvas jacketing prior to being painted and shall be jacketed with Prefroemd PVC Covers when exposed to view.

H Insulation shall be finished with a fire retardant coating to attain proper fire rating.

I Glass fiber insulated pipes conveying fluids below ambient temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

J For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

K Glass fiber insulated pipes conveying fluids above ambient temperature:

1. Provide standard jackets, with vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

L Inserts and Shields:

1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert Location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

M Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. Refer to referenced Rated Partition and/or Floor Penetration UL Details and Non-Rated Partition and/or Floor Penetration Details in the drawings where applicable.

N All insulation shall be finished with a fire retardant coating to attain proper fire rating.

O Closed cell insulation shall be installed in strict accordance with the manufacturer's installation instructions.

P Insulate fittings with pre-fabricated PVC fitting covers.

Q Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

R Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil, 0.001 inch thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

S Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULES

A Plumbing Systems:

1. Domestic Hot Water Supply:
    a. Glass Fiber Insulation:
        1) Pipe Size Range: 0-6 inch.
        2) Thickness: 1 inch.
    b. Cellular Foam Insulation:
        1) Pipe Size Range: 0-6 inch.
        2) Thickness: 1 inch.
2. Domestic Hot Water Recirculation:
    a. Glass Fiber Insulation:
        1) Pipe Size Range: All sizes.
        2) Thickness: 1 inch.
    b. Cellular Foam Insulation:
        1) Pipe Size Range: All sizes.
        2) Thickness: 1/2 inch.
3. Tempered Domestic Water Supply:
    a. Same as Domestic Hot Water Supply
4. Domestic Cold Water:
    a. Closed Cell Insulation:
        1) Pipe Size Range: All sizes
        2) Thickness: 1/2 inch
5. Roof Drain Bodies:
    a. Glass Fiber Insulation:
        1) Thickness: 1 inch
6. Roof Drainage Above Grade:
    a. Glass Fiber Insulation:
        1) Thickness: 1 inch
7. Mechanical Condensate, including traps and floor drain bodies:
    a. Glass Fiber Insulation:
        1) Pipe Size Range: All sizes.
        2) Thickness: 1 inch.

END OF SECTION 22 07 19

SECTION 22 08 00
PLUMBING COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A Commissioning

1. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the owner's project requirements and operational needs. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, performance testing and training. Commissioning during the construction phase is intended to achieve the following specific objectives:
2. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
3. Verify and document proper functional performance of equipment and systems.
4. Verify that O&M documentation is complete.
5. Verify that the Owner's operating personnel are adequately trained.

1.02 RELATED WORK

A Section 01 1000 – Summary of Work
B Section 01 3300 – Submittal Procedures
C Section 01 7700 – Closeout Procedures
D Section 01 7823 – Operation and Maintenance Data
E Section 01 7839 – Project Record Document
F Section 01 7900 – Demonstration and Training
G Section 01 9113 – General Commissioning Requirements
H Division 22 - Plumbing

1.03 ABBREVIATIONS AND DEFINITIONS

A A/E: Architect, Architect/Engineer, and/or Engineer
B ASI: Architectural Supplemental Instruction
C BAS: Building Automation System
D BoD: Basis of Design. A narrative of how the designer plans to achieve the OPR
E CxA: Commissioning Authority
F Controls Contractor
G CM: Construction Manager
H Cx: Commissioning
I Cx Plan: Commissioning Plan
J Cx RFI: Commissioning Request for Information
K DDC: Direct Digital Control System
L Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents and cannot be corrected in five (5) minutes time.
M EC: Electrical Contractor
N FBO: Furnished By Others
O FT: Functional Performance Test
P IAW: In Accordance With
Q MC: Mechanical Contractor
R O&M: Operation and Maintenance
S OPM: Owner Project Manager
T OPR: Owner Project Requirement. A dynamic document expressing how the owner expects the building systems to perform upon project completion.
U PC: Prefunctional Checklist
V RFI: Request for Information
W Sub(s): Subcontractors or Prime Contractor

X TC: Testing Contractor
Y TBD: To Be Determined

1.04 PLUMBING SYSTEMS TO BE COMMISSIONED

A Domestic hot water systems
B Natural gas supply equipment
C Sump pumps and sump pump controls

1.05 SUBMITTALS

A Refer also to Specification Section 01 9113, Subsection 1.6.
B Provide the CxA a copy of the following items, for the systems to be commissioned:
1. Equipment and System Submittals to include, at minimum, the following:
a. Cut Sheets
b. Performance data
c. Manufacturer's pre-startup checklists
1) Manufacturer's start-up checklists
2) Installation Instructions
d. Shop drawings (including any resubmittals required by the A/E)
e. Test plan
f. Completed field test report, including all completed forms and checklist; and list of all outstanding deficiencies and uncompleted items
g. Operational and maintenance documentation
h. Training plan and training materials
i. As-built documentation

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A Refer to Specification Section 01 9113, Subsection 2.1.
B Instrumentation required to verify readings and test system and equipment performance shall be provided by Contractor and made available to Commissioning Authority. Camera equipment capable of viewing an entire pipe assembly at one time.

2.02 CX WEB-BASED COMMISSIONING TOOL

A Refer to Specification Section 01 9113, Subsection 2.1.

PART 3 - EXECUTION

3.01 MEETINGS

A Refer to Specification Section 01 9113, Subsection 3.3.

3.02 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

A The following procedures apply to all equipment to be commissioned, according to Section 1.4 above.
B General
1. Contractor shall complete plumbing testing as required in sections 22 1118, 22 1314, and 22 3314.
2. Testing Plan
a. The subcontractor responsible for providing and installing the equipment completes the testing plan. The test plan will include checklists and procedures with specific boxes or lines for recording and documenting the tests, and a summary statement with a signature block at the end of the plan.
b. The contractor submits the full test plan to the A/E and CxA for review and approval.
3. Execution of Testing Plan
a. Two weeks prior to testing, the Subs and vendors schedule testing with the OPM, CM and CxA. The performance of the tests are directed and executed by the Sub or vendor.
b. The CxA and possibly the A/E will observe the testing procedures for selected pieces of equipment.
c. The Subs and vendors shall execute testing and provide the CM with a signed and dated copy of the completed testing report. The CM reviews for completion and accuracy, then submits to the CxA and A/E.

d. Only individuals that have direct knowledge and witnessed that a line item task on the testing was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

4. Deficiencies, Non-Conformance and Approval in Checklists and Startup
   a. The Sub(s) shall clearly list any outstanding items of the initial testing that were not completed successfully. The testing forms and any outstanding deficiencies shall be provided to the CxA within two days of test completion.
   b. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the tests in a timely manner, and shall notify the CxA as soon as outstanding items have been corrected.
   c. Items left incomplete, which later cause deficiencies or delays during functional performance testing may result in backcharges to the responsible party. Refer to Section 01 9113, 3.7 – Documentation, Non-Conformance and Approval of Tests.

3.03 FUNCTIONAL PERFORMANCE TESTING, VERIFICATION AND VALIDATION

A Objectives and Scope

1. The contractor will perform functional performance testing of the water heating equipment and any plumbing automation system integration with the EMS.
2. The objective is to demonstrate that each system is operating according to the owner's project requirements, documented project program, and Contract Documents. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and function of the systems.
3. The CxA develops specific functional test procedures and forms to verify and document proper operation of each piece of equipment and system. The CxA provides a copy of the test procedures to the A/E, OPM and installing Sub who shall review the tests prior to testing. The A/E and Sub(s) shall point out to the CxA any specific problems as related to feasibility, safety, equipment and warranty protection.
4. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.
5. The contractor shall supply all personnel and equipment for the demonstration, including, but not limited to, tools, instruments, ladders, lifts, computers, software, cables, etc. Contractor supplied personnel must be competent with and knowledgeable of all project-specific systems. All training documentation, submittals, installation manuals, and O&Ms, shall be at the job site before demonstration testing commences.
6. Coordination and Scheduling
   a. The CM shall provide sufficient notice to the CxA regarding the Subs completion schedule for the testing of all equipment and systems. The CxA will schedule demonstration and validation after written notification from the CM and affected Subs. The CxA shall direct, witness and document the demonstration retesting of equipment and systems. The Subs shall execute the tests.
   b. In general, functional performance testing shall not be scheduled until all equipment submittals are approved, testing plans are approved, testing has been satisfactorily completed, and testing report has been provided. Scheduling of testing shall be done with a minimum of two weeks notice prior to testing. Testing which occurs outside the presence of the CxA or OPM without written authorization to do so will be required to be re-tested at no expense to the owner.
7. Problem Solving
8. The CxA will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the CM, Subs and A/E.

3.04 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A Refer to Specification Section 01 9113, Subsection 3.7.

3.05 OPERATION AND MAINTENANCE MANUALS

A In addition to installation manuals, the contractor shall provide one copy of the Operation and Maintenance Manuals to the CxA for the systems to be commissioned. The O&M Manuals shall be provided to the CxA

at least 8 weeks prior to the start of Functional Testing. O&M Manuals shall be in electronic form, the file format shall be Adobe Acrobat readable document. The document shall be formatted to include level 1 bookmarks that link to each main section of equipment. Refer to specification section 01 9113, subsection 3.8 for further detail.

3.06 TRAINING OF OWNER PERSONNEL

A See Specification Section 01 9113, Subsection 3.9.

B Provide designated Owner personnel with comprehensive training in the understanding of the systems and the operation and maintenance of cabling systems.

C Training shall start with classroom sessions, if necessary, followed by hands-on training on each piece of equipment.

3.07 DEFERRED TESTING

A See Specification Section 01 9113, Subsection 3.10.

END OF SECTION 22 08 00

SECTION 22 10 05
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A Pipe, pipe fittings, specialties, and connections for piping systems.
1. Sanitary Sewer Drain, Waste and Vent Pipe and Fittings
2. Lead-Free Domestic Water Pipe and Fittings
3. Stormwater Drain Pipe and Fittings
4. Condensate Drain Pipe and Fittings
5. Natural or LP Gas Pipe and Fittings
6. Flanges, unions, and couplings
7. Manufactured sleeve-seal systems
8. Thermostatic, Self-Actuating Balancing Valves (replaced cicuit setters)
9. Water pressure reducing valves
10. Relief valves
11. Strainers

1.02 REFERENCE STANDARDS

A ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems; 2015 (Reaffirmed 2020).
B ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
C ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
D ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
E ASME B31.1 - Power Piping; 2022.
F ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2023.
G ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.
H ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
I ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2021.
J ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
K ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.
L ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
M ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
N ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.
O ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.
P ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2020.
Q ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2023.
R ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2020.
S ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.
T ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2020.
U ASTM D2846/D2846M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems; 2019a.

V ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020.

W ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2023.

X ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2022.

Y ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2022).

Z ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2023.

AA ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems; 2023.

BB ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-Linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing; 2023b.

CC AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

DD AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2017, with Errata (2018).

EE CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.

FF NSF 61 - Drinking Water System Components - Health Effects; 2022, with Errata.

GG NSF 372 - Drinking Water System Components - Lead Content; 2022.

1.03 SUBMITTALS

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

B Welder Certificate: Include welders certification of compliance with ASME BPVC-IX.

C Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

D Project Record Documents: Record actual locations of valves.

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

1. Valve Repacking Kits: One for each type and size of valve.

1.04 QUALITY ASSURANCE

A Perform work in accordance with applicable codes.

B Valves: Manufacturer's name and pressure rating marked on valve body.

C Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

D Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

F All wetted components of system shall comply with United States Safe Drinking Water Act (Sec.1417) amended 1-4-2011.

1.05 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.

1.06 FIELD CONDITIONS

A Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 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.

B Pipe Bedding - PVC Piping to be bedded in the ground shall be installed according to the requirements and recommendations in ASTM-D2321 and shall be backfilled with Soils meeting the Soils Class III unless otherwise approved by the engineer of record prior to installation. PVC Piping less than 8" in diameter shall be backfilled with material with a maximum aggregate size of 10% of the diameter of the pipe being covered.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A Cast Iron Pipe: ASTM A74 extra heavy weight.
1. Fittings: Cast iron.
2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.
3. Pipe and Fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and shall be listed with NSF International.

B PVC Pipe: ASTM D2665 or ASTM D3034.
1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.
3. Foam Core PVC Piping is not allowed.

2.03 SANITARY SEWER PIPING, ABOVE GRADE

A Cast Iron Pipe: CISPI 301, hubless, service weight.
1. Fittings: Cast iron.
2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies. Heavy-Duty (4-band) type only.
3. Pipe and Fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and shall be listed with NSF International.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A Piping larger than 2 inch: Ductile Iron Pipe: AWWA C151/A21.51.
1. Fittings: Ductile or gray iron, standard thickness.
2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with 3/4 inch diameter rods.

B Piping 2 inch and smaller: Type K copper, soft drawn
1. ASTM B88 (ASTM B88M)
2. Fittings: ASME B16.22, wrought copper and bronze.
3. Use silver solder on all joints underground.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

A Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
1. Fittings: ASME B16.22, wrought copper and bronze.
2. Joints: Grooved mechanical couplings on piping 3" and larger is acceptable
3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.
    a. Manufacturers:
        1) Apollo Valves
        2) Grinnell Products
        3) Viega LLC
        4) Nibco.

2.06 CONDENSATE PIPING

A Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
1. Fittings: ASME B16.22, wrought copper and bronze.

B Cast Iron Pipe: CISPI 301, hubless, service weight.
1. Fittings: Cast iron.
2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies. Heavy-Duty (4-band) type only.

2.07 NATURAL GAS PIPING, BURIED BEYOND 5 FEET OF BUILDING

A Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Fittings: ASTM A234/A234M, wrought steel welding type, with AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.
2. Joints: ASME B31.1, welded.

2.08 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Fittings: ASTM A234/A234M, wrought steel welding type.
2. Joints: ASME B31.1, welded.
3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.09 NATURAL GAS PIPING, ABOVE GRADE

A Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
2. Joints: Threaded or welded to ASME B31.1.

2.10 FLANGES, UNIONS, AND COUPLINGS

A Unions for Pipe Sizes 3 Inches and Under:
1. Ferrous Pipe: Class 150 malleable iron threaded unions.
2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B Flanges for Pipe Size Over 1 Inch:
1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C No-Hub Couplings:
1. Gasket Material: Neoprene complying with ASTM C564.
2. Band Material: Stainless steel.
3. Eyelet Material: Stainless steel.
4. Must meet CISPI 310 and shall be listed by NSF International.
5. NOTE: Transition fittings from Cast Iron piping to PVC Piping must be FM Approved PVC Transition Fitting specifically deisgned for transition from Cast Iron to PVC - "Band" type transition fittings are not approved.

2.11 MANUFACTURED SLEEVE-SEAL SYSTEMS

A Manufacturers:
1. The Metraflex Company
2. Approved Equal

B Modular/Mechanical Seal:
1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
2. Provide watertight seal between pipe and wall/casing opening.
3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass reinforced plastic pressure end plates.

2.12 PIPING SPECIALTIES

A Thermostatic Flow Controls (Replacing Circuit Setters): Thermostatic, self-actuating balancing valve that automatically and continuously adjusts the flow of domestic hot water recirculation systems to maintain a specified temperature at the end of each branch.
1. Manufacturers:
   a. Circuit Solver
   b. Acorn
   c. Approved Equal
2. 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

3. Calibration: Device Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.
4. Installation / TAB: During the initial start-up of the Domestic Hot Water System (DHWS), the valve shall be set to wide open and will begin to close once the system temperature requirements are met. System shall be placed into operation and time given for the valves to make the necessary adjustments. BAS Control of Recirculation Pump on and off will not allow the system to properly balance - The specified Aquastat shall be allowed to run Pump On and Off for proper balancing.

2.13 WATER PRESSURE REDUCING VALVES

A Manufacturers:
1. Amtrol Inc
2. Apollo Valves
3. Watts Regulator Company
4. Victaulic Series 386 Pressure Reducing Valve Stations

2.14 RELIEF VALVES

2.15 PRESSURE-TEMPERATURE VALVES

A Temperature and Pressure:
1. ANSI Z21.22, AGA certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME BPVC-IV certified and labelled.

2.16 STRAINERS

A Size 2 Inches and Under:
1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B Remove scale and dirt, on inside and outside, before assembly.
C Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A Install in accordance with manufacturer's instructions.
B Testing of all piping under this contract shall be made in the presence of the Engineer or a designated representative of the Owner. No piping shall be covered or put into operation before such testing has been approved.
C Copper tubing which is out of round will not be acceptable.
D The arrangement of the piping shall follow the general locations shown on the Drawings, such that clearances, line drainages, etc., shall be maintained.
E No notching or mitering of copper tubing will be permitted.
F Joints in Type "K" copper tubing will not be permitted underfloor unless otherwise noted on drawings.
G In pipe chases, the Contractor shall provide for suspension of all piping from the structure. Do not allow piping to rub against masonry when expanding and contracting.
H Close and protect open ends of piping until final connections are made. Such closing shall be made with fittings which cannot be easily removed. Caps or plugs shall be required at all times during construction so that no pipes are left open at the end of any day's work, even though continuation is expected the next day.
I Copper pipe ends shall be reamed, sanded and deburred before soldering. Non-corrosive flux shall be used.
J Any leaky joints shall be remade with new materials. Caulking to make joints tight is absolutely prohibited.
K Sleeves shall be provided wherever pipes pass through walls, floors and ceilings. Sleeves shall be Schedule 40, Black Steel, ½ inch in diameter larger than the pipe or insulation on the pipe. Sleeves through walls and ceiling shall be flush. Sleeves through floors shall extend 1 inch above finished floor. Sleeves installed in

exterior walls shall be caulked and made water-tight.

L Pipe joint compound shall be LACO, Hercules, Oatey, or Rector Seal.

M All water piping shall be hydrostatically tested at 150 psig for a period of four (4) hours.

N All piping and equipment installed under this Contract shall be tested in the presence of the Engineer and the proper Plumbing Inspector, and provided tight for the periods stated above, or longer if required by the Inspector. The test shall be administered in sections if deemed advisable.

O No plumbing system or part thereof shall be covered or concealed until after it has been tested and approved. If such work has been covered or concealed before testing, it shall be exposed for testing.

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

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

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

S Group piping whenever practical at common elevations.

T Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 05 16.

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

1. Refer to Section 22 07 19.

V Provide access where valves and fittings are not exposed.

1. Coordinate types, sizes, finish, and locations of Access doors with General Contractor, Other Trades, Owner, and Architect prior to completion of wall and/or ceiling framing in all cases.

W Establish elevations of buried piping outside the building to ensure not less than 2 ft of cover. Provide Additional cover where required by code.

X PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

Y Manufactured Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a watertight seal.
6. Install in accordance with manufacturer's recommendations.

3.04 APPLICATION

A Where allowed by Piping Material and Type specified, use grooved mechanical couplings and fasteners only in accessible locations.

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

C Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D Install ball or butterfly valves for throttling, bypass, or manual flow control services.

E Provide spring-loaded check valves on discharge of water pumps.

F Provide flow controls in water recirculating systems where indicated.

3.05 TOLERANCES

A Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8" per foot or 1/4 inch per foot slope where indicated in plans and required by code.

B Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

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

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

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

D Maintain disinfectant in system for 24 hours, after which the system shall be flushed prior to being put into service.

E During the flushing of the system, all flush valves shall be thoroughly flushed out to insure the removal of sediment, pipe dope, etc., from water lines and flush valves, removing such working parts of the flush valves as may be deemed necessary.

F After flushing of the system has been completed, the Contractor shall have water samples taken and delivered to an independent laboratory for testing to show that the water is suitable for drinking. Copies of the laboratory report shall be provided to the Owner and the Engineer. If the State Construction Office is involved, provide form “Water Test Report for Use."

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

3.07 DWV SMOKE TEST

A The final test of the completed drainage and vent systems shall be visual and in sufficient detail to determine compliance with the provisions of the NC Plumbing Code. Where a smoke test is utilized, it shall be made by filling all traps with water and then introducing into the entire system a pungent, thick smoke produced by one or more smoke machines or devices with the appropriate capacity for a system of this size.

B in sufficient detail to determine compliance with the provisions of the NC Plumbing Code. Where a smoke test is utilized, it shall be made by filling all traps with water and then introducing into the entire system a pungent, thick smoke produced by one or more smoke machines or devices with the appropriate capacity for a system of this size. When the

C smoke appears at stack openings on the roof (VTRs), the stack openings shall be closed and a pressure equivalent to a 1-inch water column (248.8 Pa) shall be held on the entire system for a test period of not less than 15 minutes while personnel spread throughout the area of the test observe for visual or olfactory detection of smoke. Where leaks or deficiencies are detected they shall be repaired and the test repeated until owner's and engineer of record's representatives are satisfied that the test has been "passed". Written observations (minutes) of the test shall be documented by the Plumbing Contractor and provided for record with O&M Materials.

D When the smoke appears at stack openings on the roof (VTRs), the stack openings shall be closed and a pressure equivalent to a 1-inch water column (248.8 Pa) shall be held on the entire system for a test period of not less than 15 minutes while personnel spread throughout the area of the test observe for visual or olfactory detection of smoke. Where leaks or deficiencies are detected they shall be repaired and the test repeated until owner's and engineer of record's representatives are satisfied that the test has been "passed".

E Written observations (minutes) of the test shall be documented by the Plumbing Contractor and provided for record with O&M Materials.

3.08 DWV HYDROSTATIC TESTING

A Waste and vent piping shall be hydrostatically tested at each floor. A test tee will be installed below each floor and pipe will be filled with water for a height of 10' above finished floor. The pipe shall be gas and watertight. Water shall stand in the system for a period of 30 minutes without evidence of leakage. After the waste and vent piping has been hydrostatically tested for the entire system the piping shall be smoke tested using smoke bombs. The contractor shall plug waste line where it exits building, fill all of the traps with water and test the waste and vent piping by using a smoke bomb in a wall or floor cleanout. He shall install a plug on the cleanout once the smoke bomb has been dropped into the cleanout. The smoke bomb test shall be held for thirty minutes without evidence of leakage in the piping. The smoke bombs for this testing shall be furnished by the contractor. Once the testing of the piping has been completed, the contractor shall flush all of the smoke bombs from the waste piping system

B All piping and equipment installed under this Contract shall be tested in the presence of the Engineer and the proper Plumbing Inspector, and proved tight for the periods stated above, or longer if required by the Inspector

C The final test of the completed drainage and vent systems shall be visual and

D No plumbing system or part thereof shall be covered or concealed until after it has been tested and approved.

E If such work has been covered or concealed before testing, it shall be exposed for testing

F After the pipe is installed, tested and inspected, backfill shall be installed and compacted. Backfill material shall conform to ASTM D-2371 Soil Class III. Backfill shall be installed, compacted and tested in 6" layers up to 12" above top of pipe. Backfill shall continue in 12" layers to finished grade

3.09 DWV UNDERGROUND CAMERA INVESTIGATION

A The entire underground waste piping system shall be videoed and recorded by the Contractor on an audible CD/DVD to ensure that the Owner knows the location of the piping being viewed. The recorded CD/DVD shall be provided to the Engineer of Record and the Owner's Project Manager three (3) weeks prior to Substantial Completion inspection. The Substantial Completion inspection cannot occur until the video has been reviewed and all the underground waste piping system has been approved by the Engineer in Record.

3.10 SCHEDULES

A Pipe Hanger Spacing:

1. Metal Piping:
   a. Pipe Size: 1/2 inches to 1-1/4 inches:
      1) Maximum Hanger Spacing: 6.5 ft.
      2) Hanger Rod Diameter: 3/8 inches.
   b. Pipe Size: 1-1/2 inches to 2 inches:
      1) Maximum Hanger Spacing: 10 ft.
      2) Hanger Rod Diameter: 3/8 inch.
   c. Pipe Size: 2-1/2 inches to 3 inches:
      1) Maximum Hanger Spacing: 10 ft.
      2) Hanger Rod Diameter: 1/2 inch.
   d. Pipe Size: 4 inches to 6 inches:
      1) Maximum Hanger Spacing: 10 ft.
      2) Hanger Rod Diameter: 5/8 inch.
2. Plastic Piping:
   a. All Sizes:
      1) Maximum Hanger Spacing: 6 ft.
      2) Hanger Rod Diameter: 3/8 inch.

END OF SECTION 22 10 05

SECTION 22 10 06
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A Drains
B Cleanouts
C Hose bibbs
D Hydrants
E Washing machine boxes and valves
F Refrigerator valve and recessed box
G Back water valves
H Backflow preventers
I Double check valve assemblies
J Water hammer arrestors
K Sumps
L Sanitary waste interceptors
M Mixing valves

1.02 REFERENCE STANDARDS

A ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
B NSF 61 - Drinking Water System Components - Health Effects; 2022, with Errata.
C NSF 372 - Drinking Water System Components - Lead Content; 2022.
D PDI-WH 201 - Water Hammer Arresters; 2017.

1.03 SUBMITTALS

A Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
B Certificates: Certify that grease interceptors meet or exceed specified requirements.
C Operation Data: Indicate frequency of treatment required for interceptors.
D Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors, access panels.
E Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Loose Keys for Outside Hose Bibbs: One.
2. Extra Hose End Vacuum Breakers for Hose Bibbs: One.

1.04 QUALITY ASSURANCE

A Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than five years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 WATER HAMMER ARRESTORS

A Manufacturers:
1. Cash Acme, a brand of Reliance Worldwide Corporation
2. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
3. Watts Regulator Company, a part of Watts Water Technologies
4. Zurn Industries, LLC

B Water Hammer Arrestors:
1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

2.03 SANITARY WASTE INTERCEPTORS

A Manufacturers:
1. Jay R. Smith Manufacturing Company; _____: www.jrsmith.com/#sle.
2. Zurn Industries, LLC; _____: www.zurn.com/#sle.
3. Mifab.

PART 3 EXECUTION

3.01 INSTALLATION

A Install in accordance with manufacturer's instructions.

B Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C Encase exterior cleanouts in concrete flush with grade.

D Install floor cleanouts at elevation to accommodate finished floor.

E Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

F Pipe relief from backflow preventer to nearest drain.

G Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks, washing machine outlets, or _____.

H Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.

END OF SECTION 22 10 06

SECTION 22 30 00
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A Commercial gas-fired water heaters.
B Commercial electric water heaters.
C Diaphragm-type compression tanks.
D In-line circulator pumps.

1.02 REFERENCE STANDARDS

A ANSI Z21.10.1 - Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less; 2019, with Errata (2020).
B ANSI Z21.10.3 - Gas-Fired Water Heaters, Volume III, Storage Water Heaters with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous; 2019.
C ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.
E UL 174 - Standard for Household Electric Storage Tank Water Heaters; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A Product Data:
1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
2. Provide electrical characteristics and connection requirements.

B Shop Drawings:
1. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

C Project Record Documents: Record actual locations of components.
D Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
E Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
F Project Record Documents: Record actual locations of components.
G Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements for additional provisions.

1.04 QUALITY ASSURANCE

A Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
B Certifications:
1. Water Heaters: NSF approved.
2. Gas Water Heaters: ANSI Z21.10.1 and ANSI Z21.10.3.
3. Electric Water Heaters: UL listed and labeled to UL 174.
4. Water Tanks: ASME labeled to ASME BPVC-VIII-1.
5. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

A Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.06 WARRANTY

A See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B Manufacturer Warranty: Provide 5-year manufacturer warranty for domestic water heaters and water storage tanks. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 WATER HEATERS

A Manufacturers:
1. A.O. Smith Water Products Co
2. Rheem Manufacturing Company
3. Bradford White.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B Commercial Gas-Fired Water Heaters:
1. Manufacturers:
   a. Bradford White Corporation; eF Series, Ultra High Efficiency Model:
   b. A.O. Smith.
   c. Locinvar.
   d. Substitutions: See Section 01 60 00 - Product Requirements.
2. Type: Automatic, natural gas-fired, vertical storage.
3. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
4. Performance:
5. Tank: Antimicrobial-infused, enamel-lined, welded steel, ASME labeled; multiple flue passages, 4-inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
6. Accessories:
   a. Water Connections: Brass.
   b. Dip Tube: Brass.
   c. Drain valve.
   d. Anode: Magnesium.
7. Applications:
8. Controls: Automatic water thermostat with temperature range adjustable from 120 to 180 degrees F, automatic reset high temperature limiting thermostat factory set at 195 degrees F, gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, flue baffle and draft hood.

C Commercial Electric Water Heaters:
1. Manufacturers:
   a. Bradford White Corporation; ElectriFLEX Series: www.bradfordwhite.com/#sle.
   b. A. O. Smith.
   c. Rheem.
   d. Substitutions: See Section 01 60 00 - Product Requirements.
2. Type: Factory-assembled and wired, electric, vertical storage.
3. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
4. Performance:
5. Electrical Characteristics:
6. Tank: Glass lined welded steel; 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.
7. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F, flanged or screw-in nichrome elements, high temperature limit thermostat.
8. Accessories:
   a. Water Connections: Brass.
   b. Dip Tube: Brass.
   c. Drain valve.
   d. Anode: Magnesium.
   e. Temperature and Pressure Relief Valve: ASME labeled.

9. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 W/sq in.

2.02 DIAPHRAGM-TYPE COMPRESSION TANKS

A Manufacturers:
1. Amtrol Inc; _____: www.amtrol.com/#sle.
2. Bell & Gossett, a brand of Xylem, Inc; _____: www.bellgossett.com/#sle.
3. Taco, Inc; _____: www.taco-hvac.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

C Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psig.

2.03 IN-LINE CIRCULATOR PUMPS

A Manufacturers:
1. Armstrong Fluid Technology; _____: www.armstrongfluidtechnology.com/#sle.
2. Bell & Gossett, a brand of Xylem, Inc; _____: www.bellgossett.com/#sle.

B Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.

C Impeller: Bronze.

D Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

E Seal: Carbon rotating against a stationary ceramic seat.

F Drive: Flexible coupling.

PART 3 EXECUTION

3.01 INSTALLATION

A Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions required for applicable certifications.

B Coordinate system, equipment, and piping work with applicable electrical, fuel, gas, vent, drain, and waste support interconnections as included or provided by other trades.

C Domestic Water Storage Tanks:
1. Provide steel pipe support, independent of building structural framing members.
2. Clean and flush prior to delivery to site. Seal until pipe connections are made.

D 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 22 30 00

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A Flush valve water closets.
B Wall hung urinals.
C Lavatories.
D Wall-hung, solid surface, multistation lavatory units.
E All-in-one lavatory system.
F Sinks.
G Under-lavatory pipe supply covers.
H Showers.
I Bi-level, electric water coolers.
J Mop sinks.

1.02 REFERENCE STANDARDS

A ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
B ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008 (Reaffirmed 2013).
C ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).
D ASME A112.18.1 - Plumbing Supply Fittings; 2018, with Errata.
E ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2022).
F ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures; 2018.
G ASME A112.19.2 - Ceramic Plumbing Fixtures; 2018, with Errata.
H ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2022.
I ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2022.
J ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2020.
K ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
L ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
M NSF 61 - Drinking Water System Components - Health Effects; 2022, with Errata.
N NSF 372 - Drinking Water System Components - Lead Content; 2022.
O UL (DIR) - Online Certifications Directory; Current Edition.

1.03 SUBMITTALS

A Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
B Manufacturer's Instructions: Indicate installation methods and procedures.
C Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
D Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. Extra Faucet Washers: One set of each type and size.
    2. Extra Lavatory Supply Fittings: One set of each type and size.
    3. Extra Shower Heads: One of each type and size.
    4. Extra Toilet Seats: One of each type and size.

1.04 QUALITY ASSURANCE

A Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A Accept fixtures on-site in factory packaging. Inspect for damage.
B Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.06 WARRANTY

A Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B Water Efficiency: EPA WaterSense label is required for all water closets, urinals, lavatory faucets, and showerheads.

C Maximum Fixture or Faucet Supply Pressure: 60 psi unless stated otherwise.

2.02 REGULATORY REQUIREMENTS

A Comply with applicable codes for installation of plumbing systems.

B Comply with UL (DIR) requirements.

C Perform work in accordance with local health department regulations.

2.03 FLUSH VALVE WATER CLOSETS

A Water Closets:

1. Vitreous china, ASME A112.19.2, floor mounted, siphon jet flush action, china bolt caps.
2. Flush Valve: Exposed (top spud).
3. Flush Operation: Sensor operated.
4. Handle Height: 44 inches or less.
5. Inlet Size: 1-1/2 inches.
6. Trapway Outlet: 4 inch.
7. Color: White.
8. Manufacturers:
   a. American Standard, Inc
   b. Kohler Company
   c. Zurn Industries, LLC
   d. Sloan.
   e. Substitutions: See Section 01 60 00 - Product Requirements.

B Flush Valves:

1. Valve Supply Size: 1 inch.
2. Valve Outlet Size: 1-1/2 inches.
3. Manufacturers:
   a. American Standard, Inc
   b. Sloan Valve Company:
   c. Toto
   d. Zurn Industries, LLC:
   e. Substitutions: See Section 01 60 00 - Product Requirements.
4. Manual Operated:
   a. Type: ASME A112.18.1 or ASME A112.19.5; diaphragm type complete with vacuum breaker stops, and accessories.
   b. Supplied Volume Capacity: 1.5 gal per flush.

C Toilet Seats:

1. Manufacturers:
   a. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
   b. Bemis Manufacturing Company; _____: www.bemismfg.com/#sle.
   c. Church Seat Company; _____: www.churchseats.com/#sle.
   d. Zurn Industries, LLC; _____: www.zurn.com/#sle.
2. Plastic: Solid, white finish, enlongated shape, open front, slow-closing hinged seat cover, extended back complete with self-sustaining hinges, and brass bolts with covers.
3. Plastic: Black finish, open front, extended back, self-sustaining hinge, brass bolts, with cover.

2.04 WALL HUNG URINALS

A Manufacturers:
1. American Standard, Inc
2. Kohler Company
3. Zurn Industries, LLC
4. Sloan.

B Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
1. Consumption Volume: 1.0 gal per flush, maximum.
2. Flush Valve: Exposed (top spud).
3. Flush Operation: Sensor operated.
4. Trapway Outlet: Integral.
5. Supply Size: 3/4 inch.
6. Outlet Size and Location: 2 inches, bottom side.

C Flush Valves:
1. Manufacturers:
   a. American Standard, Inc
   b. Sloan Valve Company
   c. Zurn Industries, LLC
2. Manual Operated:
   a. Type: ASME A112.18.1 or ASME A112.19.5; diaphragm type, complete with vacuum breaker stops, and accessories.
   b. Supplied Volume Capacity: 0.125 gal per flush.

D Urinal Carriers:
1. Manufacturers:
   a. Jay R. Smith Manufacturing Company
   b. JOSAM Company
   c. Zurn Industries, LLC: ww
2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.05 LAVATORIES

A Manufacturers:
1. American Standard, Inc
2. Kohler Company
3. Zurn Industries, LLC

B Wall-Hung Basin:
1. Porcelain-Enamelled Cast Iron: ASME A112.19.1; white, rectangular basin with splash lip, front overflow, soap depression, and hanger. Size as indicated on drawings with 4-inch centerset spacing.
2. Carrier:
   a. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.
   b. Manufacturers:
      1) Jay R. Smith MFG. Co: www.jrsmith.com/#sle.
      2) JOSAM Company: www.josam.com/#sle.
      3) Zurn Industries, LLC; Z1231: www.zurn.com/#sle.

C Sensor Operated Faucet:
1. Spout Style: Standard.
2. Power Supply:
   a. Wired: 6 VDC, field-wired into dedicated or common power supply.
   b. Wireless:
      1) Battery: Replaceable alkaline or lithium type with 200,000 cycles, minimum.

2) Light Cell: Photovoltaic or infra-red cell that transforms both sunlight and artificial light into electrical energy for use and battery charging.
3) Low Battery Warning: Provide red or yellow colored indicator to light periodically at 30 days of remaining capacity and continuously 2 weeks prior to get fully discharged.

3. Mixing Valve: None, single line for tempered water.
4. Water Supply: 3/8 inch compression connections.
5. Aerator: Vandal resistant, 0.5 gpm, laminar flow device.
6. Finish: Polished chrome.
7. Manufacturers:
   a. American Standard, Inc: www.americanstandard-us.com/#sle.
   b. Moen Incorporated; _____: www.moen.com/#sle.
   c. Sloan Valve Company: www.sloanvalve.com/#sle.
   d. Watts; _____: www.watts.com/#sle.
   e. Zurn Industries, LLC; _____: www.zurn.com/#sle.

D Thermostatic Mixing Valve:
1. ASSE 1070 listed with combination stop, strainer, and check valves, and flexible stainless steel connectors.
2. Manufacturers:
   a. Acorn Controls; _____: www.acorneng.com/#sle.
   b. Cash Acme, a brand of Reliance Worldwide Corporation; _____: www.cashacme.com/#sle.
3. Braided hot and cold water supply lines.
4. Chrome plated 17 gauge, 0.0538 inch brass P-trap with clean-out plug and arm with escutcheon.

E Lavatory Carrier:
1. Manufacturers:
   a. Jay R. Smith Manufacturing Company; _____: www.jrsmith.com/#sle.
   b. JOSAM Company; _____: www.josam.com/#sle.
   c. Zurn Industries, LLC; Z1231EZ: www.zurn.com/#sle.
2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

2.06 WALL-HUNG, SOLID SURFACE, MULTISTATION LAVATORY UNITS

A Manufacturers:
1. Zurn Industries, LLC; Sundara Drift Handwashing System: www.zurn.com/#sle.
2. Bradley.
3. Sloan.

B Description: Rectilinear, level-surface deck, seamless and integral elongated basin, with stainless steel enclosed pedestal cabinet.

C Deck and Bowl Material: Fabricate from molded engineered stone material consisting of natural quartz, granite, and other minerals in a matrix of thermoset acrylic modified bio-based polyester resin and meeting requirements of IAPMO Z124.

D Surface Burning Characteristics: Smoke developed index less than 450, and flame spread index less than 25, Class A, when tested in accordance with ASTM E84.

E Number of Wash Stations: Three.

F Unit Length: _____ inches.

G Soap Dispenser:

H Color: As selected by Architect from manufacturer's full line.

I Faucet Drilling: 4 inch (100 mm) centerset drilling.

J Access Panel: Stainless steel.

K Support Frame: Wall-mounted, heavy gauge, stainless steel.

L Manufacturers:
1. Acorn Engineering Company; Corterra Solid Surface: www.acorneng.com/#sle.
2. Bradley Corporation; VergeLVLD1: www.bradleycrp.com/#sle.

3. Sloan.
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.07 SINKS

A Manufacturers:
1. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
2. Kohler Company; _____: www.kohler.com/#sle.

B Single Compartment Bowl
1. ASME A112.19.3; _____ by _____ by _____ inch outside dimensions 20 gauge, 0.0359 inch thick, Type 302 stainless steel, self rimming and undercoated, with ledge back drilled for trim.
2. Drain: 3-1/2 inch crumb cup and tailpiece.

C Kitchen Faucets:
1. Manufacturers:
   a. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
2. Single Handle Faucet with Three-Function Pulldown Spray Head:
   a. Minimum Spout Height: 8 inch.
   b. Type: Deck-mount, swivel faucet with mounting plate.
   c. Spray Functions: Stream, full spray and pause at 1.8 gpm, maximum.
   d. ASME A112.18.1, ADA Standards, and NSF 61 compliant assembly.
   e. Materials: Ceramic disc-cartridge valve on brass body with polished chrome finish.

2.08 UNDER-LAVATORY PIPE SUPPLY COVERS

A Manufacturers:
1. Plumberex Specialty Products, Inc; _____: www.plumberex.com/#sle.

B General:
1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
2. Construction: 1/8 inch PVC with antimicrobial, antifungal and UV resistant properties.
   a. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
   b. Comply with ICC A117.1.

2.09 SHOWERS

A Manufacturers:
1. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
2. Aqua Glass Corporation; _____: www.aquaglass.com/#sle.
3. Kohler Company; _____: www.kohler.com/#sle.

B Shower Trim:
1. Single Handle: ASME A112.18.1; lever-handle operated, pressure balanced mixing valve with integral service stops, bent shower arm with adjustable spray ball joint shower head with maximum flow, and escutcheon.

2.10 BI-LEVEL, ELECTRIC WATER COOLERS

A Manufacturers:
1. Elkay Manufacturing Company; _____: www.elkay.com/#sle.
2. Haws Corporation; _____: www.hawsco.com/#sle.
3. Oasis International; _____: www.oasiscoolers.com/#sle.

B Water Cooler: Bi-level, electric, mechanically refrigerated; surface mounted, ADA compliant; stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser and stainless steel grille.
1. Capacity: 8 gph of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.
2. Electrical: 115 VAC, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.

C Bottle Filler: Materials to match fountain.

2.11 MOP SINKS

A Manufacturers:
1. Acorn Engineering Company; _____: www.acorneng.com/#sle.
2. Just Manufacturing Company; _____: www.justmfg.com/#sle.
3. Zurn Industries, LLC; _____: www.zurn.com/#sle.

B Accessories:
1. 5 feet of 1/2 inch diameter plain end reinforced plastic hose.
2. Hose clamp hanger.
3. Mop hanger.

2.12 HOSE BIB BOXES

A Manufacturers:
1. Metcraft Industries, Inc; _____: metcraftindustries.com/#sle.

B Material: 316 stainless steel.

C Finish: Satin.

D Mount in wall fully recessed.

E Provide with NPT PVC ball valves and fittings.

F Provide with internal hose drain bracket and waste outlet.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B Verify that electric power is available and of the correct characteristics.

C Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

A Install each fixture with trap, easily removable for servicing and cleaning.

B Provide chrome-plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C Install components level and plumb.

D Install and secure fixtures in place with wall supports and bolts.

E Solidly attach water closets to floor with lag screws. Lead flashing is not intended to hold fixture in place.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A Clean plumbing fixtures and equipment.

3.07 PROTECTION

A Protect installed products from damage due to subsequent construction operations.

B Do not permit use of fixtures by construction personnel.

C Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 22 40 00