SECTION 22 0513
COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General construction and requirements.

B. Applications.

C. Single phase electric motors.

D. Three phase electric motors.

E. Electronically Commutated Motors (ECM).

1.02 RELATED REQUIREMENTS

A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

B. Section 26 2913 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2004.

C. NEMA MG 00001 - Motors and Generators; 2024.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 1/2 horsepower.

D. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

E. Operation Data: Include instructions for safe operating procedures.

F. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of electric motors for domestic water use, and their accessories, with minimum three years documented product development, testing, and manufacturing experience.

B. Comply with NFPA 70.

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

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Baldor Electric Company/ABB Group; _____: www.baldor.com/#sle.

B. Leeson Electric Corporation; _____: www.leeson.com/#sle.

C. Regal-Beloit Corporation (Century); _____: www.centuryelectricmotor.com/#sle.

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:
   1. Motors 1/2 HP and Smaller: 115 volts, single phase, 60 Hz.
   2. Motors Larger than 1/2 Horsepower: 208 or 480 volts, three phase, 60 Hz.

B. Nominal Efficiency:
   1. Open Motor with Two Poles: 82.5.
   2. Open Motor with Four Poles: 82.5.
   3. Open Motor with Six poles: 50.0.
   4. Enclosed Motor with Two Poles: 75.5.
   5. Enclosed Motor with Four Poles: 82.5.
   6. Enclosed Motor with Six Poles: 50.0.

C. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 104 degrees F environment.
   3. Design for temperature rise in accordance with NEMA MG 00001 limits for insulation class, service factor, and motor enclosure type.

D. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

E. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 APPLICATIONS

A. Single phase motors for shaft mounted fans and centrifugal pumps: Split phase type or ECM.

B. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type or ECM.

C. Single phase motors for fans, pumps, blowers, and air compressors: Capacitor start type or ECM.

D. Single phase motors for fans, blowers, and pumps: Capacitor start, capacitor run type or ECM.

E. Motors located in exterior locations, wet air streams downstream of sprayed coil dehumidifiers, draw through cooling towers, air cooled condensers, humidifiers, direct drive axial fans, roll filters, explosion proof environments, and dust collection systems: Totally enclosed type.

F. Motors located in outdoors, in wet air streams downstream of sprayed coil dehumidifiers, in draw through cooling towers, and in humidifiers: Totally enclosed weatherproof epoxy-treated type.

G. Motors located outdoors and in draw through cooling towers: Totally enclosed weatherproof epoxy-sealed type.

2.04 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.05 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.06 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.07 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Comply with NEMA MG 00001 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 26 2913.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: To NEMA MG 00001.

K. Part Winding Start Where Indicated: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

L. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

M. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

N. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

2.08 ELECTRONICALLY COMMUTATED MOTORS (ECM)

A. Manufacturers:
   1. US Motors, a brand of NIDEC Motor Corporation; _____: www.usmotors.com/#sle.
   2. Wilo USA_____; www.wilo-usa.com

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION 22 0513

SECTION 22 0516
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 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

B. Section 23 2113 - Hydronic Piping.

C. Section 23 2213 - Steam and Condensate Heating Piping.

D. Section 23 2300 - Refrigerant Piping.

1.03 REFERENCE STANDARDS

A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.

B. EJMA (STDS) - EJMA Standards; Tenth Edition.

C. FM (AG) - FM Approval Guide; current edition.

D. ITS (DIR) - Directory of Listed Products; current edition.

E. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. 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.

C. Design Data: Indicate selection calculations.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

E. Maintenance Data: Include adjustment instructions.

F. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Manufacturers:
   1. Mercer Rubber Company; _____: www.mercer-rubber.com/#sle.
   2. The Metraflex Company; _____: www.metraflex.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Inner Hose: Carbon steel.

C. Exterior Sleeve: Single braided, stainless steel.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: As specified for pipe joints.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

2.02 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Manufacturers:
   1. Mercer Rubber Company; _____: www.mercer-rubber.com/#sle.
   2. The Metraflex Company; _____: www.metraflex.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: As specified for pipe joints.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

H. Application: Copper piping.

2.03 EXPANSION JOINTS - STAINLESS STEEL BELLOWS TYPE

A. Manufacturers:
   1. Mercer Rubber Company; _____: www.mercer-rubber.com/#sle.
   2. The Metraflex Company; _____: www.metraflex.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

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 3 inches and under.

2.04 EXPANSION JOINTS - EXTERNAL RING CONTROLLED STAINLESS STEEL BELLOWS TYPE

A. Manufacturers:
   1. Mercer Rubber Company; _____: www.mercer-rubber.com/#sle.
   2. The Metraflex Company; _____: www.metraflex.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Pressure Rating: 125 psi and 400 degrees F.

C. Maximum Compression: 15/16 inch.

D. Maximum Extension: 5/16 inch.

E. Maximum Offset: 1/8 inch.

F. Joint: Flanged.

G. Size: Use pipe sized units.

H. Accessories: Internal flow liner.

I. Application: Steel piping over 2 inches.

2.05 EXPANSION JOINTS - TWO-PLY BRONZE BELLOWS TYPE

A. Manufacturers:
   1. Mercer Rubber Company; _____: www.mercer-rubber.com/#sle.
   2. The Metraflex Company; _____: www.metraflex.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Construction: Bronze with anti-torque device, limit stops, internal guides.

C. Pressure Rating: 125 psi and 400 degrees F.

D. Maximum Compression: 1-3/4 inches.

E. Maximum Extension: 1/4 inch.

F. Joint: Soldered.

G. Size: Use pipe sized units.

H. Application: Copper piping.

2.06 EXPANSION JOINTS - LOW PRESSURE COMPENSATOR WITH TWO-PLY BRONZE BELLOWS

A. Manufacturers:
   1. Mercer Rubber Company; _____: www.mercer-rubber.com/#sle.
   2. The Metraflex Company; _____: www.metraflex.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Working Pressure: 75 psi.

C. Maximum Temperatures: 250 degrees F.

D. Maximum Compression: 1/2 inch.

E. Maximum Extension: 5/32 inch.

F. Joint: Soldered.

G. Size: Use pipe sized units.

H. Application: Copper or steel piping 3 inches and under.

2.07 ACCESSORIES

A. Stainless Steel Pipe: ASTM A269/A269M, seamless type, Grade TP304.

B. Pipe Alignment Guides:
   1. Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inches travel.

C. Swivel Joints:
   1. Fabricated steel body, double ball bearing race, field lubricated, with rubber (Buna-N) o-ring seals.

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.

G. Substitute grooved piping for vibration isolated equipment instead of flexible connectors. Grooved piping need not be anchored. Where grooved piping is used and altrnate desidn is approved by Facilities Engineering. Calculations/Design to be provided by grooved piping manufacturer.

END OF SECTION 22 0516

SECTION 22 0517
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Manufactured sleeve-seal systems.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 09 9113 - Exterior Painting: Preparation and painting of exterior piping systems.

C. Section 09 9123 - Interior Painting: Preparation and painting of interior piping systems.

D. Section 22 0523 - General-Duty Valves for Plumbing Piping.

E. Section 22 0553 - Identification for Plumbing Piping and Equipment: Piping identification.

F. Section 22 0716 - Plumbing Equipment Insulation.

G. Section 22 0719 - 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); 2013.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

1.04 SUBMITTALS

A. See Section 01 3000 - 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.

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.
   1. Minimum three years experience.
   2. Approved by manufacturer.

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 7800 - 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. Substitutions: See Section 01 6000 - Product Requirements.

B. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.
   3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
   4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

C. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

D. Pipe Passing Through Below Grade Exterior Walls:
   1. Zinc coated or cast iron pipe.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

E. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:
   1. Galvanized steel pipe or black iron pipe with asphalt coating.
   2. Connect sleeve with floor plate except in mechanical rooms.

F. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:
   1. Galvanized steel pipe or black iron pipe with asphalt coating.
   2. Connect sleeve with floor plate except in mechanical rooms.

G. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.

H. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

2.02 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Manufacturers:
   1. Substitutions: See Section 01 6000 - Product Requirements.

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.

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. Inserts:

1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

E. Structural Considerations:
1. Do not penetrate building structural members unless indicated.

F. Provide sleeves when penetrating footings, floors, walls, partitions, and _____. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
2. Aboveground Piping:
   a. Pack solid using mineral fiber complying with ASTM C592.
   b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
3. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.
4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

G. 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.

H. 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.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

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

C. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

END OF SECTION 22 0517

SECTION 22 0519
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 RELATED REQUIREMENTS

A. Section 23 0923 - Direct-Digital Control System for HVAC.

B. Section 23 0943 - Pneumatic Control System for HVAC.

C. Section 23 0993 - Sequence of Operations for HVAC Controls.

D. Section 23 2113 - Hydronic Piping.

E. Section 23 2213 - Steam and Condensate Heating Piping.

1.03 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.

B. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi; 2004 (Reaffirmed 2017).

C. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.

D. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).

E. AWWA C700 - Cold-Water Meters -- Displacement Type, Metal Alloy Main Case; 2020.

F. AWWA C701 - Cold-Water Meters -- Turbine Type, for Customer Service; 2012.

G. AWWA C702 - Cold-Water Meters -- Compound Type; 2010.

H. AWWA M6 - Water Meters -- Selection, Installation, Testing, and Maintenance; 2012, with Addendum (2018).

I. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

J. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

C. Project Record Documents: Record actual locations of components and instrumentation.

1.05 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)

A. Manufacturers:

1. Dwyer Instruments, Inc; _____: www.dwyer-inst.com/#sle.
2. FMC Technologies; _____: www.fmctechnologies.com/#sle.
3. Venture Measurement, a Danaher Corporation Company; _____: www.venturemeasurement.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. AWWA C700, positive displacement disc type suitable for fluid with bronze case and cast iron frost-proof, breakaway bottom cap, hermetically sealed register, remote reading.

C. Meter: Brass body turbine meter with magnetic drive register.
1. Service: Cold water, 122 degrees F.
2. Nominal Flow: _____ gpm.
3. Pressure Drop at Nominal Flow: _____ psi.
4. Maximum Flow: _____ gpm.
5. Maximum Operating Pressure: _____ psi.
6. Accuracy: 1-1/2 percent.
7. Maximum Counter Reading: 10 million gallons.
8. Size: 3/4 inch.

2.02 HEAT CONSUMPTION METERS

A. Manufacturers:
1. Dwyer Instruments, Inc; _____: www.dwyer-inst.com/#sle.
2. FMC Technologies; _____: www.fmctechnologies.com/#sle.
3. Venture Measurement, a Danaher Corporation Company; _____: www.venturemeasurement.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Meter: Brass body turbine meter with magnetic drive register, platinum temperature sensors.
1. Maximum Service Temperature: 200 degrees F.
2. Nominal Flow: _____ gpm.
3. Pressure Drop at Nominal Flow: _____ psi.
4. Maximum Flow: _____ gpm.
5. Maximum Operating Pressure: _____ psi.
6. Accuracy: 1-1/2 percent.
7. Maximum Counter Reading: 1 million btuh.
8. Size: 1/2 inch.
9. Power: Lithium battery.

2.03 LIQUID FLOW METERS

A. Manufacturers:
1. Dwyer Instruments, Inc; _____: www.dwyer-inst.com/#sle.
2. Venture Measurement, a Danaher Corporation Company; _____: www.venturemeasurement.com/#sle.
3. McCrometer, Inc; _____: www.mccrometer.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Calibrated ASME MFC-3M venturi orifice plate and flanges with valved taps, chart for conversion of differential pressure readings to flow rate, with pressure gauge in case.

C. Annular element flow stations with meter set.
1. Measuring Station: Type 316 stainless steel pitot type flow element inserted through welded threaded couplet, with safety shut-off valves and quick coupling connections, and permanent metal tag indicating design flow rate, reading for design flow rate, metered fluid, line size, station or location number.
   a. Pressure rating: 275 psi.
   b. Maximum temperature: 400 degrees F.
   c. Accuracy: Plus 0.55 percent to minus 2.30 percent.

2. Portable Meter Set: Dry single diaphragm type pressure gauge with 6 inch dial pointer, stainless steel wetted metal parts, variable pulsation damper, equalizing valve, two bleed valves, and master chart for direct conversion of meter readings to flow rate, mounted in rust-proof carrying case with two ten foot long rubber test hoses with brass valves or quick connections for measuring stations.

2.04 PRESSURE GAUGES

A. Manufacturers:
   1. Dwyer Instruments, Inc; _____: www.dwyer-inst.com/#sle.
   2. Moeller Instrument Company, Inc; _____: www.moellerinstrument.com/#sle.
   3. Omega Engineering, Inc; _____: www.omega.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

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 and kPa.

2.05 PRESSURE GAUGE TAPPINGS

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

B. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

D. Syphon: Steel, Schedule 40, 1/4 inch angle or straight pattern.

2.06 STEM TYPE THERMOMETERS

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.
   4. Substitutions: See Section 01 6000 - Product Requirements.

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. Stem: ____ inch brass.
   4. Accuracy: 2 percentper ASTM E77.
   5. 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. Stem: 3/4 inch NPT brass.
   4. Accuracy: 2 percentper ASTM E77.
   5. Calibration: Degrees F.

2.07 DIAL THERMOMETERS

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.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Thermometers - Fixed Mounting: Dial type bimetallic actuated; ASTM E1; stainless steel case, silicone fluid damping, white with black markings and black pointer, hermetically sealed lens, stainless steel stem.
1. Size: 5 inch diameter dial.
2. Lens: Clear glass.
3. Accuracy: 1 percent.
4. Calibration: Degrees F.

C. Thermometers - Adjustable Angle: Dial type bimetallic actuated; ASTM E1; stainless steel case, adjustable angle with front recalibration, silicone fluid damping, white with black markings and black pointer, hermetically sealed lens, stainless steel stem.
1. Size: 5 inch diameter dial.
2. Lens: Clear glass.
3. Accuracy: 1 percent.
4. Calibration: Degrees F.

D. Thermometers: Dial type vapor or liquid actuated; ASTM E1; stainless steel case, with brass or copper bulb, copper or bronze braided capillary, white with black markings and black pointer, glass lens.
1. Size: 4-1/2 inch diameter dial.
2. Lens: Clear glass.
3. Length of Capillary: Minimum 5 feet.
4. Accuracy: 2 percent.
5. Calibration: Degrees F.

2.08 THERMOMETER SUPPORTS

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

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.09 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass 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.

2.10 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.

B. 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

C. Inclined manometer, red liquid on white background with black figures, front recalibration adjustment, 3 percent of full scale accuracy.

D. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install positive displacement meters with isolating valves on inlet and outletto AWWA M6. Provide full line size valved bypass with globe valve for liquid service meters.

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

D. Install pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Extend nipples and siphons to allow clearance from insulation. Provide siphon on gauges in steam systems.

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. Install thermometers in air duct systems on flanges.

G. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets. Refer to Section 23 0943. Where thermometers are provided on local panels, duct or pipe mounted thermometers are provided on local panels, duct or pipe mounted thermometers are not required.

H. Locate duct mounted thermometers minimum 10 feet downstream of mixing dampers, coils, or other devices causing air turbulence.

I. Coil and conceal excess capillary on remote element instruments.

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

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

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

M. Locate test plugs adjacent thermometers and thermometer sockets.

3.02 SCHEDULES

A. Pressure Gauges, Location and Scale Range:
   1. Pumps, 0 to ____ psi.
   2. Expansion tanks, 0 to ____ psi.
   3. Pressure tanks, 0 to ____ psi.
   4. Standpipe, highest points, 0 to ____ psi.
   5. Standpipe and sprinkler water supply connection, 0 to ____ psi.
   6. Sprinkler system, 0 to ____ psi.
   7. Pressure reducing valves, 0 to ____ psi.
   8. Backflow preventers, 0 to ____ psi.

B. Pressure Gauge Tappings, Location:
   1. Control valves 3/4 inch & larger - inlets and outlets.
   2. Major coils - inlets and outlets.
   3. Heat exchangers - inlets and outlets.
   4. Chiller - inlets and outlets.
   5. Boiler - inlets and outlets.

C. Stem Type Thermometers, Location and Scale Range:
   1. Headers to central equipment, 0 to ____ degrees F.
   2. Coil banks - inlets and outlets, 0 to ____ degrees F.
   3. Heat exchangers - inlets and outlets, 0 to ____ degrees F.
   4. Boilers - inlets and outlets, 0 to ____ degrees F.
   5. Chiller - inlets and outlets, 0 to ____ degrees F.
   6. Water zone supply and return, 0 to ____ degrees F.
   7. After major coils, 0 to ____ degrees F.

8. Domestic hot water supply and recirculation, 0 to ____ degrees F.

D. Thermometer Sockets, Location:
   1. Control valves 1 inch & larger - inlets and outlets.
   2. Reheat coils - inlets and outlets.
   3. Cabinet heaters - inlets and outlets.
   4. Unit heaters - inlets and outlets.

E. Dial Thermometers, Location and Scale Range:
   1. Each supply air zone, 0 to ____ degrees F.
   2. Outside air, 0 to ____ degrees F.
   3. Return air, 0 to ____ degrees F.
   4. Mixed air, 0 to ____ degrees F.

F. Static Pressure and Filter Gauges, Location and Scale Range:
   1. Built up filter banks, 0 to ____ inches W.C..
   2. Unitary filter sections, 0 to ____ inches W.C..
   3. Supply fan discharge, 0 to ____ inches W.C..
   4. Building static, 0 to ____ inches W.C..

END OF SECTION 22 0519

SECTION 22 0523
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. Gate valves.
H. Globe valves.
I. Plug valves.
J. Chainwheels.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.
B. Section 08 3100 - Access Doors and Panels.
C. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
D. Section 22 0553 - Identification for Plumbing Piping and Equipment.
E. Section 22 0716 - Plumbing Equipment Insulation.
F. Section 22 0719 - Plumbing Piping Insulation.
G. Section 22 1005 - Plumbing Piping.
H. Section 22 1500 - General-Service Compressed-Air Systems.

1.03 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.

1.04 REFERENCE STANDARDS

A. API STD 594 - Check Valves: Flanged, Lug Wafer, and Butt-Welding; 2007 (Errata 2010).
B. ASME B1.20.1 - Pipe Threads, General Purpose (Inch); 2013.
C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2010.
D. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard; 2013.
E. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2009.
F. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

G. ASME B16.34 - Valves - Flanged, Threaded and Welding End; 2013.

H. ASME B31.9 - Building Services Piping; 2014.

I. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

J. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2003 (Reapproved 2012).

K. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2014).

L. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2014).

M. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).

N. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings; 2015.

O. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.

P. AWWA C606 - Grooved and Shouldered Joints; 2011.

Q. MSS SP-45 - Bypass and Drain Connections; 2003 (Reaffirmed 2008).

R. MSS SP-67 - Butterfly Valves; 2011.

S. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends; 2011.

T. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends; 2011.

U. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010.

V. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; 2011.

W. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.

X. MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends; 2011.

Y. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

Z. MSS SP-125 - Gray Iron and Ductile Iron In-Line, Spring-Loaded, Center-Guided Check Valves; 2010.

AA. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

BB. NSF 372 - Drinking Water System Components - Lead Content; 2011.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

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

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

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

E. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 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 three years of documented experience.

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

1.07 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.

1.08 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. Provide the following valves for the applications if not indicated on drawings:
   1. Shutoff: Ball, butterfly, gate or plug.
   2. Dead-End: Single-flange butterfly (lug) type.
   3. Throttling: Provide globe, angle, ball, or butterfly.
   4. Swing Check (Pump Outlet):
      a. 2 NPS and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
      b. 2-1/2 NPS and Larger for Domestic Water: Iron swing check valves with closure control , 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.

C. 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.

D. 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.

E. Low Pressure, Compressed Air Valves 150 psig or Less:
   1. 2 NPS and Smaller:

a. Bronze ____: Provide with solder-joint ends.
b. Ball: One piece, full port, brass or bronze with brass trim.
c. Bronze Lift Check: Class 125, bronze disc.
d. Bronze Swing Check: Class 125, bronze disc.
e. Bronze Gate: Class 125, NRS.

F. High Pressure, Compressed Air Valves 150 psig to 200 psig:
1. 2 NPS and Smaller:
a. Bronze _____: Provide with solder-joint or _____ ends.
b. Ball: One piece, full port, brass or _____ with brass trim.
c. Bronze Lift Check: Class 125, _____ disc.
d. Bronze Swing Check: Class 125, bronze disc.
e. Bronze Gate: Class 125, NRS.

G. Domestic, Hot and Cold Water Valves:
1. 2 NPS and Smaller:
a. Bronze and Brass: Provide with solder-joint, threaded, or press fit ends.
b. Ball: One piece, full port, brass or _____ with brass trim.
c. Bronze Swing Check: Class 125, bronze disc.
d. Bronze Gate: Class 125, NRS.
e. Bronze Globe: 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 Single-Flange Butterfly: 200 CWP, EPDM seat, aluminum-bronze disc.
d. Iron Grooved-End Butterfly: 175 CWP.
e. Iron Swing Check: Class 125, metal seats.
f. Iron Swing Check with Closure Control: Class 125, lever and spring.
g. Iron Grooved-End Swing Check: 300 CWP.
h. Iron Center-Guided Check: Class 125, compact-wafer, metal seat.
i. Iron Gate: Class 125, NRS.
j. Iron Globe: Class 125.

2.02 GENERAL REQUIREMENTS

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

B. Chemical resistance of Gaskets, Seals and O-rings:
1. All valves and associated components used in Potable water systems shall be resistant to Chlorine and Mono-Chloramine water treatment chemicals.

C. Valve Sizes: Match upstream piping unless otherwise indicated.

D. 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.
5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator, of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2 NPS stem extensions and the following features:
1. Gate Valves: Rising stem.
2. 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.
3. Butterfly Valves: Extended neck.

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

F. 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. Solder Joint Connections: ASME B16.18.
5. Grooved End Connections: AWWA C606.

G. 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.

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

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

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

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

2.03 BRONZE ANGLE VALVES

A. Class 125: CWP Rating: 200 psig: and _____.
1. Ends: Threaded.

2.04 BRASS BALL VALVES

A. Two Piece, Full Port and _____ with Brass Trim:
1. SWP Rating: 150 psig.
2. CWP Rating: 600 psig.
3. Body: Forged brass.
4. Seats: PTFE.
5. Stem: Brass.
6. Ball: Stainless steel, vented.
7. Manufacturers:
a. Apollo Valves; _____: www.apollovalves.com/#sle.
b. Ferguson Enterprises Inc; _____: www.fnw.com/#sle.
c. Jomar.
d. Substitutions: See Section 01 6000 - Product Requirements.

B. Three 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: Forged brass.
5. Ends: Threaded.
6. Seats: PTFE or ____.
7. Stem: Stainless steel.
8. Ball: Stainless steel, vented.
9. Manufacturers:
a. Ferguson Enterprises Inc; _____: www.fnw.com/#sle.
b. Jomar.

2.05 BRONZE BALL VALVES

A. One Piece, Reduced Port with Bronze Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 400 psig.

3. CWP Rating: 600 psig.
4. Body: Bronze.
5. Ends: Threaded.
6. Seats: PTFE or ____.
7. Stem: Bronze.
8. Ball: Chrome plated brass.
9. Manufacturers:
    a. Viega LLC; _____: www.viega.us/#sle.
    b. Jomar

B. Two Piece, Standard Port and _____ with Bronze Trim:
1. SWP Rating: 150 psig.
2. CWP Rating: 600 psig.
3. Body: Bronze.
4. Ends: Threaded.
5. Seats: PTFE or ____.
6. Stem: Bronze.
7. Ball: Chrome plated brass.
8. Manufacturers:
    a. Apollo Valves; _____: www.apollovalves.com/#sle.
    b. Viega LLC; _____: www.viega.us/#sle.
    c. Jomar.
    d. Substitutions: See Section 01 6000 - Product Requirements.

C. Three 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 or ____
7. Stem: Stainless steel.
8. Ball: Stainless steel, vented.
9. Manufacturers:
    a. Apollo Valves; _____: www.apollovalves.com/#sle.
    b. Viega LLC; _____: www.viega.us/#sle.
    c. Jomar.
    d. Substitutions: See Section 01 6000 - Product Requirements.

2.06 STAINLESS STEEL BALL VALVES

A. One-Piece, Standard Port with Stainless-Steel Trim:
1. SWP Rating: 150 psig.
2. CWP Rating: 800 psig.
3. Ends: Threaded.
4. Stem: Stainless steel.
5. Manufacturers:
    a. Ferguson Enterprises Inc; _____: www.fnw.com/#sle.
    b. Viega LLC; _____: www.viega.us/#sle.
    c. Jomar.

B. Two Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 1000 psig.
4. Body: Stainless steel.

5. Seats: PFTE.
6. Stem: Stainless steel.
7. Ball: Stainless steel.
8. Manufacturers:
    a. Apollo Valves; _____: www.apollovalves.com/#sle.
    b. Ferguson Enterprises Inc; _____: www.fnw.com/#sle.
    c. Viega LLC; _____: www.viega.us/#sle.
    d. Jomar.

C. Three Piece, Full Port with Stainless Steel Trim:
1. SWP Rating: 150 psig.
2. CWP Rating: 1000 psig.
3. Stem: Stainless steel.
4. Ball: Stainless steel.
5. Manufacturers:
    a. Apollo Valves; _____: www.apollovalves.com/#sle.
    b. Ferguson Enterprises Inc; _____: www.fnw.com/#sle.
    c. Viega LLC; _____: www.viega.us/#sle.
    d. Jomar.

2.07 IRON BALL VALVES

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 or _____.
6. Stem: Stainless steel.
7. Ball: Stainless steel.
8. Operator: Lever, with locking handle.
9. Manufacturers:
    a. Apollo Valves; _____: www.apollovalves.com/#sle.
    b. Ferguson Enterprises Inc; _____: www.fnw.com/#sle.
    c. Jomar.
    d. Substitutions: See Section 01 6000 - Product Requirements.

2.08 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Lug type: Bi-directional dead-end service without use of downstream flange.
1. Body: ASTM A126, cast iron or ASTM A536, ductile iron.
2. Seat: EPDM.
3. Disc: Stainless steel or bronze.
4. Manufacturers:
    a. Apollo Valves; _____: www.apollovalves.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

2.09 IRON, GROOVED-END BUTTERFLY VALVES

A. CWP Rating: 175 psig (1200 kPa).
1. Disc: Stainless steel or bronze.

2.10 BRONZE LIFT CHECK VALVES

1. Comply with MSS SP-80, Type 1, Metal Disc to Metal Seat, Type 2, Nonmetallic Disc to Metal Seat, and _____.
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.

2.11 BRONZE SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig (1380 kPa) and _____.
   1. Comply with MSS SP-80, Type 3.
   2. Design: Horizontal flow.
   3. Ends: Threaded as indicated.
   4. Disc: Bronze.
   5. Manufacturers:
      a. Apollo Valves; _____: www.apollovalves.com/#sle.

2.12 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: Composition.
   7. Seat Ring and Disc Holder: Bronze.
   8. Disc: PTFE or ____.
   9. Gasket: Asbestos free.
   10. Manufacturers:
      a. Apollo Valves; _____: www.apollovalves.com/#sle.
      b. Ferguson Enterprises Inc; _____: www.fnw.com/#sle.
      c. Flomatic Valves; Flo-Flex Swing Check Valve: www.flomatic.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Class 250:
   1. Comply with MSS SP-71, Type I.
   2. CWP Rating: 500 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. Metal Seat.
   8. Gasket: Asbestos free.

2.13 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

1. Comply with MSS SP-71, Type I.
2. Description:
   a. CWP Rating: 200 psig.
   b. Design: Clear or full waterway.
   c. Body: ASTM A126, gray iron with bolted bonnet.
   d. Ends: Flanged as indicated.
   e. Trim: Bronze.
   f. Gasket: Asbestos free.
   g. Closer Control: Factory installed, exterior lever, and weight.
3. Manufacturers:
   a. Apollo Valves; _____: www.apollovalves.com/#sle.
   b. Flomatic Valves; 90LS/92LS Swing Check Valve: www.flomatic.com/#sle.
   c. Substitutions: See Section 01 6000 - Product Requirements.

2.14 IRON GROOVED-END SWING CHECK VALVES

A. 300 CWP:
   1. CWP Rating: 300 psig.

2. Seal: EPDM or ____.

2.15 BRONZE GATE VALVES

A. Rising Stem (RS) or _____:
   1. Comply with MSS SP-80, Type I.
   2. Class 125: CWP Rating: 200 psig: and _____.
   3. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
   4. Ends: Threaded or solder joint joint.
   5. Stem: Bronze.
   6. Disc: Solid wedge; bronze.
   7. Packing: Asbestos free.
   8. Handwheel: Malleable iron, bronze, or aluminum.
   9. Manufacturers:
      a. Apollo Valves; _____: www.apollovalves.com/#sle.
      b. Ferguson Enterprises Inc; _____: www.fnw.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.16 IRON GATE VALVES

A. OS & Y or _____:
   1. Comply with MSS SP-70, Type I.
   2. Class 125: CWP Rating: 200 psig: and _____.
   3. Ends: Flanged.
   4. Manufacturers:
      a. Apollo Valves; _____: www.apollovalves.com/#sle.
      b. Ferguson Enterprises Inc; _____: www.fnw.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.17 BRONZE GLOBE VALVES

A. Class 125: CWP Rating: 200 psig: and _____.
   1. Comply with MSS SP-80, Type 1.
   2. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
   3. Ends: Threaded joint.
   4. Stem: Bronze.
   5. Disc: PTFE or ____.
   6. Packing: Asbestos free.
   7. Handwheel: Malleable Iron.
   8. Manufacturers:
      a. Apollo Valves; _____: www.apollovalves.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.18 IRON GLOBE VALVES

A. Class 125: CWP Rating: 200 psig:.
   1. Ends: Flanged.
   2. Packing and Gasket: Asbestos free.
   3. Operator: Handwheel or chainwheel.
   4. Manufacturers:
      a. Apollo Valves; _____: www.apollovalves.com/#sle.
      b. Ferguson Enterprises Inc; _____: www.fnw.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.19 STAINLESS STEEL GLOBE VALVES

A. Class 150: CWP Rating: 300 psig:.
   1. Ends: Flanged.
   2. Trim: Stainless steel.
   3. Operator: Handwheel.

4. Manufacturers:
    a. Ferguson Enterprises Inc; _____: www.fnw.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

2.20 LUBRICATED PLUG VALVES

A. Regular Gland and _____ with Flanged Ends:
    1. Class 125: CWP Rating: 200 psig.
    2. Class 250: CWP Rating: 400 psig.

2.21 CHAINWHEELS

A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
    1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
    2. Attachment: For connection to ball and _____ valve stems.
    3. Sprocket Rim with Chain Guides: Ductile iron. Include zinc coating.
    4. Chain: Hot-dip galvanized steel. Sized to fit sprocket rim.

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. 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 plate-type and _____ into horizontal or vertical position, between flanges.

E. Provide chainwheels on operators for valves 4 NPS and larger where located 96 NPS or more above finished floor, terminating 60 NPS above finished floor.

END OF SECTION 22 0523

SECTION 22 0529
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.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

1.03 REFERENCE STANDARDS

1.04 ADMINISTRATIVE REQUIREMENTS

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. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
6. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. 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, and thermal insulated pipe supports.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
   1. Application of protective inserts, saddles, and shields at pipe hangers for each type of insulation and hanger.

1.06 QUALITY ASSURANCE

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. 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 with a minimum safety factor of _____. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent 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. Manufacturers:
a. Cooper B-Line, a division of Eaton Corporation; _____: www.cooperindustries.com/#sle.
b. Thomas & Betts Corporation; _____: www.tnb.com/#sle.
c. Unistrut, a brand of Atkore International Inc; _____: www.unistrut.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.
e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Comply with MFMA-4.
3. Channel Material:
a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
4. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
5. 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. Thermal Insulated Pipe Supports:
1. Manufacturers:
a. KB Enterprises; _____: www.snappitz.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.
2. General Construction and Requirements:
a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
c. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch iron pipes.
d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by a 360 degree, PVC jacketing.
3. PVC Jacket:
a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
b. Minimum Service Temperature: Minus 40 degrees F.
c. Maximum Service Temperature: 180 degrees F.
d. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
e. Thickness: 60 mil.
f. Connections: Brush on welding adhesive.
4. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings. Field/Shop fabricated shields are not acceptable. Manufacturer provided shields shall include hanger alignment guides and chamfered edges to prevent cutting of insulation jacket.

E. Non-Penetrating Rooftop Supports for Low-Slope Roofs:

1. Manufacturers:
    a. Cooper B-Line, a division of Eaton Corporation; _____: www.cooperindustries.com/#sle.
    b. Erico International Corporation, a brand of Pentair; _____: www.erico.com/#sle.
    c. PHP Systems/Design; _____: www.phpsd.com/#sle.
    d. Unistrut, a brand of Atkore International Inc; _____: www.unistrut.com/#sle.
    e. Substitutions: See Section 01 6000 - Product Requirements.
2. 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.
3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
5. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

F. Anchors and Fasteners:
1. Manufacturers - Mechanical Anchors:
    a. Hilti, Inc; _____: www.us.hilti.com/#sle.
2. Manufacturers - Powder-Actuated Fastening Systems:
    a. Hilti, Inc; _____: www.us.hilti.com/#sle.
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. 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. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

PART 3 EXECUTION

3.01 EXAMINATION

3.02 INSTALLATION

A. Field-Welding (where approved by Architect): Comply with Section 05 5000.
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 3 inch high concrete pad constructed in accordance with Section 03 3000.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

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

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

END OF SECTION 22 0529

SECTION 22 0533
HEAT TRACING FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Self-regulating parallel resistance electric heating cable.

B. Cable outer jacket markings.

C. Connection kits.

D. Accessories.

E. Controls.

1.02 RELATED REQUIREMENTS

A. Section 22 0553 - Identification for Plumbing Piping and Equipment

B. Section 22 0719 - Plumbing Piping Insulation.

C. Section 22 1005 - Plumbing Piping.

D. Section 22 1006 - Plumbing Piping Specialties.

E. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

F. Section 26 0526 - Grounding and Bonding for Electrical Systems.

G. Section 26 0533.16 - Boxes for Electrical Systems.

H. Section 26 0583 - Wiring Connections.

1.03 REFERENCE STANDARDS

A. IEEE 515.1 - IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications; 2012.

B. ITS (DIR) - Directory of Listed Products; current edition.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

B. Coordinate the work with other trades to provide ground fault protection for electric heat tracing circuits as required by NFPA 70.

C. Coordinate the work with other trades to provide circuit breaker ratings suitable for installed circuit lengths.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for electric heat tracing.

C. Shop Drawings: Indicate electric heat tracing layout, electrical terminations, thermostats, controls, and branch circuit connections.

D. Manufacturer's Installation Instructions: Indicate installation instructions and recommendations.

E. Field Quality Control Submittals: Indicate test reports and inspection reports.

F. Project Record Documents: Record actual locations of electric heat tracing lines and thermostats.

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

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

1.06 QUALITY ASSURANCE

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

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 SELF-REGULATING PARALLEL RESISTANCE ELECTRIC HEATING CABLE

A. Manufacturers:
   1. Chromalox, Inc; _____: www.chromalox.com/#sle.
   2. Pentair; _____: www.pentairthermal.com/#sle.
   3. Thermon Manufacturing Company; _____: www.thermon.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Provide products listed, classified, and labeled by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction (AHJ).

C. Factory Rating and Testing: Comply with IEEE 515.1.

D. Heating Element:
   1. Provide pair of parallel No.16 tinned or nickel coated stranded copper bus wires embedded in cross linked conductive polymer core with varying heat output in response to temperature along its length.
   2. Terminations: Waterproof, factory assembled, non-heating leads with connector at one end and water-tight seal at opposite end.
   3. Capable of crossing over itself without overheating.

E. Insulated Jacket: Flame retardant polyolefin.

F. Cable Cover: Provide tinned copper and polyolefin outer jacket with UV inhibitor.

G. Maximum Power-On Operating Temperature: 150 degrees F.

H. Maximum Power-Off Exposure Temperature: 185 degrees F.

I. Electrical Characteristics:
   1. Refer to Section 26 0583.

2.02 CABLE OUTER JACKET MARKINGS

A. Name of manufacturer, trademark, or other recognized symbol of identification.

B. Catalog number, reference number, or model.

C. Month and year of manufacture, date coding, applicable serial number, or equivalent.

D. Agency listing or approval.

E. Applicable environmental or area use requirements, such as NEMA 4, Type 4, IP ratings, and hazardous (classified) location markings including temperature rating.

F. Any applicable warning/caution statements such as "WARNING: De-energize circuit before removing cover.

2.03 CONNECTION KITS

A. Provide power connection, splice/tee, and end seal kits compatible with the heating cable and without requiring cutting of the cable core to expose bus wires.

B. Provide with NEMA 4X rating for prevention of corrosion and water ingress.

C. Provide UV stabilized components.

2.04 ACCESSORIES

A. Provide Accessories As Indicated or As Required for Complete Installation, Including but Not Limited To:
   1. High temperature, glass filament tape for attachment of heating cable to metal piping.
   2. Aluminum self-adhesive tape for attachment of heating cable to plastic piping.
   3. Heat-conductive putty.
   4. Cable ties.
   5. Silicone end seals and splice kits.
   6. Installation clips.
   7. Warning labels for attachment to exterior of piping insulation. Refer to Section 22 0553.

2.05 CONTROLS

A. Pipe Mounted Thermostats:
   1. Remote bulb unit with adjustable temperature range from 30 to 50 degrees F.
   2. Snap-action, open-on-rise, single pole switch with minimum current rating adequate for the connected cable.
   3. Remote bulb on capillary, resistance temperature device (RTD) or thermistor for direct sensing of pipe wall temperature.
   4. Control Enclosure: Corrosion resistant and waterproof.

B. Provide minimum 30 ampere contactor to indicate operational status and on/off control.

C. Line sensing high-limit temperature control and high-limit alarm.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping and equipment are ready to receive work.

B. Verify field measurements are as indicated on shop drawings.

C. Verify required power is available, in proper location, and ready for use.

3.02 PREPARATION

A. Clean exposed surfaces prior to installation.

B. Prepare surfaces using approved methods as recommended by manufacturer.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written installation instructions.

B. Comply with installation requirements of IEEE 515.1 and NFPA 70, Article 427.

C. Apply heating cable linearly on pipe with fiberglass tape only after piping has successfully completed any required pressure testing.

D. Comply with applicable local building codes and requirements of authorities having jurisdiction.

E. Identification:
   1. After thermal insulation installation, apply external pipeline decals to indicate presence of the thermal insulation cladding at intervals not to exceed 20 ft including cladding over each valve or other equipment that may require maintenance.
   2. Refer to Section 22 0553.

F. Equipment Wiring: Refer to Section 26 0583.

G. Electrical Connections: Refer to Section 26 0519.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Perform start-up by factory technician or factory representative as per Owner's requirements.

C. Field Testing and Inspections:
   1. Commission system in accordance with installation and operation manual.
   2. Inspect for sources of water entry and proper sealing.
   3. Inspect weather barrier to confirm that no sharp edges are contacting the trace heating.
   4. Insulation Resistance: Greater than 20 megohms at a test voltage of 2500 VDC for polymer insulated trace heaters.
   5. Test heating cable integrity with megohmmeter at the following intervals:
      a. Before installing the cable.
      b. After cable has been installed onto the piping.
      c. After installing the connection kits.
      d. After the installation of thermal insulation onto the piping.
      e. Prior to initial start-up (commissioning).
   6. Measure voltage and current at each unit.
   7. Controls:
      a. Verify control parameters are set to the application requirements.
      b. Verify factory provided digital temperature controller is correctly configured with the building automation system.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 22 0533

SECTION 22 0548
VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration-isolated equipment support bases.

1.02 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; 2015.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.04 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience.

PART 2 PRODUCTS

2.01 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

PART 3 EXECUTION

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

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION 22 0548

SECTION 22 0553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

D. Ceiling tacks.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Identification painting.

B. Section 22 6000 - Gas and Vacuum Systems for Laboratory and Healthcare Facilities: Supply of pipe labels for placement under this section.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2007.

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

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

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

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. The following list is not all inclusive, all equipemnt, piping and support utilities shall be labeled/identified. Where in question consult Corewell Health facilities engineering department.

B. Air Handling Units: Nameplates.

C. Air Terminal Units: Tags.

D. Automatic Controls: Tags. Key to control schematic.

E. Control Panels: Nameplates.

F. Dampers: Ceiling tacks, where located above lay-in ceiling.

G. Heat Transfer Equipment: Nameplates.

H. Instrumentation: Tags.

I. Major Control Components: Nameplates.

J. Piping: Tags.

K. Pumps: Nameplates.

L. Relays: Tags.

M. Small-sized Equipment: Tags.

N. Tanks: Nameplates.

O. Valves: Tags and ceiling tacks where located above lay-in ceiling.

P. Water Treatment Devices: Nameplates.

2.02 NAMEPLATES

A. Manufacturers:
   1. Brimar Industries, Inc; _____: www.pipemarker.com/#sle.
   2. Kolbi Pipe Marker Co; _____: www.kolbipipemarkers.com/#sle.
   3. Seton Identification Products; _____: www.seton.com/#sle.

B. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.

2.03 TAGS

A. Manufacturers:
   1. Advanced Graphic Engraving; _____: www.advancedgraphicengraving.com/#sle.
   2. Brady Corporation; _____: www.bradycorp.com/#sle.
   3. Brimar Industries, Inc; _____: www.pipemarker.com/#sle.
   4. Kolbi Pipe Marker Co; _____: www.kolbipipemarkers.com/#sle.
   5. Seton Identification Products; _____: www.seton.com/#sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

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

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

2.04 PIPE MARKERS

A. Manufacturers:
   1. Brady Corporation; _____: www.bradycorp.com/#sle.
   2. Brimar Industries, Inc; _____: www.pipemarker.com/#sle.
   3. Kolbi Pipe Marker Co; _____: www.kolbipipemarkers.com/#sle.
   4. MIFAB, Inc; _____: www.mifab.com/#sle.
   5. Seton Identification Products; _____: www.seton.com/#sle.

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

E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
   1. For non-metalic piping, include continuous pipe tracing wire for future piping location identification

F. Color code as follows:
   1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.
   2. Fire Quenching Fluids: Red with white letters.
   3. Toxic and Corrosive Fluids: Orange with black letters.
   4. Flammable Fluids: Yellow with black letters.
   5. Combustible Fluids: Brown with white letters.
   6. Compressed Air: Blue with white letters.

2.05 CEILING TACKS

A. Manufacturers:

1. Craftmark Pipe Markers; _____: www.craftmarkid.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

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

C. Color code as follows:
1. HVAC Equipment: Yellow.
2. Fire Dampers and Smoke Dampers: Red.
3. Plumbing Valves: Green.
4. Heating/Cooling Valves: Blue.

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

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

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

F. 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.

G. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

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

END OF SECTION 22 0553

SECTION 22 0716
PLUMBING EQUIPMENT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment insulation.

B. Flexible removable and reusable blanket insulation.

C. Covering.

D. Breeching insulation.

1.02 RELATED REQUIREMENTS

A. Section 09 9113 - Exterior Painting: Painting insulation covering.

B. Section 09 9123 - Interior Painting: Painting insulation covering.

C. Section 22 0553 - Identification for Plumbing Piping and Equipment.

D. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts.

E. Section 23 2113 - Hydronic Piping: Placement of hangers and hanger inserts.

F. Section 23 2114 - Hydronic Specialties.

G. Section 23 2300 - Refrigerant Piping: Placement of inserts.

1.03 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; 2013.

B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

D. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2015.

E. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

F. ASTM C1410 - Standard Specification for Cellular Melamine Thermal and Sound-Absorbing Insulation; 2017 (Reapproved 2023).

G. ASTM C1695 - Standard Specification for Fabrication of Flexible Removable and Reusable Blanket Insulation for Hot Service; 2010 (Reapproved 2015).

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

I. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

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

1.04 SUBMITTALS

A. See Section 01 3000 - 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.

1.05 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 3 years of experience.

1.06 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.

1.07 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, UL 723, ASTM E84, or UL 723.

2.02 CELLULAR MELAMINE

A. Manufacturers:
   1. TECHLITE; _____: www.techlite.com/#sle.

B. Insulation: Flexible preformed open-cell polymeric foam tubing, slit lengthwise for installation, complying with applicable requirements of ASTM C1410.
   1. K Value: ASTM C177; 0.25 at 75 degrees F.
   2. Minimum Service Temperature: Minus 40 degrees F.
   3. Maximum Service Temperature: 350 degrees F.
   4. Density: 0.56 lb/cu ft.
   5. Jacketing material to be field-applied.

2.03 GLASS FIBER, FLEXIBLE

A. Manufacturers:
   1. CertainTeed Corporation; _____: www.certainteed.com/#sle.
   2. Johns Manville Corporation; _____: www.jm.com/#sle.
   3. Owens Corning Corporation; _____: www.ocbuildingspec.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.
   5. K Value: 0.36 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
   6. Maximum Service Temperature: 450 degrees F.
   7. Maximum Water Vapor Absorption: 5.0 percent by weight.

B. 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.

C. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.04 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.

2.05 GLASS FIBER, RIGID

A. Manufacturer:
   1. CertainTeed Corporation; _____: www.certainteed.com/#sle.
   2. Johns Manville Corporation; _____: www.jm.com/#sle.
   3. Owens Corning Corporation; _____: www.ocbuildingspec.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.
   5. K Value: 0.25 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
   6. Maximum Service Temperature: 850 degrees F.
   7. Maximum Water Vapor Absorption: 5.0 percent by weight.
   8. Maximum Density: 8.0 lb/cu ft.

B. 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.

C. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.06 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Aeroflex USA, Inc; _____: www.aeroflexusa.com/#sle.
   2. Armacell LLC; AP Armaflex: www.armacell.us/#sle.
   3. K-Flex USA LLC; _____: www.kflexusa.com/#sle.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3, in sheet form.

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

2.07 JACKETS

A. PVC Plastic:
   1. Manufacturers:
      a. Johns Manville Corporation; _____: www.jm.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.
   2. Jacket: Sheet material, off-white color.
      a. Minimum Service Temperature: Minus 40 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil.
      e. Connections: Brush on welding adhesive.
   3. Covering Adhesive Mastic: Compatible with insulation.

B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
   1. Thickness: 0.016 inch sheet.
   2. Finish: Smooth.
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

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.
   1. Install seal over seams with factory-approved room temperature vulcanization (RTV) silicone sealant to ensure a positive vapor barrier seal in outdoor and sanitary wash down environments.

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

I. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.

J. Fiberglass insulated equipment containing fluids above ambient temperature: Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.

K. Inserts and Shields:
   1. Application: Equipment 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between hangers and inserts. Shields to be mfg purchased and include hanger mounting grooves and rolled edges to prevent cutting of insulation, (contractor fabricated rolled sheetmetal is not acceptable).
   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; shall be manufacturer constructed (not site fabricated).
   5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

L. Finish insulation at supports, protrusions, and interruptions.

M. Equipment and Piping in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.

N. Exterior Applications:
   1. Provide vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement.
   2. Cover with aluminum, stainless steel, or UV protected Weather-proof PVC.

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

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

Q. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.03 SCHEDULES

A. Plumbing Systems:
   1. Domestic Hot Water Storage Tanks:
      a. Glass Fiber, Flexible Insulation: ____ inches thick.
      b. Cellular Foam Insulation: ____ inches thick.

B. Heating Systems:

1. Heat Exchangers/Converters:
2. Air Separators:
3. Expansion Tanks:
4. Hot Thermal Storage Tanks:
5. Boiler Feed Water Storage Tanks:
6. Steam Condensate Receivers:
7. Condensate Tanks:
8. Deaerators:
9. Flue Gas Breeching:
10. Stacks to Roof:
11. Boiler and Flue Boxes:
12. Boiler Drum Heads:

C. Cooling Systems:
1. Air Separators:
2. Expansion Tanks:
3. Chiller Cold Surfaces (Not Factory Insulated):
4. Cold Thermal Storage Tanks:
5. Equipment Exposed to Freezing with Heat Tracing:

END OF SECTION 22 0716

SECTION 22 0719
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

C. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 09 9113 - Exterior Painting: Painting insulation jacket.

C. Section 09 9123 - Interior Painting: Painting insulation jacket.

D. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts.

E. Section 23 2113 - Hydronic Piping: Placement of hangers and hanger inserts.

F. Section 23 2213 - Steam and Condensate Heating Piping: Placement of hangers and hanger inserts.

G. Section 23 2300 - Refrigerant Piping: Placement of inserts.

1.03 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

E. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

F. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.

G. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2015.

H. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2010.

I. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

J. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

L. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

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

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

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

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 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 3 years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

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

1.07 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 index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

2.02 GLASS FIBER

A. Manufacturers:
   1. CertainTeed Corporation; _____: www.certainteed.com/#sle.
   2. Johns Manville Corporation; _____: www.jm.com/#sle.
   3. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/#sle.
   4. Owens Corning Corporation; VaporWick Pipe Insulation: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C547and ASTM C795; rigid molded, noncombustible.
   1. K Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. 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.

D. 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-inches.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

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

2.03 CELLULAR GLASS

A. Manufacturers:
   1. Owens Corning Corporation; _____: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C552, Type II, Grade 6.
   1. K Value: 0.35 at 100 degrees F.
   2. Service Temperature Range: From 250 degrees F to 800 degrees F.
   3. Water Vapor Permeability: 0.005 perm inch maximum per inch.
   4. Water Absorption: 0.5 percent by volume, maximum.

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:

1. Aeroflex USA, Inc; _____: www.aeroflexusa.com/#sle.
2. Armacell LLC; AP Armaflex: www.armacell.us/#sle.
3. K-Flex USA LLC; Insul-Tube: www.kflexusa.com/#sle.

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.

2.05 JACKETS

A. PVC Plastic.
1. Manufacturers:
a. Johns Manville Corporation; _____: www.jm.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.
2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
a. Minimum Service Temperature: 0 degrees F.
b. Maximum Service Temperature: 150 degrees F.
c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
d. Thickness: 10 mil.
e. Connections: Brush on welding adhesive.
3. Covering Adhesive Mastic: Compatible with insulation.

B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
1. Thickness: 0.016 inch sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. 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. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Exposed Piping: Located in Plumbing/Mechanical Rooms shall include protective PVC jacket over insulation and fittings on any piping located below 10'0" AFF.

E. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

F. 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.

G. 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.

H. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

I. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without 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.

J. 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.

K. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.

L. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

M. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with _____ jacket with seams located on bottom side of horizontal piping.

N. 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 thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

O. 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 _____ 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:
      b. Cellular Foam Insulation:
   2. Domestic Hot Water Recirculation:
      a. Glass Fiber Insulation:
   3. Tempered Domestic Water Supply:
   4. Tempered Domestic Water Recirculation:
   5. Domestic Cold Water:
   6. Roof Drain Bodies:
   7. Roof Drainage Within 10 Feet of the Exterior:
   8. Roof Drainage Run Horizontal at Roof Level:

B. Heating Systems:
   1. Heating Water Supply and Return:
   2. Glycol Heating Supply and Return:
   3. Low Pressure Steam Piping:
   4. Low Pressure Steam Condensate:

5. Gravity Steam Condensate:
6. Pumped Steam Condensate:
7. High Pressure Steam Piping:
8. High Pressure Steam Condensate:
9. Boiler Feed Water:

C. Cooling Systems:
1. Chilled Water:
2. Condenser Water:
3. Dual Temperature Water:
4. Heat Recovery Water:
5. Glycol Cooling Supply and Return:
6. Cold Condensate Drains:
7. Condensate Drains from Cooling Coils:
8. Refrigerant Suction:
9. Refrigerant Hot Gas:

D. Other Systems:
1. Humidifier Piping:
2. Piping Exposed to Freezing with Heat Tracing:

END OF SECTION 22 0719

SECTION 22 1005
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.
   2. Chemical resistant sewer.
   3. Domestic water.
   4. Storm water.
   5. Flanges, unions, and couplings.
   6. Pipe hangers and supports.
   7. Valves.
   8. Flow controls.
   9. Check Valves.
   10. Water pressure reducing valves.
   11. Relief valves.
   12. Strainers.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 08 3100 - Access Doors and Panels.

C. Section 09 9113 - Exterior Painting.

D. Section 09 9123 - Interior Painting.

E. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.

F. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

G. Section 22 0553 - Identification for Plumbing Piping and Equipment.

H. Section 22 0719 - Plumbing Piping Insulation.

I. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

J. Section 31 2316 - Excavation.

K. Section 31 2316.13 - Trenching.

L. Section 31 2323 - Fill.

M. Section 33 0110.58 - Disinfection of Water Utility Piping Systems.

1.03 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 1999, and addenda A&B (R2004).

B. ANSI Z223.1 - National Fuel Gas Code; 2024.

C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2010.

D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2011.

F. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

G. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

H. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV; 2011.

I. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2013.

J. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV; 2012.

K. ASME B31.1 - Power Piping; 2014.

L. ASME B31.9 - Building Services Piping; 2014.

M. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2015.

N. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

O. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems; 2009.

P. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2018).

Q. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

R. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2015.

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

T. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.

U. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

V. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.

W. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes; 2014.

X. ASTM B68/B68M - Standard Specification for Seamless Copper Tube, Bright Annealed; 2011.

Y. ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2011.

Z. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.

AA. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.

BB. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2013.

CC. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes; 2017.

DD. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2013.

EE. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2010.

FF. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2002 (Reapproved 2010).

GG. ASTM C4 - Standard Specification for Clay Drain Tile and Perforated Clay Drain Tile; 2004 (Reapproved 2014).

HH. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.

II. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.

JJ. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings; 2004 (Reapproved 2011).

KK. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter; 2012.

LL. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2015.

MM. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2013.

NN. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2014.

OO. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.

PP. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe; 2002 (Reapproved 2009).

QQ. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

RR. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

SS. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping; 2001 (Reapproved 2014).

TT. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2014.

UU. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.

VV. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems; 2014.

WW. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).

XX. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2015.

YY. ASTM F437 - Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2015.

ZZ. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40; 2015.

AAA. ASTM F439 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2013.

BBB. ASTM F441/F441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80; 2013.

CCC. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR); 2013.

DDD. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2010.

EEE. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2014.

FFF. ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core; 2012.

GGG. ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings; 2015.

HHH. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 2024.

III. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2013a.

JJJ. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems; 2011.

KKK. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe; 2011.

LLL. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe; 2010.

MMM. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing; 2015.

NNN. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.

OOO. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

PPP. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.

QQQ. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2012.

RRR. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2012.

SSS. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2009.

TTT. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2013.

UUU. AWWA C606 - Grooved and Shouldered Joints; 2011.

VVV. AWWA C651 - Disinfecting Water Mains; 2005.

WWW. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution; 2007.

XXX. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service; 2008.

YYY. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009.

ZZZ. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011.

AAAA. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2012.

BBBB. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2012.

CCCC. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2013.

DDDD. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2013.

EEEE. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

FFFF. MSS SP-67 - Butterfly Valves; 2011.

GGGG. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends; 2011.

HHHH. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends; 2011.

IIII. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; 2011.

JJJJ. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.

KKKK. MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends; 2011.

LLLL. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

MMMM. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

NNNN. NSF 372 - Drinking Water System Components - Lead Content; 2011.

OOOO. PPI TR-4 - PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings For Thermoplastic Piping Materials or Pipe; 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

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

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

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 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.

1.06 DELIVERY, STORAGE, AND HANDLING

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

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

1.07 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. Chemical resistance of Gaskets, Seals and O-rings:
   1. All valves and associated components used in Potable water systems shall be resistant to Chlorine and Mono-Chloramine water treatment chemicals.

2.02 SANITARY SEWER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
   1. Fittings: Cast iron.
      a. Prohibited fittings; Double sanitary wye, double sanitary tee, sanitary cross or any other fitting that allows two entries into the system at the same point.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
      a. Prohibited fittings; Double sanitary wye, double sanitary tee, sanitary cross or any other fitting that allows two entries into the system at the same point.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
   1. Fittings: Cast iron.

a. Prohibited fittings; Double sanitary wye, double sanitary tee, sanitary cross or any other fitting that allows two entries into the system at the same point.

2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless.

1. Fittings: Cast iron.
   a. Prohibited fittings; Double sanitary wye, double sanitary tee, sanitary cross or any other fitting that allows two entries into the system at the same point.
2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

C. PVC Pipe: ASTM D2665 or ASTM D3034.

1. Fittings: PVC.
   a. Prohibited fittings; Double sanitary wye, double sanitary tee, sanitary cross or any other fitting that allows two entries into the system at the same point.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.04 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. Fittings: Cast iron.
   a. Prohibited fittings; Double sanitary wye, double sanitary tee, sanitary cross or any other fitting that allows two entries into the system at the same point.
2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

B. Copper Tube: ASTM B306, DWV.

1. Fittings: ASME B16.29, wrought copper, or ASME B16.23, sovent.
   a. Prohibited fittings; Double sanitary wye, double sanitary tee, sanitary cross or any other fitting that allows two entries into the system at the same point.
2. Joints: ASTM B32, alloy Sn50 solder.

C. PVC Pipe: ASTM D1785 Schedule 40, or ASTM D2241 SDR 26 with not less than 150 psi pressure rating.

1. Fittings: ASTM D2466, PVC.
   a. Prohibited fittings; Double sanitary wye, double sanitary tee, sanitary cross or any other fitting that allows two entries into the system at the same point.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.05 CHEMICAL RESISTANT SEWER PIPING

A. ABS Pipe: ASTM F628.

1. Fittings: ABS.
2. Joints: Solvent welded with ASTM D2235 cement.
   a. Prohibited fittings; Double sanitary wye, double sanitary tee, sanitary cross or any other fitting that allows two entries into the system at the same point.

B. PVC Pipe: ASTM D2729 or ASTM D2665.

1. Fittings: PVC.
   a. Prohibited fittings; Double sanitary wye, double sanitary tee, sanitary cross or any other fitting that allows two entries into the system at the same point.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.

C. CPVC Pipe: ASTM F2618, ASTM D2846/D2846M, ASTM F441/F441M, or ASTM F442/F442M.

1. Fittings: CPVC; ASTM 2518, ASTM D2846/D2846M, ASTM F437, ASTM F438, or ASTM F439.
2. Joints: ASTM 2618, ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement.
   a. Prohibitted fittings; Double sanitary wye, double sanitary tee, sanitary cross or any other fitting that allows two entries into the system at the same point.

2.06 DOMESTIC WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: AWWA C110/A21.10, 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. Copper Pipe: ASTM B42, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
   2. Joints: AWS A5.8M/A5.8, BCuP copper/silver braze.

C. PE Pipe: ASTM D2239.
   1. Fittings: ASTM D2609, PE.
   2. Joints: Mechanical with stainless steel clamp.

D. PVC Pipe: AWWA C900.

2.07 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
   2. Joints: AWS A5.8M/A5.8, BCuP copper/silver braze.

B. 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.

C. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
   1. Manufacturers:
      a. Uponor, Inc; _____: www.uponorengineering.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.
   2. PPI TR-4 Pressure Design Basis:
      a. 160 psig at maximum 73 degrees F.
   3. Fittings: Brass and engineered polymer (EP) ASTM F1960.
   4. Joints: Mechanical compression fittings.
   5. Joints: ASTM F1960 cold-expansion fittings.

2.08 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.
   3. Mechanical Press Sealed Fittings: Double pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, non toxic synthetic rubber sealing elements.
      a. Manufacturers:
         1) Grinnell Products; _____: www.grinnell.com/#sle.
         2) Viega LLC; _____: www.viega.us/#sle.
         3) Substitutions: See Section 01 6000 - Product Requirements.

B. CPVC Pipe: ASTM D2846/D2846M, ASTM F441/F441M, or ASTM F442/F442M.
   1. Fittings: CPVC; ASTM D2846/D2846M, ASTM F437, ASTM F438, or ASTM F439.
   2. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement.

2.09 STORM WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. PVC Pipe: ASTM D3034 DR 35.
   1. Fittings: PVC.
   2. Joints: Push-on, using ASTM F477 elastomeric gaskets.

C. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.10 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

B. ABS Pipe: ASTM D2680.
   1. Fittings: ABS.
   2. Joints: Solvent welded with ASTM D2235 cement.

C. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.11 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

B. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.12 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.

2.13 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.

2.14 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.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A) or L (B) annealed.
   1. Fittings: ASME B16.26, cast bronze.
   2. Joints: Flared.

2.15 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. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.
   2. Housing Material: Provide ASTM A47/A47M malleable iron, ductile iron, or _____, galvanized.
   3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
   4. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
   5. When pipe is field grooved, provide coupling manufacturer's grooving tools.
   6. Manufacturers:
      a. Grinnell Products; _____: www.grinnell.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

D. Dielectric Connections: Shall be made with the use of brass fittings (union, flange or coupling) or other non-conductive connections (final approval by owner) whenever joining dissimilar metals. A valve shall be placed upstream of any connection involving a union or flange. Dielectric unions shall not be installed and shall be replaced with any of the prior listed connections at time of repair in the case of renovations.

2.16 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.
   5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.
   6. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases 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; and as follows:
      a. Bases: High density polypropylene.
      b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
      c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
      d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
      e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.
      f. Manufacturers:
         1) PHP Systems/Design; _____: www.phpsd.com/#sle.
         2) Substitutions: See Section 01 6000 - Product Requirements.

B. Plumbing Piping - Drain, Waste, and Vent:
   1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
   2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   3. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   4. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
   5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:

1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
2. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
3. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron pipe roll, double hanger.
5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
7. Wall Support for Hot Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron pipe roll.
8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
10. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
11. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.

2.17 BALL VALVES

A. Manufacturers:
1. Grinnell Products; _____: www.grinnell.com/#sle.
2. Nibco, Inc; _____: www.nibco.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends.

2.18 BUTTERFLY VALVES

A. Manufacturers:
1. Crane Company; _____: www.cranecpe.com/#sle.
2. Grinnell Products; B302: www.grinnell.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Construction 1-1/2 Inches and Larger: MSS SP-67, 200 psi CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.

C. Provide gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

2.19 PIPING SPECIALTIES

A. Flow Controls:
1. Manufacturers:
a. ITT Bell & Gossett; Model _____: www.bellgossett.com/#sle.
b. Griswold Controls; Model _____: www.griswoldcontrols.com/#sle.
c. Taco, Inc; Model _____: www.taco-hvac.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.
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: 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.

2.20 WATER PRESSURE REDUCING VALVES

A. Manufacturers:
   1. Amtrol Inc; _____: www.amtrol.com/#sle.
   2. Cla-Val Company; _____: www.cla-val.com/#sle.
   3. Watts Regulator Company; _____: www.wattsregulator.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Up to 2 Inches:
   1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.

C. Over 2 Inches:
   1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.21 RELIEF VALVES

A. Pressure:
   1. Manufacturers:
      a. Cla-Val Co; Model _____: www.cla-val.com/#sle.
      b. Henry Technologies; Model _____: www.henrytech.com/#sle.
      c. Watts Regulator Company; Model _____: www.wattsregulator.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.
   2. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

B. Temperature and Pressure:
   1. Manufacturers:
      a. Cla-Val Co; Model _____: www.cla-val.com/#sle.
      b. Henry Technologies; Model _____: www.henrytech.com/#sle.
      c. Watts Regulator Company; Model _____: www.wattsregulator.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.
   2. 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.

2.22 STRAINERS

A. Manufacturers:
   1. Armstrong International, Inc; Model _____: www.armstronginternational.com/#sle.
   2. Green Country Filter Manufacturing; Model _____: www.greencountryfilter.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Size 2 inch 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.

C. Size 1-1/2 inch to 4 inch:
   1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

D. Size 5 inch and Larger:
   1. Class 125, flanged iron body, basket pattern with 1/8 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. Provide non-conducting brass connections wherever joining dissimilar metals. Dielectric unions shall not be installed.

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

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

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 0516.

G. Install hot water return loops in all clinical areas reagardless of lenth of run of HW piping.

H. Do not leave any dead legs of more than 6" in any piping system.

I. 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 0719.

J. Provide access where valves and fittings are not exposed.
   1. Coordinate size and location of access doors with Section 08 3100.

K. Establish elevations of buried piping outside the building to ensure not less than 3.5 ft of cover.

L. Install vent piping penetrating roofed areas to maintain integrity of roof assembly; refer to Section _____.

M. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

N. Provide support for utility meters in accordance with requirements of utility companies.

O. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
   1. Painting of interior plumbing systems and components is specified in Section 09 9123.
   2. Painting of exterior plumbing systems and components is specified in Section 09 9113.

P. Excavate in accordance with Section 31 2316.

Q. Backfill in accordance with Section 31 2323.

R. Install bell and spigot pipe with bell end upstream.

S. Install valves with stems upright or horizontal, not inverted. Refer to Section 22 0523.

T. Install water piping to ASME B31.9.

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

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

W. Sleeve pipes passing through partitions, walls and floors.

X. Inserts:

1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

Y. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
2. Support horizontal piping as indicated.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
    a. Painting of interior plumbing systems and components is specified in Section 09 9123.
    b. Painting of exterior plumbing systems and components is specified in Section 09 9113.
10. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 22 0548.
11. Support cast iron drainage piping at every joint.

3.04 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

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

C. Provide spring loaded check valves on discharge of water pumps.

D. 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 1/4 inch per foot slope.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with Sections 33 0110.58 and 13533.1.03.D.

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

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

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

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

F. Maintain disinfectant in system for 24 hours.

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

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

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

3.07 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.
   1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
   2. Provide 18 gage, 0.0478 inch galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

3.08 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.
      e. Pipe Size: 8 inches to 12 inches:
         1) Maximum hanger spacing: 14 ft.
         2) Hanger Rod Diameter: 7/8 inch.
      f. Pipe Size: 14 inches and Over:
         1) Maximum Hanger Spacing: 20 ft.
         2) Hanger Rod Diameter: 1 inch.
   2. Plastic Piping:
      a. All Sizes:
         1) Maximum Hanger Spacing: 6 ft.
         2) Hanger Rod Diameter: 3/8 inch.

END OF SECTION 22 1005

SECTION 22 1006
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Drains.
B. Cleanouts.
C. Hose bibbs.
D. Hydrants.
E. Backflow preventers.
F. Double check valve assemblies.
G. Water hammer arrestors.
H. Mixing valves.
I. Catch basins and manholes.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Product requirements for Owner furnished kitchen equipment.
B. Section 01 6000 - Product Requirements: Procedures for Owner-supplied products.
C. Section 03 3000 - Cast-in-Place Concrete: Manhole bottoms.
D. Section 03 3000 - Cast-in-Place Concrete: Execution requirements for concrete catch basin bases.
E. Section 22 1005 - Plumbing Piping.
F. Section 22 3000 - Plumbing Equipment.
G. Section 22 4000 - Plumbing Fixtures.
H. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.
I. Section 33 0561 - Concrete Manholes.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
B. ASME A112.6.3 - Floor and Trench Drains; 2001 (R2007).
C. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2003.
D. ASSE 1011 - Hose Connection Vacuum Breakers; 2004.
E. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent; 2009.
F. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011.
G. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011.
H. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections; 2015.
I. ASTM C478M - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections [Metric]; 2015.
J. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
K. NSF 372 - Drinking Water System Components - Lead Content; 2011.
L. PDI-WH 201 - Water Hammer Arresters; 2010.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Certificates: Certify that grease interceptors meet or exceed specified requirements.

E. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

F. Operation Data: Indicate frequency of treatment required for interceptors.

G. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Loose Keys for Outside Hose Bibbs: One.

1.05 QUALITY ASSURANCE

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

1.06 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.

B. Chemical resistance of Gaskets, Seals and O-rings:
   1. All valves and associated components used in Potable water systems shall be resistant to Chlorine and Mono-Chloramine water treatment chemicals.

2.02 DRAINS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company; _____: www.jayrsmith.com/#sle.
   2. Josam Company; _____: www.josam.com/#sle.
   3. Zurn Industries, LLC; _____: www.zurn.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Roof Drains:
   1. Assembly: ASME A112.6.4.
   2. Body: Lacquered cast iron with sump.
   3. Strainer: Removable polyethylene dome with vandal proof screws.
   4. Accessories: Coordinate with roofing type, refer to Section _____:
      a. Membrane flange and membrane clamp with integral gravel stop.
      b. Adjustable under deck clamp.
      c. Roof sump receiver.
      d. Waterproofing flange.
      e. Leveling frame.
      f. Adjustable extension sleeve for roof insulation.

C. Roof Overflow Drains:
   1. Lacquered cast iron body and clamp collar and bottom clamp ring; pipe extended to 2 inches above flood elevation.

D. Downspout Nozzles:
   1. Bronze round with straight bottom section.

E. Floor Drain (FD-1):
   1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

F. Floor Drain (FD-2):
   1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable round nickel bronze strainer with removable perforated sediment bucket.

G. Floor Drain (FD-3):
   1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer with polished bronze funnel or anti-splash rim.

H. Floor Drain (FD-4):
   1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze extra heavy duty strainer.

I. Floor Drain (FD-5):
   1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze extra heavy duty strainer with hinged grate and sediment bucket.

J. Floor Drain (FD-6):
   1. Lacquered cast iron or stainless steel, two piece body with drainage flange, heavy duty grate 6 inches wide, 12 inches long, dome strainer, end plates with gaskets.

K. Prefabricated Trench Drain (TD-1): Trench drain system assembled from factory fabricated, polymer concrete castings in standard lengths and variable depths, with integral joint flanges and integral grating support rails; includes joint gaskets and grating.

L. Floor Sink (FS-1):
   1. Lacquered cast iron body with dome strainer and seepage flange.

M. Floor Sink (FS-2):
   1. Round lacquered cast iron body with integral seepage pan, epoxy coated interior, aluminum dome strainer, nickel bronze frame, full grate.

2.03 CLEANOUTS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company; _____: www.jayrsmith.com/#sle.
   2. Josam Company; _____: www.josam.com/#sle.
   3. Zurn Industries, LLC; _____: www.zurn.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Cleanouts at Exterior Surfaced Areas (CO-1):
   1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas (CO-2):
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D. Cleanouts at Interior Finished Floor Areas (CO-3):
   1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

E. Cleanouts at Interior Finished Wall Areas (CO-4):
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

F. Cleanouts at Interior Unfinished Accessible Areas (CO-5): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.04 HOSE BIBBS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company; _____: www.jayrsmith.com/#sle.
   2. Watts Regulator Company; _____: www.wattsregulator.com/#sle.
   3. Zurn Industries, LLC; _____: www.zurn.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Interior Hose Bibbs:
   1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with handwheel, integral vacuum breaker in compliance with ASSE 1011.

C. Interior Mixing Type Hose Bibbs:
   1. Bronze or brass, wall mounted, double service faucet with hose thread spout, integral stops, chrome plated where exposed with handwheels, and vacuum breaker in compliance with ASSE 1011.

2.05 HYDRANTS

A. Manufacturers:
   1. Arrowhead Brass & Plumbing, LLC; _____: www.arrowheadbrass.com/#sle.
   2. Jay R. Smith Manufacturing Company; _____: www.jayrsmith.com/#sle.
   3. Zurn Industries, LLC; _____: www.zurn.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Wall Hydrants:
   1. ASSE 1019; freeze resistant, self-draining type with chrome plated wall plate hose thread spout, handwheel, and integral vacuum breaker.

2.06 BACKFLOW PREVENTERS

A. Manufacturers:
   1. Watts Regulator Company, a part of Watts Water Technologies; _____: www.wattsregulator.com/#sle.
   2. Zurn Industries, LLC; _____: www.zurn.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Reduced Pressure Backflow Preventers:
   1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.07 DOUBLE CHECK VALVE ASSEMBLIES

A. Manufacturers:
   1. Watts Regulator Company, a part of Watts Water Technologies; _____: www.wattsregulator.com/#sle.
   2. Zurn Industries, LLC; _____: www.zurn.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Double Check Valve Assemblies:
   1. ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

2.08 WATER HAMMER ARRESTORS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company; _____: www.jayrsmith.com/#sle.

2. Watts Regulator Company, a part of Watts Water Technologies; _____: www.wattsregulator.com/#sle.
3. Zurn Industries, LLC; _____: www.zurn.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

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.

2.09 MIXING VALVES

A. Thermostatic Mixing Valves:
1. Manufacturers:
a. Honeywell International Inc; _____: www.honeywellhome.com/#sle.
b. Leonard Valve Company; _____: www.leonardvalve.com/#sle.
c. Watts Company; www.watts.com
d. Substitutions: See Section 01 6000 - Product Requirements.
2. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.
3. Capacity: _____ gpm at _____ psi differential.
4. Accessories:
a. Check valve on inlets.
b. Volume control shut-off valve on outlet.
c. Stem thermometer on outlet.
d. Strainer stop checks on inlets.
5. Cabinet: 16 gage, 0.0598 inch prime coated steel, for recessed mounting with keyed lock.

B. Pressure Balanced Mixing Valves:
1. Manufacturers:
a. Delta Faucet Company; _____: www.deltafaucet.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.
2. Valve: Chrome plated cast brass body, stainless steel cylinder, integral temperature adjustment.
a. Capacity: _____ gpm at _____ psi differential.
3. Accessories:
a. Volume control shut-off valve on outlet.
b. Stem thermometer on outlet.
c. Strainer stop checks on inlets.
d. Cabinet: 16 gage, 0.0598 inch prime coated steel, for recessed mounting with keyed lock.

2.10 CATCH BASINS AND MANHOLES

A. Catch Basins:
1. Barrel: ASTM C478 (ASTM C478M); precast concrete sections laid on cast-in-place reinforced concrete foundation pad, 36 inches or 48 inches diameter with precast concrete top.
2. Inlet Assembly: Two piece heavy duty cast steel or cast iron frame and grate with ground or machined grate and frame bearing surfaces.
3. Curb and gutter style: Rectangular grate and storm back:
a. Capacity 247 cu ft/s.
4. Standard: Round frame and grate:
a. Capacity 194 cu ft/s.
5. Manhole frame: Grated top:
a. Capacity 141 cu ft/s.
6. Slope bottom slab 10 percent to outlet invert.

7. Provide minimum 2 feet sump below outlet.

B. Manholes: Formed-bottom type, laid on cast-in-place reinforced concrete foundation pad; concrete as specified in Section 03 3000.
   1. Construction: Concrete masonry units.
   2. Size: _____ inch diameter.
   3. Cover: Standard cast iron with minimum sized pick hole, and frame. Use heavy duty cover and frame in vehicular traffic areas.
   4. Manufacturers:
      a. Campbell Group; _____: www.campbellfoundry.com/#sle.
      b. Neenah Enterprises, Inc; _____: www.nfco.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.
   5. Steps: 3/4 inch diameter galvanized steel on 16 inch centers.

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 other quick closing valves..

END OF SECTION 22 1006

SECTION 22 1429
SUMP PUMPS

PART 2 PRODUCTS

END OF SECTION 22 1429

SECTION 22 1500
GENERAL-SERVICE COMPRESSED-AIR SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and pipe fittings.

B. Air compressor.

C. Air receiver and accessories.

D. Aftercooler.

E. Refrigerated air dryer.

F. Pressure reducing station.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 07 8400 - Firestopping.

C. Section 22 0513 - Common Motor Requirements for Plumbing Equipment.

D. Section 22 0523 - General-Duty Valves for Plumbing Piping.

E. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

F. Section 22 0553 - Identification for Plumbing Piping and Equipment: Identification of piping system.

G. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

E. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2013.

F. ASME B31.1 - Power Piping; 2014.

G. ASME B31.9 - Building Services Piping; 2014.

H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

I. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.

J. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

K. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.

L. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.

M. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.

N. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

O. NEMA ICS 4 - Application Guideline for Terminal Blocks; 2015.

P. NEMA MG 00001 - Motors and Generators; 2024.

Q. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers catalog literature with capacity, weight, and electrical characteristics and connection requirements.

C. Shop Drawings: Indicate piping system schematic with electrical characteristics and connection requirements.

D. Certificates: Provide certificate of compliance from Authority Having Jurisdiction indicating approval of air receiver.

E. Test Reports: Submit inspector's certificate for air receiver for inclusion in Operating and Maintenance Manuals.

F. Manufacturer's Instructions: Indicate manufacturer's installation instructions, hoisting and setting requirements, starting procedures.

G. Operation Data: Submit for air compressor, air receiver and accessories, after cooler, refrigerated air dryer, and pressure reducing station.

H. Maintenance Data: Submit for air compressor, air receiver and accessories, after cooler, refrigerated air dryer, and pressure reducing station.

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

J. Project Record Documents: Record actual locations of equipment and components. Modify shop drawings to indicate final locations.

1.05 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. Pressure Vessels: Comply with applicable code for installation of pressure vessels.

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

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept air compressors, refrigerated air dryer on site in factory fabricated containers with shipping skids and plastic pipe end protectors in place. Inspect for damage.

B. Protect piping and equipment from weather and construction traffic.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for reciprocating air compressors.

PART 2 PRODUCTS

2.01 PIPE AND PIPE FITTINGS

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.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), annealed.
   1. Fittings: ASME B16.26, cast bronze.
   2. Joints: Flared.

2.02 AIR OUTLETS

A. Quick Connector: 3/8 inch brass, snap on connector with self closing valve, Style A.

2.03 UNIONS AND COUPLINGS

A. Unions:

1. Ferrous Pipe: 150 psi malleable iron threaded unions.
2. Copper Tube and Pipe: 150 psi bronze unions with soldered joints.

2.04 COMPRESSOR

A. Manufacturers:
   1. Gardner Denver, Inc. (Champion); _____: www.gardnerdenver.com/#sle.
   2. Ingersoll Rand Compressed Air Solutions; _____: www.ingersollrandproducts.com/#sle.
   3. Sullair Corporation; _____: www.sullair.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Type: Simplex compressor unit consisting of air cooled compressor, air receiver, after cooler, refrigerated air dryer.

C. Screw Compressors:
   1. Unit: Direct drive, open drive, 3600 RPM, fixed compression, rotary screw compressor with control panel.
   2. Features: Differential pressure oil pump, oil separator and filter, oil charging valve, compressor bearings with ABMA STD 9, L10 life expectancy at 100,000 hours.
   3. Motor: Open drip proof flange squirrel cage induction, close coupled to compressor.
   4. Control panel: Factory mountedNEMA ICS 4 panel with starter and refrigeration controls including:
      a. Non-fused molded case disconnect switch.
      b. Single point power connection and grounding lug.
      c. Anti-recycle timer.
      d. Solid state overload relay for each compressor.
      e. Phase loss/reversal monitor.
      f. Cycle counter and hour meter per compressor.
      g. Automatic shutdown on compressor overload.
   5. Automatic Capacity Reduction: Continuously variable slide valve with infinitely variable control to 25 percent of full load.

D. Motor: Refer to Section 22 0513.

E. Controls:
   1. Pressure Switch: Line voltage contactor to break at 100 psi with minimum differential of 20 psi.
   2. Compressor Regulation: Lead-lag switch with time delay relay.
   3. Electrical Alternation: Operate each compressor for 12 hours. If one compressor fails, second shall automatically maintain air pressure.

F. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

G. Disconnect Switch: Factory mount disconnect switch in control panel.

H. Cord and Plug: Provide unit with 6 foot cord and plug for connection to electric wiring system including grounding connector.

2.05 AFTERCOOLER

A. Manufacturers:
   1. Gardner Denver, Inc. (Champion); _____: www.gardnerdenver.com/#sle.
   2. Ingersoll Rand Compressed Air Solutions; _____: www.ingersollrandproducts.com/#sle.
   3. Sullair Corporation; _____: www.sullair.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Construction: Removable tube nests of non-ferrous metal tubes and corrosion resistant tube plates, safety valves, pressure gauge, moisture separator, moisture drain valve, water inlet piping with automatic water valve, automatic condensate trap and overflow piping with open funnel.

C. Working Pressure: 135 psi.

D. Discharge: Cool air to within 12 degrees F of ambient air temperature at specified flow capacity.

2.06 AIR DRYER

A. Manufacturers:
   1. Gardner Denver, Inc. (Champion); _____: www.gardnerdenver.com/#sle.
   2. Ingersoll Rand Compressed Air Solutions; _____: www.ingersollrandproducts.com/#sle.
   3. Sullair Corporation; _____: www.sullair.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Type: Self contained mechanical refrigeration type complete with heat exchanger, refrigeration compressor, automatic controls, moisture removal trap, internal wiring and piping, and full refrigerant charge.

C. Air Connections: Inlet and outlet connections at same level, factory insulated.

D. Heat Exchangers: Air to air and refrigerant to air coils. Provide heat exchangers with automatic control system to bypass refrigeration system on low or no load condition.

E. Moisture Separator: Centrifugal type located at discharge of heat exchanger.

F. Refrigeration Unit: Hermetically sealed type to operate continuously to maintain specified 21 degrees F dew point. House unit in steel cabinet provided with access door and panel for maintenance and inspection.

G. Accessories: Air inlet temperature gauge, air inlet pressure gauge, on/off switch, high temperature light, power on light, refrigerant gauge, air outlet temperature gauge, air outlet pressure gauge.

2.07 AIR RECEIVER

A. Manufacturers:
   1. Gardner Denver, Inc. (Champion); _____: www.gardnerdenver.com/#sle.
   2. Ingersoll Rand Compressed Air Solutions; _____: www.ingersollrandproducts.com/#sle.
   3. Sullair Corporation; _____: www.sullair.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Receiver: Vertical, built to ASME regulations for working pressure of 125 psi. Flange or screw inlet and outlet connections.

C. Fittings: Adjustable pressure regulator, safety valve, pressure gauge, drain cock, and automatic float actuated condensate trap.

D. Tank Finish: Shop primed.

2.08 PRESSURE REDUCING VALVE

A. Pressure Reducing Station: Consisting of automatic reducing valve and bypass, and low pressure side relief valve and gauge. Provide oil separator where indicated.

B. Valve Capacity: Reduce pressure from 200 psi to 30 psi, adjustable upwards from reduced pressure.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Install compressor unit on vibration isolators. Level and bolt in place. Refer to Section 22 0548.

C. Make air cock and drain connection on horizontal casing.

D. Install line size gate valve and check valve on compressor discharge. Refer to Section 22 0523.

E. Install replaceable cartridge type filter silencer of adequate capacity for each compressor.

F. Place shut off valve on water inlet to aftercooler. Pipe drain to floor drain. Refer to Section 22 0523.

G. Connect condensate drains to nearest floor drain.

H. Install valved bypass around air dryer. Factory insulate inlet and outlet connections. Refer to Section 22 0523.

I. Install valved drip connections at low points of piping system. Refer to Section 22 0523.

J. Install takeoffs to outlets from top of main, with shut off valve after take off. Slope take off piping to outlets.

K. Install compressed air couplings, female quick connectors, and pressure gauges where outlets are indicated.

L. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.

M. Identify piping system and components. Refer to Section 22 0553.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.1.

C. Repair or replace compressed air piping as required to eliminate leaks, and retest to demonstrate compliance.

D. Cap and seal ends of piping when not connected to mechanical equipment.

END OF SECTION 22 1500

SECTION 22 3000
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water Heaters:
   1. Commercial gas fired.
   2. Commercial electric.

B. Packaged water heating systems.

C. Domestic water heat exchangers.

D. Domestic hot water storage tanks.

E. Diaphragm-type compression tanks.

F. Water softeners.

G. Reverse osmosis equipment.

H. In-line circulator pumps.

I. Pressure booster systems.

J. Sump pumps.

K. Sewage ejectors.

L. Cooling condensate removal pumps.

M. Sanitary Sewage Pumps:
   1. Centrifugal solids handling.

1.02 RELATED REQUIREMENTS

A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.

B. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings; 1990 (Reapproved 2008).

C. ANSI Z21.10.1 - Gas Water Heaters - Volume I - Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less; 2011.

D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2015.

E. ICC (IPC) - International Plumbing Code; 2012.

F. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

G. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Current Edition, Including All Revisions.

H. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittals procedures.

B. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements.

3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
4. Provide electrical characteristics and connection requirements.

C. Shop Drawings:
1. Indicate heat exchanger dimensions, size of tappings, and performance data.
2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

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

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

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

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

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 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: Certified by CSA International to ANSI Z21.10.1, as applicable, in addition to requirements specified elsewhere.
3. Electric Water Heaters: UL listed and labeled to UL 174.
4. Pressure Vessels for Heat Exchangers: ASME labeled to ASME BPVC-VIII-1.
5. Water Tanks: ASME labeled to ASME BPVC-VIII-1.
6. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

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

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

1.07 DELIVERY, STORAGE, AND HANDLING

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

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.01 GENERALCHEMICAL RESISTANCE OF GASKETS, SEALS AND O-RINGS:

A. Chemical resistance of Gaskets, Seals and O-rings:
1. All equipment, valves and associated components used in Potable water systems shall be resistant to Chlorine and Mono-Chloramine water treatment chemicals.

2.02 WATER HEATERS

A. Manufacturers:
1. A.O. Smith Water Products Co; _____: www.hotwater.com/#sle.
2. Bock Water Heaters, Inc; _____: www.bockwaterheaters.com/#sle.
3. Rheem Manufacturing Company; _____: www.rheem.com/#sle.

4. Substitutions: See Section 01 6000 - Product Requirements.

B. Commercial Gas Fired:
   1. Type: Automatic, natural gas-fired, vertical storage.
   2. Performance:
      a. Energy Factor: ___.
      b. Storage Capacity: ____ gal.
      c. First Hour Rating: ____ gal.
      d. Input: ____ Btuh at sea level.
      e. Minimum Recovery Rate: ____ gph with 100 degrees F temperature rise.
      f. Maximum Working Pressure: 150 psig.
   3. Tank: Glass 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.
   4. Accessories:
      a. Water Connections: Brass.
      b. Dip Tube: Brass.
      c. Drain valve.
      d. Anode: Magnesium.
      e. Temperature and Pressure Relief Valve: ASME labeled.
   5. Certified For The Following Applications:
      a. Automatic storage water heater.
      b. Automatic circulating tank water heater.
      c. For operation at 180 degrees F.
      d. For operation on combustible floors.
   6. 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:
   1. Type: Factory-assembled and wired, electric, vertical storage.
   2. Performance:
      a. Energy Factor: ___.
      b. Storage Capacity: ____ gal.
      c. First Hour Rating: ____ gal.
      d. Heating Element Size: ____ kW.
      e. Number of Heating Elements: ____.
      f. Minimum Recovery Rate: ____ gph with 100 degrees F temperature rise.
      g. Maximum Working Pressure: 150 psig.
   3. Electrical Characteristics:
      a. 208 volts, three phase, 60 Hz.
      b. ____ amperes maximum fuse size.
   4. 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.
   5. 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.
   6. Accessories:
      a. Water Connections: Brass.
      b. Dip Tube: Brass.
      c. Drain valve.
      d. Anode: Magnesium.
      e. Temperature and Pressure Relief Valve: ASME labeled.

7. Controls: Ventilated control cabinet, factory-wired with solid state progressive sequencing step controller, fuses, magnetic contactors, control transformer, pilot lights indicating main power and heating steps, control circuit toggle switch, electronic low-water (probe-type) cut-off, high temperature limit thermostat, flush-mounted temperature and pressure gauges.
8. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 W/sq in.

2.03 PACKAGED WATER HEATING SYSTEMS

A. Manufacturers:
   1. Bell & Gossett, a xylem brand; _____: www.bellgossett.com/#sle.
   2. Lochinvar LLC; _____: www.lochinvar.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. System: Gas-fired direct heating boiler, circulating pump, controls, piping and valving as indicated, storage tank, all mounted on structural steel skid.

C. Boiler:
   1. Type: Gas-fired water tube boiler, with copper finned tube heat exchanger, steel jacket with glass fiber insulation.
   2. Boiler Trim: Gas burner, thermometer and pressure gauge, immersion thermostats for operating and high limit protection, 100 percent safety shut-off electric gas valve with transformer, electronic safety pilot and pilot burner, gas pressure regulator, manual gas shut-off, low water cut off, ASME rated temperature and pressure relief valve, coil relief valve, automatic boiler fill and expansion tank, draft inverter.
   3. Performance:

D. Vertical storage tank:
   1. Working Pressure: 150 psi ASME labeled.
   2. Lining: 15 mils thick epoxy lining extended through flanges and couplings.
   3. Support: Two welded tank saddles not less than 4 inches wide by 1/4 inch thick, mounted on 2 inch pipe stand with minimum four cross braced legs; sheet teflon isolation strip between tank and saddle; brass unions shall be used to make connection between tank and piping system. A valve shall be installed upstream of the union.
   4. Insulation: 3 inch glass fiber insulation with steel jacket.

E. Pump:
   1. Type: All bronze, in-line circulation pump mounted on boiler, controlled by tank mounted immersion thermostat.

F. Thermostatic Valve: Three-way, self-contained, full line size, bronze body 1/2 to 2 inches size, iron body 2-1/2 inches and over, set at 140 degrees F.

2.04 DOMESTIC WATER HEAT EXCHANGERS

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

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

C. Tubes: U-tube type with 3/4 inch diameter seamless copper tubes suitable for 125 psi working pressure.

D. Heads: Cast iron or steel, with steel tube sheets, threaded or flanged for piping connections.

E. Water Chamber and Tube Bundle: Removable for inspection and cleaning.

F. Coating: Prime coat exterior.

G. Code: ASME BPVC-VIII-1 for service pressures, ASME "U" symbol stamped on heat exchanger.

H. Shell and Tube Type: Steel shell, with threaded or flanged piping connections and necessary tappings, steel saddle and attaching U-bolts, designed for heating fluid in shell and heated fluid in tubes.

I. Accessories:
   1. Wells for temperature regulator sensor and high limit sensor at water outlet.
   2. ASME rated pressure and temperature relief valve on water outlet.
   3. ASME rated pressure relief valves from tapping on heated water side, set at 120 psig.
   4. ASME rated pressure relief valve on steam inlet on downstream side of control valve.
   5. Thermometers and pressure gauge tappings in water inlet and outlet.
   6. Vacuum breaker and pressure gauge tapping with pigtail siphon in shell.

2.05 DOMESTIC HOT WATER STORAGE TANKS

A. Manufacturers:
   1. A.O. Smith Water Products Co; _____: www.hotwater.com/#sle.
   2. Bock Water Heaters, Inc; _____: www.bockwaterheaters.com/#sle.
   3. Wessels Company; _____: www.westank.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Tank: Welded steel, ASME labeled for working pressure of 125 psig, steel support saddles, tappings for accessories, threaded connections of stainless steel, access manhole.

C. Lining: 0.024 inches self-priming polymer epoxy continued into flanged connections.

D. Openings: Up to 3 inches, copper-silicone threaded; over 4 inches, flanged; flanged collar for heat exchanger; manway fitting.

E. Accessories: Tank drain, water inlet and outlet, thermometer range of 40 to 200 degrees F, ASME pressure relief valve suitable for maximum working pressure.

2.06 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturers:
   1. Amtrol Inc; _____: www.amtrol.com/#sle.
   2. Bell & Gossett, a xylem brand; _____: www.bellgossett.com/#sle.
   3. Taco, Inc; _____: www.taco-hvac.com/#sle.
   4. Substitutions: See Section 01 6000 - 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.

D. Size: _____ inches diameter, _____ inches overall length, _____ gal capacity.

2.07 WATER SOFTENERS

A. Manufacturers:
   1. Aquapure, 3M Purification, Inc; _____: www.aquapure.com/#sle.
   2. Culligan International Company; _____: www.culligan.com/#sle.
   3. Sterling Water Treatment; _____: www.sterlingtonwatertreatment.com/#sle.

B. Performance:
   1. Softening Capacity: _____ grains.
   2. Service Flow: _____ gpm.
   3. Electrical Characteristics:
      a. ____ rated load amperes.
      b. ____ volts, single phase, 60 Hz, ____ minimum circuit ampacity.

C. Softener Tank:
   1. Glassfiber reinforced plastic tank.

D. Brine Tank:

1. Glassfiber reinforced plastic tank.

E. Microprocessor Based Control: Brass control valve cycled to regenerate from one to twelve day period.

F. Cold water in patient care facilities is not to be treated with water softeners.

2.08 REVERSE OSMOSIS EQUIPMENT

A. Manufacturers:
1. Culligan International Company; _____: www.culligan.com/#sle.
2. Marlo Incorporated; _____: www.marlo-inc.com/#sle.
3. Siemens AG; _____: www.water.siemens.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Performance and Design Requirements:
1. Influent Water Analysis:
a. Barium: _____ ppm.
b. Bicarbonate: _____ ppm.
c. Calcium: _____ ppm.
d. Carbonate: _____ ppm.
e. Chloride: _____ ppm.
f. Chlorine (Total): _____ ppm.
g. Color: _____.
h. Fluoride: _____ ppm.
i. Iron: _____ ppm.
j. Magnesium: _____ ppm.
k. Manganese: _____ ppm.
l. Nitrate: _____ ppm.
m. pH: _____.
n. Potassium: _____ ppm.
o. Silica: _____ ppm.
p. Silt Density Index (SDI): _____.
q. Sodium: _____ ppm.
r. Strontium: _____ ppm.
s. Sulfate: _____ ppm.
t. Temperature: _____ degrees F.
u. Total Dissolved Solids (TDS): _____ ppm.
v. Total Hardness: _____ ppm.
w. Turbidity: _____ NTU.
x. Water Quality: _____ ppm TDS.
2. Design Constraints:
a. Nominal Capacity: _____ gpd.
b. Recovery: _____ percent.
c. Daily Water Usage: _____ gpd.
d. Daily Hours of Water Demand: _____.
e. Motor hp: _____.
f. Operating Temperature Range: _____ degrees F.
g. Maximum Pump Operating Pressure: _____ psi.
h. Pump Flow: _____ gpm.
i. Dynamic Inlet Pressure:
1) Maximum Pressure: _____ psi.
2) Minimum Pressure: _____ psi.
j. Electrical Requirements: _____ volts, _____ phase, 60 Hz.
k. Daily Hours of Water Demand: _____.
l. Overall Size & Weight/Mass:

1) Length: _____ inch, maximum.
2) Width: _____ inch, maximum.
3) Height: _____ inch, maximum.
4) Weight/Mass: _____ pounds, maximum.

3. Effluent Water Quality: _____ ppm TDS.

C. Piping, Equipment, and Controls: Factory mounted on steel frame.
1. Pre-filter Assembly: _____.
2. Pump: _____.
3. Module Assembly: _____.
4. Plumbing Valves and Specialties:
a. Water Supply Line: _____.
b. Waste Line: _____.
c. Concentrate Return Line: _____.
d. Operating Pressures: _____.
e. Rate of Product and Waste Flow: _____.
5. Hydraulic Connections:
a. Pre-filter Inlet: _____ inch.
b. Product Water: _____ inch.
c. Concentrate Water: _____ inch.
6. Electric Controls: _____.
7. Safety Shutdown Controls: _____.
8. Electronic Controls: _____.
9. Electronic Controller: _____.
a. Indicated data via integral LED display.
1) TDS flow.
2) Feed and product flow.
3) Totalized product flow.
4) Pumping time.
5) Percent recovery.
6) Operational modes.
7) Error occurrence and description via keypad.
b. Provide a connection allowing the use of an external monitoring device for USB, RS232, or RS485 protocols.
c. Include provisions for installation of modem, telemetry service allowing the unit to record daily operating conditions, immediate email notification on system shut-down on any alarm condition, and _____.
10. TDS Monitor:
a. Remote Display: Allows user to view operation status and conditions of RO unit up to 200 ft.
b. Provide TDS monitor to track product water quality to service.

2.09 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:
1. Armstrong Fluid Technology; _____: www.armstrongfluidtechnology.com/#sle.
2. Bell & Gossett, a xylem brand; _____: www.bellgossett.com/#sle.
3. Wilo USA; www.wilo-usa.com
4. Substitutions: See Section 01 6000 - Product Requirements.

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.

G. Performance:
   1. Flow: _____ gpm, at _____ feet head.
   2. Electrical Characteristics:
      a. ____ hp.
      b. ____ volts, single phase, 60 Hz, ____ minimum circuit ampacity.

2.10 PRESSURE BOOSTER SYSTEMS

A. Manufacturers:
   1. Armstrong Fluid Technology; _____: www.armstrongfluidtechnology.com/#sle.
   2. Bell & Gossett, a xylem brand; _____: www.bellgossett.com/#sle.
   3. Wilo USA; wilo-usa.com
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. System: Packaged with two pumps, factory assembled, tested, and adjusted; shipped to site as integral unit; consisting of pumps, valves, and copper piping, with control panel assembled on fabricated steel base with structural steel framework.

C. Controls and Instruments: Locate in NEMA EN 10250 Type 1 general purpose enclosure with main disconnect interlocked with door, fused circuit for each motor, magnetic starters with three overloads, control circuit transformer with fuse protection, selector switch for each pump, low limit pressure switch, low pressure alarm light, running lights, current sensing devices, minimum run timers, manual alternation, and suction and discharge pressure gauges.

D. Lead Pump: Operate continuously with lag pump operating on system demand. Should lead pump fail to operate, next pump in sequence shall start automatically.

E. Time Delay Relay: Prevent lag pump short cycling on fluctuating demands.

F. Thermal Bleed Circuit with Solenoid Valve: Prevent overheating during low demand.

G. Low Pressure Control: Stop pump operation if incoming water pressure drops to atmospheric.

H. Pump Switch: Permit manual or automatic operation.

I. Valving: Each pump outlet combination pressure reducing and check valve to maintain constant system pressure. Provide gate or butterfly valves on suction and discharge of each pump. Provide check valve on each pump discharge.

J. Time Clock for Automatic Day-Night Changeover:
   1. Day cycle: System shall operate continuously with pressure to fixtures maintained by pressure reducing valves.
   2. Night Cycle: Pump shall operate intermittently on pressure switch located near pressure tank operating pump for pre-determined adjustable time period.

K. Performance:
   1. Flow: _____ gpm, at _____ feet head.
   2. Motors: ____ hp.
   3. Electrical Characteristics:
      a. ____ volts, single phase, 60 Hz, ____ minimum circuit ampacity.
      b. ____ amperes maximum fuse size.

2.11 SUMP PUMPS

A. Manufacturers:
   1. Armstrong Fluid Technology; _____: www.armstronfluidtechnology.com/#sle.
   2. Goulds Water Technology, a xylem brand; _____: www.goulds.com/#sle.
   3. Zoeller Company; _____: www.zoeller.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Type: Vertical centrifugal, direct connected, simplex arrangement.

C. Casing: Cast iron volute with radial clearance around impeller, inlet strainer, slide away couplings.

D. Impeller: Cast iron; open non-clog, keyed to corrosion resistant alloy steel shaft.

E. Support: Cast iron pedestal motor support on steel floor plate with gas tight gaskets.

F. Bearings: Forced grease lubricated bronze sleeve spaced maximum 48 inches and grease lubricated ball thrust at floor plate.

G. Drive: Flexible coupling to vertical, solid shaft ball bearing electric motor.

H. Sump: Steel cover plate with steel curb frame for grouting into concrete sump with inspection opening and cover, and alarm fittings.

I. Controls (Simplex): Float switch with float rod, stops, and corrosion resistant float, and separate pressure switch high level alarm with transformer, alarm bell and stand-pipe.

2.12 COOLING CONDENSATE REMOVAL PUMPS

A. Manufacturers:
   1. Franklin Electric Company; _____: www.franklin-electric.com/#sle.
   2. Liberty Pumps Inc; _____: www.libertypumps.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Construction: Commercial grade, nonferrous pump with stainless steel shaft, integral discharge check valve, integral float switch, safety switch, thermoplastic reservoir, motor assembly, and power cord with ground.

C. Safety: UL 778.

D. Performance:
   1. Flow: _____ gpm, at _____ feet head.
   2. Size: _____ inches diameter, _____ inches overall length, Reservoir Capacity: _____ gal.
   3. Electrical Characteristics:
      a. ____ hp.
      b. ____ volts, single phase, 60 Hz, ____ minimum circuit ampacity.

2.13 SANITARY SEWAGE PUMPS

A. Centrifugal Solids Handling:
   1. Manufacturers:
      a. Buffalo Pump, a subsidiary of Ampco-Pittsburgh Corporation; _____: www.buffalopumps.com/#sle.
      b. Flowserve Corporation; _____: www.flowserve.com/#sle.
      c. Hayward Gordon ULC; _____: www.haywardgordon.com/#sle.
      d. Zoeller.
      e. Substitutions: See Section 01 6000 - Product Requirements.
   2. General: Non-clogging centrifugal type suitable for pumping solids up to 3 inches in diameter without internal interstices that can collect stringy materials and solids resulting in clogging.
   3. Casing:
      a. Capable of withstanding operating pressures 50 percent greater than the maximum operating pressure.
      b. Plugged and tapped holes for draining and venting pump.
      c. Volute to consist of smooth passages.
      d. Configuration to permit removal of impeller without disturbing discharge and suction connections.
      e. Handhole to allow cleaning and inspection of pump interior.
      f. Lifting eyes to facilitate handling of pump.
   4. Impeller:

a. Design to consist of smooth passages to prevent clogging and pass fibrous or stringy material.
b. Securely keyed to shaft with locking arrangement preventing loosening by torque from either forward or reverse direction.
c. Balance statically, dynamically, and hydraulically within the operating range and to the first critical speed at 150 percent of the maximum operating speed.

5. Wearing Rings:
   a. Provide renewable wearing rings on the casing and impeller with wearing surfaces normal to the axis of rotation.
   b. Construction: Cast iron.
   c. Factory designed for simple maintenance and secured to prevent rotation.
   d. In lieu of wearing rings on impeller and casing, replaceable steel wear plates fastened to casing may be used.
6. Pump Shaft:
   a. Provide with adequate size and strength to transmit full driver horsepower with liberal safety factor.
   b. Fabricate from stainless steel.
7. Pump Shaft Sleeve:
   a. Fabricate from stainless steel.
   b. Seal joint between shaft and sleeve to prevent leakage.
   c. Stuffing Box:
      1) Factory designed for minimum 5 rings of packing with removable split type glands.
      2) Fabricate from same material as casing and water sealed.
8. Mechanical Seal System:
   a. Furnish single seals to seal pump shaft against leakage.
   b. Each seal to be held in place by its own spring system, supplemented by external liquid pressures.
   c. System to be readily removable from the shaft.
9. Bearings:
   a. Provide ball type designed to handle all thrust loads in either direction.
   b. Furnish with a L-10 life of minimum 50,000 hours as required by ABMA 9 or ABMA 11.
   c. Pumps depending only on hydraulic balance and thrust are not acceptable.
10. Lubrication:
    a. Bearing:
       1) Grease Lubricated:
          (a) Provide grease fitting of the type that prevents over-lubrication and the building up of pressure injurious to the bearings.
          (b) Provide grease tubing if fitting is not readily accessible.
11. Pump Support:
    a. Vertical Dry Pit Centrifugal Pumps: Heavy cast iron base with legs designed for maximum rigidity and balance.
12. Coupling:
    a. Provide heavy duty, flexible type, locked to the shaft.
    b. Disconnection of the coupling possible without removing the driver half or the pump half of the coupling from the shaft.
13. Performance:
    a. Flow: _____ gpm, at _____ feet lift.
    b. Motor: ____ hp, ____ volt, single phase, 60 Hz.

2.14 ELECTRICAL WORK

A. Provide electrical motor driven equipment specified complete with motors, motor starters, controls, and wiring.

B. Electrical characteristics to be as specified or indicated.

C. Furnish motor starters complete with thermal overload protection and other appurtenances necessary for the motor control specified.

D. Supply manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices not shown.

PART 3 EXECUTION

3.01 INSTALLATION

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

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

C. Domestic Water Heat Exchangers:
   1. Install domestic water heat exchangers with clearance for tube bundle removal without disturbing other installed equipment or piping.
   2. Support unit on pipe stand.
   3. Pipe relief valves and drains to nearest floor drain.
   4. Connect steam branch line from top of main. Pipe in flexible manner, pitched with steam flow, with pipe union connections. Provide steam pressure gauge at exchanger inlet.
   5. Provide steam traps and valves as indicated.
   6. Pitch shell for condensate drain to traps.

D. 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.

E. Pumps:
   1. Ensure shaft length allows sump pumps to be located minimum 24 inches below lowest invert into sump pit and minimum 6 inches clearance from bottom of sump pit.
   2. Provide air cock and drain connection on horizontal pump casings.
   3. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
   4. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.
   5. 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.

3.02 SCHEDULES

A. Water Heaters:
   1. Drawing Code:
   2. Manufacturer:
   3. Model:
   4. Input:
   5. Heating Element Size:
   6. Number of Heating Elements:
   7. Recovery:
   8. Recovery Temperature Rise:
   9. Storage Capacity:
   10. Volt/phase:

B. Domestic Water Heat Exchangers:
   1. Drawing Code:
   2. Location:
   3. Service:

4. Heating Media:
    a. Type:
    b. Entering:
    c. Leaving:
    d. Flow:
    e. Max. Head Loss:
    f. Fouling Factor:
    g. Working Pressure:
5. Heated Media:
    a. Type:
    b. Entering:
    c. Leaving:
    d. Flow:
    e. Max. Head Loss:
    f. Fouling Factor:
    g. Working Pressure:

C. Tanks:
1. Drawing Code:
2. Location:
3. Service:
4. Capacity:
5. Diameter:
6. Length:

D. Pumps:
1. Drawing Code:
2. Manufacturer:
3. Model No.:
4. Location:
5. Service:
6. Capacity:
7. Head:
8. Minimum Efficiency:
9. Seal Type:
10. Motor Size:
11. Motor volt/phase:

END OF SECTION 22 3000

SECTION 22 4000
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water closets.

B. Urinals.

C. Lavatories.

D. All-in-one lavatory system.

E. Sinks.

F. Service sinks.

G. Under-lavatory pipe supply covers.

H. Electric water coolers.

I. Drinking fountains.

J. Showers.

K. Eye wash fountains.

L. Emergency showers.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Owner-furnished fixtures.

B. Section 06 4100 - Architectural Wood Casework: Preparation of counters for sinks and lavatories.

C. Section 07 9200 - Joint Sealants: Sealing joints between fixtures and walls and floors.

D. Section 11 4000 - Foodservice Equipment: Food service sinks.

E. Section 11 5300 - Laboratory Equipment: Laboratory sinks.

F. Section 12 3600 - Countertops: Preparation of counters for sinks and lavatories.

G. Section 22 1005 - Plumbing Piping.

H. Section 22 1006 - Plumbing Piping Specialties.

I. Section 22 3000 - Plumbing Equipment.

J. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

E. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2015.

F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

G. IAPMO Z124 - Plastic Plumbing Fixtures; 2012.

H. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2009.

I. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration.; 2008.

J. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2002).

K. ASME A112.18.1 - Plumbing Supply Fittings; 2012.

L. ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures; 2013.

M. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2013.

N. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use); 2008 (R2013).

O. ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures; 2013.

P. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2011.

Q. ASME A112.19.14 - Six Liter Water Closets Equipped with Dual Flushing Device; 2013.

R. ASME A112.19.15 - Bathtub/Whirlpool Bathtubs with Pressure Sealed Doors; 2012.

S. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2004.

T. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).

U. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.

V. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between - 30 C and 30 C with a Vitreous Silica Dilatometer; 2008.

W. ASTM D785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials; 2008.

X. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

Y. IAPMO Z124 - Plastic Plumbing Fixtures; 2012.

Z. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

AA. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

BB. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

CC. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

DD. NSF 372 - Drinking Water System Components - Lead Content; 2011.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

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

1.05 QUALITY ASSURANCE

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

1.06 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.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. 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. Chemical resistance of Gaskets, Seals and O-rings:
   1. All equipment, valves and associated components used in Potable water systems shall be resistant to Chlorine and Mono-Chloramine water treatment chemicals.

2.02 REGULATORY REQUIREMENTS

A. Perform work in accordance with State and local health department regulations.

2.03 FLUSH VALVE WATER CLOSETS

A. Water Closets: Vitreous china, ASME A112.19.2, wall hung, siphon jet flush action, china bolt caps.
   1. Flush Valve: Exposed (top spud).
   2. Flush Operation: Manual metering valve.
   3. Handle Height: 44 inches or less.
   4. Supply Size: 1-1/2 inches.
   5. Outlet Size: 2 inches.
   6. Color: White.
   7. Manufacturers:
      a. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
      b. Kohler Company; _____: www.kohler.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

B. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
   1. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
   2. Metering Type: Manual Flush. Easily accessible adjustment nut.
   3. Manufacturers:
      a. Sloan Valve Company; _____: www.sloanvalve.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

C. Seats:
   1. Manufacturers:
      a. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
      b. Bemis Manufacturing Company; _____: www.bemismfg.com/#sle.
      c. Olsonite; _____: www.olsonite.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.
   2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, with cover.

D. Water Closet Carriers:
   1. Manufacturers:
      a. JOSAM Company; _____: www.josam.com/#sle.
      b. Zurn Industries, Inc; _____: www.zurn.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.04 WALL HUNG URINALS

A. Wall Hung Urinal Manufacturers:
   1. American Standard, Inc; _____: www.americanstandard-us.com/#sle.

2. Kohler Company; _____: www.kohler.com/#sle.
3. Zurn Industries, Inc; EcoVantage Z5798 High-Efficiency Urinal System: www.zurn.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
1. Flush Volume: 1.0 gallons, maximum.
2. Flush Valve: Exposed (top spud).
3. Flush Operation: Manual metering valve.
4. Trap: Integral.
5. Supply Size: 3/4 inch.
6. Outlet Size: 2 inches.

C. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
1. Sensor-Operated Type: Solenoid operator, battery powered, infrared sensor and over-ride push button.
2. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
3. Metering Type: Manual Flush. Easily accessible adjustment nut.
4. Manufacturers:
a. Sloan Valve Company; _____: www.sloanvalve.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.

D. Carriers:
1. Manufacturers:
a. JOSAM Company; _____: www.josam.com/#sle.
b. Zurn Industries, Inc; _____: www.zurn.com/#sle.
c. Substitutions: See Section 01 6000 - Product Requirements.
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. Lavatory Manufacturers:
1. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
2. Kohler Company; _____: www.kohler.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Vitreous China Wall Hung Basin: ASME A112.19.2; vitreous china wall hung lavatory, ___ by ___ inch minimum, with 4 inch high back, rectangular basin with splash lip, and soap depression.
1. Drilling Centers: 8 inch.

C. Vitreous China Counter Top Basin: ASME A112.19.2; vitreous china self-rimming counter top lavatory, ____ with drillings on 8 inch centers, soap depression, seal of putty, calking, or concealed vinyl gasket.

D. Supply Faucet Manufacturers:
1. Chicago Faucet; ____.

E. Supply Faucet: ASME A112.18.1; chrome plated combination supply fitting with open grid strainer, no aerator with maximum flow of 2.2 gallons per minute, indexed handles. 8" gooseneck spout. Chicago Faucet model 786-E29XKABCP.

F. Thermostatic Mixing Valve: Thermostatic mixing valve, ASSE 1070 listed, with combination stop, strainer, and check valves, and flexible stainless steel connectors. Provide additional check valves in both Cold and Hot water supply piping to mixing valve:
1. Manufacturers:
a. Watts Company; www.watts.com

G. Accessories:

1. Chrome plated 17 gage, 0.0538 inch brass P-trap with clean-out plug and arm with escutcheon.
2. Offset waste with perforated open strainer.
3. Tamper proof with removable key stops.
4. Flexible supplies.
5. Carrier:
    a. Manufacturers:
        1) JOSAM Company; _____: www.josam.com/#sle.
        2) Zurn Industries, Inc; _____: www.zurn.com/#sle.
        3) Substitutions: See Section 01 6000 - Product Requirements.
    b. 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 SINKS

A. Sink Manufacturers:
    1. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
    2. Kohler Company; _____: www.kohler.com/#sle.
    3. Elkay____: www.elkay.com
    4. Substitutions: See Section 01 6000 - Product Requirements.

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

C. Double Compartment Bowl: ASME A112.19.3; _____ by _____ by _____ inch outside dimensions 20 gage, 0.0359 inch thick, Type 302 stainless steel, self rimming and undercoated, with ledge back drilled for trim.
    1. Drain: 1-1/2 inch chromed brass drain.

2.07 UNDER-LAVATORY PIPE SUPPLY COVERS

A. Manufacturers:
    1. Plumberex Specialty Products, Inc; _____: www.plumberex.com/#sle.
    2. Substitutions: See Section 01 6000 - Product Requirements.

B. Basis of Design: Plumberex Specialty Products, Inc; www.plumberex.com/#sle.
    1. Under-Lavatory Covers with Snap-Lock Fasteners (Molded): Plumberex Pro-Extreme.

C. General:
    1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
    2. Exterior Surfaces: Smooth nonabsorbent with no finger recessed indentations for easy cleaning.
    3. Construction: 1/8 inch PVC with antimicrobial, antifungal and UV resistant properties.
        a. Comply with ASTM C1822 Type III for covers on accessible lavatory piping.
        b. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
        c. Comply with ICC A117.1.
        d. Thermal Resistance: R value of 0.504 or lower when tested by ASTM C177.
        e. Thermal Conductivity: K value of 0.358 or density of 21.61 pcf per ASTM C518.
        f. Microbial and Fungal Resistance for Interior and Exterior: Comply with ASTM G21.
    4. Color: High gloss white.
    5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces. No cable ties allowed.

2.08 ELECTRIC WATER COOLERS

A. Electric Water Cooler Manufacturers:
    1. Elkay Manufacturing Company; _____: www.elkay.com/#sle.

2. Haws Corporation; _____: www.hawsco.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Water Cooler: 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 gallons per hour 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 V, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.

C. Bottle Filler: Materials to match fountain.

2.09 BI-LEVEL, ELECTRIC WATER COOLERS

2.10 SERVICE SINKS

A. Service Sink Manufacturers:
1. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
2. Elkay Manufacturing Company; _____: www.elkay.com/#sle.
3. Just Manufacturing Company; _____: www.justmfg.com/#sle.
4. Zurn Industries, Inc; _____: www.zurn.com/#sle.

B. Bowl: ASME A112.19.1; 22 by 18 by 12 inch deep, porcelain enamelled (inside only) cast iron roll-rim sink, with 12 inch high back, concealed hanger, chrome plated strainer, stainless steel rim guard, cast iron P-trap with adjustable floor flange.

C. Trim: ASME A112.18.1 exposed wall type supply with cross handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.

D. Accessories:
1. 5 feet of 1/2 inch diameter plain end reinforced plastic hose.
2. Hose clamp hanger.
3. Mop hanger.
4. Wall splash guards
5. Rim Guard sink coating protection

2.11 EMERGENCY EYE WASH

A. Emergency Wash Manufacturers:
1. Chicago
2. Speakman Corporation____.: speakman.com
3. Bradley Corporation; bradleycorp.com

B. Emergency Wash: Deck mounted combination faucet and independently operated eyewash with eyewash tempering valve. Chrome plated, cast brass fixture. Eyewash complies with ANSI Z358.1, 2.6 GPM @ 30 psi includes pull handle with graphics, two aerated yellow ABS plastic spray outlets with flip-top dust caps. Faucet complies with ASME A112.18.1 CSA B 125-98. Includes 1/4 turn ceramic cartridges, adjustable center of 6" to 12", vandal resistent 4" wrist blade handles with color coded indexes. Provide Speakman SEF-1800-CA with Speakman SE-370 thermostatic mixing valve.

C. Emergency Wash: In retrofits where the standard eye wash cannot be used due to space constraints the following is allowed; Faucet mounted eyewash equal to Bradley S19-200B.

2.12 EMERGENCY SHOWERS

A. Emergency Shower Manufacturers:
1. Haws Corporation; _____: www.hawsco.com/#sle.
2. Therm-Omega-Tech, Inc; _____: www.thermomegatech.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Emergency Shower: ANSI Z358.1; wall-mounted, self- cleaning, non-clogging 8 inch diameter stainless steel deluge shower head with elbow, one inch full flow valve with pull chain and 8 inch diameter ring, one inch interconnecting fittings.

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.

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.

B. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

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.

3.08 SCHEDULES

A. Fixture Heights: Install fixtures to heights above finished floor as indicated.
   1. Water Closet:
      a. Standard: 15 inches to top of bowl rim.
      b. Accessible: 18 inches to top of seat.
   2. Water Closet Flush Valves:
      a. Standard: 11 inches min. above bowl rim.
      b. Recessed: 10 inches min. above bowl rim.
   3. Urinal:
      a. Standard: 22 inches to top of bowl rim.
      b. Accessible: 17 inches to top of bowl rim.
   4. Lavatory:
      a. Standard: 31 inches to top of basin rim.
      b. Accessible: 34 inches to top of basin rim.

5. Drinking Fountain:
    a. Child: 30 inches to top of basin rim.
    b. Standard Adult: 40 inches to top of basin rim.
    c. Accessible: 36 inches to top of spout.
6. Emergency Eye and Face Wash:
    a. Standard: 38 inches to receptor rim.

B. Fixture Rough-In
1. Water Closet (Flush Valve Type):
    a. Cold Water: 1 Inch.
    b. Waste: 4 Inch.
    c. Vent: 2 Inch.
2. Urinal (Flush Valve Type):
    a. Cold Water: 3/4 Inch.
    b. Waste: 2 Inch.
    c. Vent: 1-1/2 Inch.
3. Lavatory:
    a. Hot Water: 1/2 Inch.
    b. Cold Water: 1/2 Inch.
    c. Waste: 1-1/2 Inch.
    d. Vent: 1-1/4 Inch.
4. Sink:
    a. Hot Water: 1/2 Inch.
    b. Cold Water: 1/2 Inch.
    c. Waste: 1-1/2 Inch.
    d. Vent: 1-1/4 Inch.
5. Service Sink:
    a. Hot Water: 1/2 Inch.
    b. Cold Water: 1/2 Inch.
    c. Waste: 2 Inch.
    d. Vent: 1-1/2 Inch.
6. Drinking Fountain:
    a. Cold Water: 1/2 Inch.
    b. Waste: 1-1/4 Inch.
    c. Vent: 1-1/4 Inch.

END OF SECTION 22 4000

SECTION 22 4300
HEALTHCARE PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work includes providing new hospital plumbing fixtures and related work.

B. Fixtures include:
   1. Hand held shower heads.
   2. Bedpan rinse valves.
   3. Eyewash fountains.
   4. Eyewash/shower fountains.
   5. Thermostatic mixing valves.
   6. Wrist control lavatories.
   7. Surgeons lavatories.
   8. Single bowl sinks.
   9. Deep, double bowl sinks with drainboard.
   10. Emergency showers.
   11. Safety deluge showers.
   12. Flushing rim disposal service sinks, pedestal type.
   13. Surgeons scrub-up sinks.
   14. Automatic surgical scrub stations.
   15. Wheelchair lavatories.
   16. Specimen water closets.

C. Providing rough-in and making final plumbing connections to equipment furnished under other specification sections.

1.02 RELATED REQUIREMENTS

A. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

B. Section 11 5300 - Laboratory Equipment.

C. Section 22 0716 - Plumbing Equipment Insulation.

D. Section 22 0719 - Plumbing Piping Insulation.

E. Section 22 1005 - Plumbing Piping: Disinfection of piping.

F. Section 22 1006 - Plumbing Piping Specialties.

G. Section 22 3000 - Plumbing Equipment.

H. Section 22 4000 - Plumbing Fixtures.

I. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2009.

B. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2002).

C. ASME A112.18.1 - Plumbing Supply Fittings; 2012.

D. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2013.

E. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use); 2008 (R2013).

F. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2011.

G. ASSE 1014 - Performance Requirements for Backflow Prevention Devices for Hand-Held Showers; 2005.

H. ICC (IPC) - International Plumbing Code; 2012.

I. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

J. NSF 372 - Drinking Water System Components - Lead Content; 2011.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog sheets for fixtures, fittings, and accessories.

C. Manufacturer's Instructions: Fixture installation methods and procedures.

D. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.

E. Operation and Maintenance Manuals: Hospital plumbing fixtures.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

PART 2 PRODUCTS

2.01 GENERAL

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. Chemical resistance of Gaskets, Seals and O-rings:
   1. All equipment, valves and associated components used in Potable water systems shall be resistant to Chlorine and Mono-Chloramine water treatment chemicals.

2.02 ELECTRICAL MOTORS, CONTROLLERS, CONTACTORS, AND DISCONNECTS

A. Furnish motors, controllers, contactors, and disconnects with their respective pieces of equipment.

B. Controllers and contractors shall have a maximum of 120-volt control circuits, and auxiliary contacts for use with the controls furnished.

2.03 PLUMBING FIXTURES, FITTINGS, ACCESSORIES, AND SUPPLIES

A. Manufacturers:
   1. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
   2. Kohler Company; _____: www.kohler.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. General Requirements:
   1. Provide control stop valves on each supply to each fixture.
   2. Provide chromium-plated finish on fittings and accessories exposed to view.
   3. Fixture fittings and trim: Comply with ASME A112.18.1 and ASME A112.19.5, as applicable.
   4. Centerset faucets: Top-mounted with inlets on not greater than 4 inch centers.
   5. Separate faucets and combination supply fittings: Provide inlets on 8 inch centers.
   6. Zinc-alloy or plastic handles are not permitted for faucets and valves.
   7. Provide special roughing-in for wheelchair fixtures.
   8. Fixture dimensions specified are nominal.

C. Hand-Held Shower Head:
   1. ASME A112.18.1, adjustable spray hand-held shower head with swivel fitting, with ASSE 1014 backflow preventer.
   2. Provide pushbutton flow control.
   3. Include 60 inch minimum flexible polished stainless steel hose and in-line vacuum breaker
   4. Provide 25 inch grab bar with sliding spray holder that locks at any height, allowing use of unit as either a hand-held spray or a fixed shower head.

D. Rinse Valve, Bedpan:

1. Wall mounted self-closing hand operated mixing valve with integral stops.
2. Provide with hot and cold water volume control, elevated vacuum breaker, 4 feet of flexible hose, spray nozzle with wall hook, and loose key supply stop valves.

E. Fountain, Eyewash/Shower:
1. ANSI Z358.1, pedestal mounted, twin eyewash heads with pop-off dust covers, stainless steel receptor, 1/2 inch chrome plated copper alloy hand operated stay open ball valve, and hand spray unit.
2. Provide hand spray unit with hose guide bracket, wall mounting flange, 6 feet of coiled reinforced hose with minimum burst strength of 250 psig, noncorrosive spray head, and hand squeeze valve with hold open feature.

F. Valve, Thermostatic Mixing:
1. Thermostatic mixing valve, assembly with washout hose, for use with portable whirlpool equipment.
2. Provide thermostatic valve to maintain temperature between 70 and 110 degrees F, with a flow rate of 10 to 20 gallons a minute.
3. Manufacturers:
   a. Powers
   b. Watts Company; www.watts.com
   c. Substitutions: See Section 01 6000 - Product Requirements.

G. Lavatory, Wrist Control:
1. ASME A112.19.2, wall mounted, 20 inches long by 18 inches wide, vitreous china, slab type.
2. Provide with combination faucets with 4 inch wrist control handles, gooseneck spout with laminar flow outlet (Chicago Faucets 786-E29XKABCP), open drain with perforated strainer, angle stops, and 1-1/4 inch cast brass adjustable P-trap with tailpiece.

H. Lavatory, Surgeon's:
1. ASME A112.19.2, wall mounted, vitreous china, front overflow, 28 inches long by 20 inches wide by 3-5/8 inches deep, with integral back and instrument trays.
2. Provide with combination faucets, 4 inch wrist control handles, gooseneck spout with spray, open drain with perforated strainer, angle stops, and 1-1/4 inch cast brass adjustable P-trap with tailpiece.

I. Sink, Single Bowl:
1. ASME A112.19.3, stainless steel, Type 302, 18 gage, 0.05 inch, satin finish, countertop type, polished rim, sound dampened, 25 inches long by 22 inches wide by 7-1/2 inches deep, three faucet holes.
2. Provide with combination faucet, gooseneck spout, laminar flow outlet, 4 inch wrist control handles, cup strainer, 1-1/2 inch brass tailpiece, and 1-1/2 inch cast brass P-trap.
3. Manufacturers:
   a. Chicago Faucets series 786

J. Sink, Deep, Double Bowl without Drainboard:
1. ASME A112.19.3, stainless steel, Type 304, 18 gage, 0.05 inch, polished finish, sound dampened, ledge-back with right hand drainboard.
2. Provide with combination faucet, swing spout, laminar flow outlet, 4 inch wrist control handles, cup strainers, 1-1/2 inch brass tailpieces and 1-1/2 inch cast brass P-trap.
3. Size of sink shall be as indicated.
4. Manufacturers:

K. Sink, Deep, Double Bowl with Drainboard:
1. ASME A112.19.3, stainless steel, Type 304, 18 gage, 0.05 inch, polished finish, sound dampened, ledge-back with right hand drainboard.
2. Provide with combination faucet, swing spout, laminar flow outlet, 4 inch wrist control handles, cup strainers, 1-1/2 inch brass tailpieces and 1-1/2 inch cast brass P-trap.
3. Size of sink shall be as indicated.

L. Shower, Emergency:
   1. ANSI Z358.1; stainless steel ceiling shower with 8 inch self-cleaning head with integral flange for flush mounting.
   2. Provide with a one inch slow closing, self-closing valve operated by a heavy chain extending to and attached to the floor.
   3. The shower head shall provide not less than 25 gallons per minute at 30 pounds per square inch of pressure.

M. Shower, Deluge, Safety:
   1. ANSI Z358.1; complete combination emergency station consisting of a free-standing drench shower; self-cleaning, nonclogging eye and face wash with 1/2 inch quick opening, hand operated, copper alloy, full-flow valves; and stainless steel eye and face wash receptor with twin eyewash heads with pop-off covers.
   2. Provide a chrome-plated brass one inch stay-open ball valve operated by a stainless steel pull rod for the drench shower.

N. Sink, Service, Disposal, Flushing Rim:
   1. Vitreous china pedestal type, 20 by 20 inches, with flushing rim and siphon jet flushing action.
   2. Provide 1-1/2 inch top inlet spud and a minimum rim to floor height of 18 inches, with stainless steel rim guards on front and both sides, and elongated open-front seat.
   3. Provide ANSI large diaphragm (not less than 2.625 inches upper chamber inside diameter at the point where the diaphragm is sealed between the upper and lower chambers), nonhold open flush valve of chrome plated copper alloy, including vacuum breaker and angle (control-stop) valve with back check.

O. Scrub Station, Surgical, Automatic:
   1. Wall mounted, 14 gage, 0.0781 inch, Type 304, welded stainless steel scrub sink with 2 automatic scrub stations.
   2. Provide each station with volume regulator, thermostat controlled water temperature selector, solid state electronic timer with automatically timed scrub period, gooseneck spout with full arm wash/rinse spray, laminar flow outlet, automatic water shut-off, built-in detergent dispenser, foot controls, perforated strainer, 1-1/2 inch tailpieces, and 1-1/2 inch cast brass P-trap.
   3. Provide plastic splash shields between scrub stations.
   4. Temperature controls and timing devices: Watertight and enclosed to prevent tampering.
   5. Provide 1/2 inch lines with hot and cold water at a pressure between 20 psi and 50 psi and 120 volt, 60 hertz, single phase power to an internal junction box.

P. Lavatory, Wheelchair:
   1. ASME A112.19.2, wall mounted, vitreous china, 20 inches long by 27 inches wide, slab type.
   2. Provide with combination lavatory faucets, gooseneck spout, 4 inch wrist control handles, open drain with perforated strainer, angle stops, and 1-1/4 inch cast brass adjustable P-trap with tailpiece.

Q. Water Closet, Specimen:
   1. ASME A112.19.2, floor mounted with wax gasket, vitreous china, siphon jet, elongated bowl, and 1-1/2 inch brass top spud, elongated bowl and 1-1/2 inch back inlet spud, with concealed elongated open-front seat.
   2. Provide ANSI large diaphragm (not less than 2.625 inches upper chamber inside diameter at the point where the diaphragm is sealed between the upper and lower chambers), nonhold-open flush valve of chrome plated copper alloy, including vacuum breaker and angle (control-stop) valve with back check, with lever operator.
   3. Bowl shall be capable of receiving a full size bedpan.
   4. Seat: Elongated, of white solid plastic, open front without cover.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fixtures and accessories are of the correct type and size prior to installation.

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

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

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. Install fixtures and fittings in accordance with the manufacturer's instructions and in accordance with the applicable codes.

C. When fixtures require both hot water and cold water supplies, provide the hot water supply to the left of the cold water supply.

D. Install off-the-floor supports to comply with ASME A112.6.1M.

E. Adjust water flow rates to comply with manufacturer's rating of the fixture.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. General Requirements:
   1. Before final acceptance of the work, test each fixture as in service to demonstrate compliance with the contract requirements. Perform the following tests in addition to the tests specified in the applicable codes.
   2. Correct all defects in the work provided by the Construction Manager, and repeat the tests until the work is in compliance with contract requirements.
   3. Furnish equipment, instruments, connecting devices, and personnel for the tests.

C. Operational Tests: Upon completion and sterilization of plumbing systems, conduct operating tests to demonstrate satisfactory, functional, and operating efficiency.
   1. Submit report for each test on each fixture, including the following information:
      a. Time, date, and duration of test.
      b. Statement of conclusions, including remedial work performed to make fixtures operate satisfactorily.
      c. Operation of all fixtures and fixture trim.
      d. Operation of all valves, flush valves, and faucets.
      e. Operation of all floor and shower drains by flooding with water.
      f. Operation of vacuum breakers.
      g. Complete operation of automatic scrub station, including water temperature, water pressure, and electronic timer.

3.05 CLEANING

A. Thoroughly clean plumbing fixtures and equipment.

3.06 PROTECTION

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

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

END OF SECTION 22 4300

SECTION 22 4500
EMERGENCY PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Emergency shower.

B. Eyewash equipment.

C. Eye/face wash equipment.

D. Emergency-fixture water-tempering valves.

1.02 REFERENCE STANDARDS

A. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2009.

B. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

PART 2 PRODUCTS

2.01 GENERAL

A. Chemical resistance of Gaskets, Seals and O-rings:

1. All equipment, valves and associated components used in Potable water systems shall be resistant to Chlorine and Mono-Chloramine water treatment chemicals.

2.02 EMERGENCY SHOWER

A. Manufacturers:

1. Bradley Corporation; _____: www.bradleycorp.com/#sle.

B. ANSI Z358.1, free-standing, drench type.

C. Pipe and Fittings Material: Stainless steel.

D. Shower Head:

1. Type: Self-cleaning, non-clogging, 8 inches in diameter.

E. Valve: Full flow, self closing, quick to open using assembly-fitted manual arm-rod based hand operator.

F. Accessories:

1. Drain: Built-in for covered and enclosed showers. Piped

2.03 EYEWASH EQUIPMENT

A. Manufacturers:

1. Speakman Company; _____: www.speakman.com/#sle.

B. ANSI Z358.1, free-standing pedestal-mounted bowl with dual eye-spray head assembly.

C. Pipe and Fittings Material: Stainless steel.

D. Valve: Full flow, self close, quick to open using wide-handle manual hand operator.

E. Drain: Built-into the bowl assembly with 1-1/4 inch female outlet. Piped to Drain

2.04 EYE/FACE WASH EQUIPMENT

A. Manufacturers:

1. Speakman Company; _____: www.speakman.com/#sle.

B. ANSI Z358.1, wall-mounted bowl with dual eye-spray head assembly.

C. Product Certification: UL (DIR).

D. Tepid Supply Water Temperature: Set to 85 degrees F.

E. Water Supply Connection Size: 1/2 inch.

F. Water Discharge Flow Rate: Minimum, 3 gpm for 15 minutes.

G. Pipe and Fittings Material: PVC.

H. Valve: Full flow, self closing, quick to open thru wide-handle manual hand operator.

I. Drain: Built-into the bowl assembly with 1-1/4 inch female outlet. Piped to Drain

2.05 EMERGENCY-FIXTURE WATER-TEMPERING VALVES

A. Manufacturers:
   1. Speakman Company; _____: www.speakman.com/#sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Tepid Water Temperature: Set to 85 degrees F.

C. Valve Assembly: Thermostatic mixing (blending) type made of lead-free cast brass body with integral built-in cold water bypass (fail safe), color marked dual-scale outlet temperature gauge, integral inlet check valve, integral inlet strainer, locking-type regulator, and mounting bracket.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fixtures and accessories are of the correct type and size prior to installation.

B. Verify that deck, wall and floor finishes are prepared and ready for fixture installation.

3.02 INSTALATION

A. Install fixtures and fittings in accordance with the manufacturer's instructions.

B. Adjust water flow rates to comply with manufacturer's rating of the fixture.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Operational Tests: Upon completion and sterilization of plumbing systems, conduct operating tests to demonstrate satisfactory, functional, and operating efficiency.

3.04 CLEANING

A. Thoroughly clean plumbing fixtures and equipment.

B. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

3.05 PROTECTION

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

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

END OF SECTION 22 4500