SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section supplements all Sections of this Division and shall apply to all phases of Work specified or required to provide for the complete installation of plumbing systems. The intent of this Specification is to provide a complete plumbing system.

B. Noise and vibration control measures shall be incorporated into the plumbing design, including resilient support for plumbing lines, flexible connections for pipe work, selection of moderate plumbing fluid velocities and vibration isolation for the pumps.

1.2 REFERENCES

A. American Welding Society: AWS

1.3 SUBMITTALS

A. Submit data on pipe materials, fittings, accessories, and equipment.

B. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories.

1.4 ENVIRONMENT REQUIREMENTS

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

1.5 WARRANTY

A. Furnish one year minimum.

1.6 JOB CONDITIONS

A. Existing Conditions:

1. Existing Pipe Lines.

a. If any existing water, gas, or other pipes and appurtenances are encountered which interfere with the proper installation of new Work and which will not be used in connection with new Work, or existing systems, close such pipe in a proper manner, and if necessary, move or remove the pipes as directed by LAWA.

b. Where existing Work is to be modified, it shall be done in conformance with the Specifications. Materials used shall be same as existing unless otherwise specified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wiring Diagrams. A wiring diagram of Work not in the Plumbing Division but necessary to put equipment shown in the Plumbing Division, and shall be submitted for review as a shop drawing.

B. Access to Equipment.

1. All valves, control devices, equipment, specialties, etc. shall be located for easy access for operation, repair and maintenance. If items are concealed, provide access doors of size required for easy access to the items. Provide access doors per specification.

C. List of Materials and Equipment

1. All items of material and equipment required by this section shall bear the approval of the LAWA prior to the start of any work.

PART 3 - EXECUTION

3.1 INSTALLATION

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

B. Verify adequacies of all site utilities and points-of-connection for existing buildings and/or structures prior to bid and start of work.

END OF SECTION 22 05 00

SECTION 22 05 13 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on AC power systems up to 600V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

B. Section also includes the adjustable speed drive requirements for condenser water pumps.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in Plumbing equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 104 deg F and at altitude of 3300 feet (1000 m) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1, including applications of premium efficiency motors.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.

2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.

2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.

2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.

3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 ADJUSTABLE SPEED DRIVES

A. Manufacturer:

1. MagnaDrive Corporation.

2. Or approved equal.

B. Components:

1. Copper Conductor Rotor Assembly directly connected to the motor (input) shaft.

2. The Magnet Rotor Assembly and the Actuation Components are directly connected to the load (output) shaft. Magnets to be rare-earth type.

3. The ASD’s output is controlled by an actuator. The actuator allows the process control signal to modulate the speed or torque output of the drive. Actuator to be 110V AC with a 4 to 20 mA control signal.

4. Hubs and shrink discs.
5. Oil lubricated gear box and output shaft assembly.
6. Vertical applications to have oil lubricated thrust bearings with AFBMA 40,000 hour life and with 25,000 pounds of vertical down-thrust capacity

C. Depending on size the ASD may be air cooled or water cooled.

D. Water cooled ASDs shall have an associated cooling water skid. The cooling water skid shall have the following components:

1. Circulation pump and motor.
2. Plate heat exchanger.
3. Basket strainer.
4. Water storage tank with level indicators and spill containment.
5. Flow meter.
6. RTD temperature transmitters (supply and return).
7. Pressure gages (supply and return).
8. Localized control panel with open communication gateway to the plant DDC BAS.

E. Suitable mounting kits shall be provided depending on mounting orientation (vertical or horizontal.

F. Connect power and cooling water to meet application requirements.

2.6 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 22 05 13

SECTION 22 05 16 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flexible pipe connectors.
2. Expansion joints.
3. Flexible expansion loops.
4. Expansion compensators.
5. Pipe alignment guides.
6. Swivel joints.
7. Pipe anchors.

1.2 REFERENCES

A. General: Comply with appropriate standards.

1. American Society of Mechanical Engineers: ASME.
2. American Welding Society: AWS D1.1.

1.3 DESIGN REQUIREMENTS

A. Expansion Compensation Design Criteria:

1. Installation Temperature: 50 degrees F.
2. Domestic Hot Water: 140 degrees F.

1.4 SUBMITTALS

A. Shop Drawings: Indicate layout of piping systems, including flexible connectors, expansion joints, expansion compensators, loops, offsets, and swing joints. Submit shop drawings sealed by a registered professional engineer.

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 criteria and show calculations. Submit sizing methods calculations sealed by a registered professional engineer.

D. Manufacturer's Installation Instructions: Submit special procedures.

E. Welders' Certificate: Provide welders' certificate.

F. Operation and Maintenance Data: Submit adjustment instructions.

1.5 WARRANTY

A. Provide one-year minimum.

B. Furnish five year manufacturer warranty for leak free performance of packed expansion joints.

PART 2 - PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS

A. Manufacturers:

1. Mason Industries, Inc.
2. Metraflex Company.
3. Or Approved Equal.

B. Steel Piping:

1. Inner Hose: Carbon Steel Stainless Steel Bronze.
2. Exterior Sleeve: Double braided stainless steel bronze.
3. Pressure Rating: 200 psig WOG and 250 degrees F.
4. Maximum offset: 3/4 inch on each side of installed center line.

C. Copper Piping:

1. Inner Hose: Bronze.
2. Exterior Sleeve: Braided bronze.
3. Pressure Rating: 125 psig and 250 degrees F.
4. Maximum offset: 3/4 inch on each side of installed center line.

2.2 EXPANSION JOINTS

A. Manufacturers:

1. Mason Industries, Inc.
2. Metraflex Company.
3. Or Approved Equal.

B. Stainless Steel Bellows Type:

1. Pressure Rating: 125 psig and 250 degrees F.
2. Maximum Compression: 1-3/4 inch.
3. Maximum Extension: 1/4 inch.
4. Application: Steel piping 3 inch and smaller.

C. External Ring Controlled Stainless Steel Bellows Type:

1. Pressure Rating: 125 psig and 250 degrees F.
2. Maximum Compression: 1-1/4 inch.

3. Maximum Extension: 5/16 inch.
4. Maximum Offset: 5/16 inch.
5. Application: Steel piping 3 inch and larger.

D. Single or Double Sphere, Elbow or Flexible Compensators:
1. Body: Teflon or Neoprene and nylon.
2. Working Pressure: 125 psi.
3. Maximum Temperature: 150 degrees F.
4. Maximum Compression: 1-1/8 inch.
5. Maximum Elongation: 7/8 inch.
6. Maximum Offset: 7/8 inch.
7. Maximum Angular Movement: 30 degrees.
8. Application: Steel piping 2 inch and larger.

E. Two-ply Bronze Bellows Type:
1. Construction: Bronze with anti-torque device, limit stops, internal guides.
2. Pressure Rating: 125 psig WOG and 250 degrees F.
3. Maximum Compression: 1-3/4 inch.
4. Maximum Extension: 1/4 inch.
5. Joint: Soldered as specified in piping system.
6. Application: Copper piping.

F. Low Pressure Compensators with two-ply Bronze Bellows:
1. Working Pressure: 80 psig.
2. Maximum Temperatures: 250 degrees F.
3. Maximum Compression: 1/2 inch.
4. Maximum Extension: 5/32 inch.
5. Application: Copper or steel piping 2 inch and smaller.

G. Rubber Expansion Joints: ASTM F 1123, fabric-reinforced rubber with external control rods and complying with FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
1. Manufacturers:
   a. Flex-Weld, Incorporated / Keflex Manufacturing.
   b. Mason Industries, Inc.
   c. Metraflex Company.
2. Arch Type: Single or multiple arches.
3. Spherical Type: Single or multiple spheres.
   a. Minimum Pressure and Temperature Ratings for NPS 1-1/2 to NPS 4: 150 psig at 220 deg F.

b. Minimum Pressure and Temperature Ratings for NPS 5 and NPS 6: 140 psig at 200 deg F.

4. Material: EPDM.

5. End Connections: Full-faced, integral, steel flanges with steel retaining rings.

6. Equal to Mason Industries Vibraflex.

2.3 FLEXIBLE EXPANSION LOOPS

A. Manufacturers:

1. Flex Hose.

2. Metraflex.

3. Or Approved Equal.

B. Flexible Expansion Loops shall consist of two parallel sections of corrugated metal hose, braid and a 180 degree return bend, or three equal length sections of annular corrugated close-pitch hose with over-braid, with inlet and outlet 90 degree elbow connections.

C. Type 304 Stainless steel braids shall be used with type 321 stainless steel hose. Fitting materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings.

D. The loops shall be engineered to move in all three planes, and shall impart no thrust loads to system anchors.

E. Field fabricated loops shall not be acceptable.

2.4 ACCESSORIES

A. Pipe Alignment Guides and Anchors: 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 inch travel with weld down or bolt down anchor base.

B. Swivel Joints: Fabricated steel, Bronze, Ductile Iron or Cast steel body, double ball bearing race, field lubricated, with rubber or (Buna-N) o-ring seals.

2.5 MATERIALS FOR ANCHORS

A. Steel Shapes and Plates: ASTM A36 / A36M.

B. Bolts and Nuts: ASME B18.10 or ASTM A183, steel, hex head.

C. Washers: ASTM F844, steel, plain, flat washers.

D. Expansion Anchors

1. Smooth wall, non-self-drilling internal plug expansion type anchors constructed of AISC 12L14 steel and zinc plated in accordance with Fed. Spec. QQ-A-325 type 1, Class 3.

2. Expansion anchors shall be U.L listed.

E. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened Portland cement concrete, and tension and shear capacities appropriate for application.

1. Bonding Material: ASTM C881, Type IV, Grade 3, 2-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.

2. Stud: ASTM A307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
3. Washer and Nut: Zinc-coated steel.

F. Grout: ASTM C1107, factory-mixed and packaged, dry, hydraulic-cement, non-shrink, nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

A. Install manufactured, nonmetallic expansion joints according to FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."

B. Provide cast iron test tee expansion joints every 150 feet on vertical drainage and vent lines and where noted or required.

3.2 PIPE BEND AND LOOP INSTALLATION

A. Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Attach pipe bends and loops to anchors.

1. Steel Anchors: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Concrete Anchors: Attach by fasteners. Follow fastener manufacturer's written instructions.

3.3 SWING CONNECTIONS

A. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.

B. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.

C. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

3.4 ALIGNMENT-GUIDE INSTALLATION

A. Install guides on piping adjoining pipe expansion fittings and loops.

B. Attach guides to pipe and secure to building structure.

3.5 ANCHOR INSTALLATION

A. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.

C. Install pipe anchors according to expansion-joint manufacturer's written instructions if expansion joints are indicated.

3.6 MANUFACTURER'S FIELD SERVICES

A. Furnish inspection services by flexible pipe manufacturer's representative for final installation and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION 22 05 16

SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gate valves.
2. Ball valves.
3. Plug valves.
4. Butterfly valves.
5. Check valves.
6. Chainwheels.

1.2 REFERENCES

A. American Gas Association – AGA

B. International Association of Plumbing & Mechanical Officials – IAPMO

1.3 SUBMITTALS

A. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.

1.4 QUALITY ASSURANCE

A. For drinking water service, provide valves complying with NSF 61 State of California AB 1953 and California Plumbing Code (C.P.C.) latest approved edition.

1.5 WARRANTY

A. Furnish five year manufacturer warranty.

1.6 EXTRA MATERIALS

A. Furnish two packing kits for each size valve.

PART 2 - PRODUCTS

2.1 GATE VALVES

A. Manufacturers:

1. NIBCO Inc.

2. Crane Co.

3. Milwaukee Valve Company.

B. 2 inches and Smaller: MSS-SP-80 Class 125, bronze body, bronze trim, union bonnet, non-rising stem, hand-wheel, inside screw, solid wedge disc, alloy seat rings, threaded, or soldered or press-fit ends.

C. 2-1/2 inches and Larger: MSSP-SP-80 Class 125, cast iron body, bronze trim, bolted bonnet, non-rising stem, hand-wheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

D. Class 150, NRS, Ductile-Iron Gate Valves:

1. Manufacturers:

   a. NIBCO Inc.
   b. Crane Co.
   c. Powell Valves.

2. Description:

   a. Standard: MSS SP-70, Type I.
   b. CWP Rating: 285 psig.
   c. Body Material: ASTM A 395, ductile iron with bolted bonnet.
   d. Ends: Flanged.
   e. Trim: Bronze.
   f. Disc: Solid wedge.
   g. Packing and Gasket: Asbestos free.

E. Class 150, OS&Y, Ductile-Iron Gate Valves:

1. Manufacturers:

   a. NIBCO Inc.
   b. Crane Co.
   c. Powell Valves.

2. Description:

   a. Standard: MSS SP-70, Type I.
   b. CWP Rating: 285 psig.
   c. Body Material: ASTM A 395, ductile iron with bolted bonnet.
   d. Ends: Flanged.

e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

2.2 BALL VALVES

A. Manufacturers:

1. Milwaukee Valve Company.

2. Crane Co.

3. NIBCO Inc.

B. 2 inches and Smaller: 400 psi WOG two piece bronze body, chrome plated brass ball, full port, Teflon seats, blow-out proof stem, threaded, or soldered or press-fit ends with union, lever handle.

C. 2 inches and Smaller: Class 150, bronze, two or three piece body, type 316 stainless steel ball, full port, Teflon seats, blow-out proof stem, threaded, soldered or press-fit ends with union, lever handle.

D. Class 150, Full-Port Stainless Steel Three-Piece Ball Valves:

1. Description:

a. Threaded or socket-weld up to 2-inches, with locking mechanism.
b. WOG Rating: 1000 psig.
c. Body Design: Split body.
d. Body Material: Stainless steel ASTM A-351, grade CF8M.
e. Seats: PTFE.
f. Stem: Stainless steel ASTM A-276, Type 316.
g. Ball: Stainless steel, ASTM A-351, GRADE CF8M.
h. Port: Full.

E. Flanged Class 150, split body, full bore, stainless steel ball valve.

1. Description:

a. Flanged 2-1/2-inch up to 6-inch, with locking mechanism.
b. Split body, full bore.
c. Body Material: Stainless steel A-351 grade CF8M.
d. Seats: Virgin Teflon.
e. Stem: A-276, 316SS.
f. Ball: Stainless steel A-351 grade CF8M.
g. Port: Full.

2.3 PLUG VALVES

A. Manufacturers:

1. Nordstrom / Flowserve Corporation.

2. DeZURIK Inc.

3. Crane Co.

B. 2 inches and Smaller: MSS SP 78, Class 300, cast iron construction, round port, full pipe area, pressure lubricated, Teflon packing, threaded ends. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.

C. 2-1/2 inches and Larger: MSS SP 78, Class 300, cast iron construction, round port, full pipe area, pressure lubricated, Teflon packing, flanged ends. Furnish wrench-operated or worm gear-operated.

2.4 BUTTERFLY VALVES

A. Manufacturers:

1. Milwaukee Valve Company.

2. Crane Co.

3. NIBCO Inc.

B. 2-1/2 inches and Larger: Class 150.

1. Body: Cast or ductile iron, wafer lug or grooved ends, stainless steel stem, extended neck.

2. Disc: Nickel-plated ductile iron or Elastomer coated ductile iron.

3. Seat: Resilient replaceable EPDM.

4. Handle and Operator: 10 position lever handle. Furnish gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

2.5 CHECK VALVES

A. Horizontal Swing Check Valves:

1. Manufacturers:

a. Milwaukee Valve Company.
b. Crane Co.
c. NIBCO Inc.

2. 2 inches and Smaller: Class 150, bronze body and cap, bronze seat, Buna-N disc, solder or threaded ends.

3. 2-1/2 inches and Larger: Class 125, cast iron body, bolted cap, bronze or cast iron disc, renewable disc seal and seat, flanged ends.

4. 2-1/2 inches and Larger: Class 125, cast iron body, bronze swing disc, flanged ends, outside lever and weight.

B. Spring Loaded Check Valves:

1. Manufacturers:

a. Milwaukee Valve Company.
b. Crane Co.
c. NIBCO Inc.

2. 2 inches and Smaller: Class 250, bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat, solder or threaded ends.

3. 2-1/2 inches and Larger: Class 250, wafer style, cast iron body, bronze seat, center-guided bronze disc, stainless steel spring and screws, flanged ends.

2.6 CHAINWHEELS

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

1. Babbitt Steam Specialty Co.

2. Roto Hammer Industries.

3. Trumbull Industries.

PART 3 - EXECUTION

3.1 INSTALLATION

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

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

C. Install valves with clearance for installation of insulation and allowing access.

D. Provide access where valves and fittings are not accessible.

3.2 VALVE APPLICATIONS

A. Install shutoff and drain valves at required locations.

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

C. Install 3/4 inch gate or ball valve with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

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

E. Install spring loaded check valves on discharge side of all water pumps.

F. Install check valves on discharge of all pumps.

G. Install ball or gate valve adjacent to equipment when functioning to isolate equipment.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or gate valves.

2. Throttling Service: Butterfly or gate valves.

3. Pump-Discharge Check Valves:

   a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
   b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, resilient-seat check valves.
   c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

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

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3. For Copper Tubing, NPS 5 and Larger: Flanged ends.

4. For Steel Piping, NPS 2 and Smaller: Threaded ends.

5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.4 DOMESTIC, HOT AND COLD WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 150, nonmetallic disc.
3. Ball Valves: Three piece, full port, bronze with stainless-steel trim.
4. Bronze Lift Check Valves: Class 125, nonmetallic TFE disc.
5. Bronze Swing Check Valves: Class 150, nonmetallic TFE disc.
6. Bronze Gate Valves: Class 150, RS.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Angle Valves: Class 125.
3. Steel Ball Valves: Class 150, full-port.
4. Ductile-Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.
5. Ductile-Iron, Grooved-End Butterfly Valves: 300 CWP.
6. High-Performance Butterfly Valves: Class 150, 285 CWP.
7. Iron Swing Check Valves: Class 125, metal seats.
8. Iron Swing Check Valves with Closure Control: Class 125, lever and weight.
9. Iron, Center-Guided Check Valves: Class 125, globe, resilient seat.
10. Iron, Gate Valves: Class 125, OS&Y.

3.5 SANITARY-WASTE AND STORM-DRAINAGE VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Three piece, full port, bronze with stainless-steel trim.
3. Bronze Swing Check Valves: Class 125, nonmetallic disc.
4. Bronze Gate Valves: Class 150, RS.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.

2. Steel Ball Valves: Class 150, full port.

3. Iron Swing Check Valves: Class 125, metal seats.

4. Iron Swing Check Valves with Closure Control: Class 125, lever and weight.

5. Iron Gate Valves: Class 125, OS&Y.

6. Lubricated Plug Valves: Class 125, regular gland, threaded or flanged.

END OF SECTION 22 05 23

SECTION 22 05 29 - HANGERS & SUPPORTS FOR PLUMBING PIPING & EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Sleeves.
6. Mechanical sleeve seals.
7. Formed steel channel.
8. Firestopping relating to plumbing work.
9. Firestopping accessories.
10. Equipment bases and supports.
11. Metal framing system.
12. Fastener systems.
13. Pipe stand fabrication.
14. Pipe positioning systems.

1.2 REFERENCES

A. General: Comply with Appropriate Standards.

1. American Welding Society: AWS
2. Underwriters Laboratories Inc.: UL

1.3 SUBMITTALS

A. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and details of trapeze hangers.

B. Product Data:

1. Submit manufacturers catalog data including load capacities.
2. Submit Manufacturers preparation and installation instructions.

C. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Do not apply fire-stopping materials when temperature of substrate material and ambient air is below 60 degrees F.

B. Mold/mildew resistant Firestop materials per ASTM G21 Standard. Provide product data as evaluation for Resistance of Synthetic Polymeric Materials to Fungi.

1.5 WARRANTY

A. Provide one-year minimum.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:

1. B-Line / Cooper Industries / Eaton
2. Tolco / B-Line / Cooper Industries / Eaton.
3. PHD Manufacturing, Inc.

B. Plumbing Piping – Drainage, Waste, Vent and Storm:

1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
2. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
4. Wall Support: Welded steel bracket and wrought steel clamp.
5. Vertical Support: Steel riser clamp.
6. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
7. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

C. Plumbing Piping - Water:

1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
2. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
3. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.
5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
6. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
7. Wall Support for Pipe Sizes 4 inches and Smaller: Welded steel bracket and wrought steel clamp.
8. Wall Support for Pipe Sizes 5 inches and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
9. Vertical Support: Steel riser clamp.

10. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
11. Floor Support for Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
12. Floor Support for Pipe Sizes 6 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
13. Copper Pipe Support: Copper-plated, Carbon-steel ring.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

A. Manufacturers:
   1. B-Line / Cooper Industries / Eaton.
   2. Tolco / B-Line / Cooper Industries / Eaton.
   3. Hilti Corporation.

B. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Metal Flashing: 26 gauge thick galvanized steel.

B. Metal Counterflashing: 22 gauge thick galvanized steel.

C. Lead Flashing:
   1. Waterproofing: 5 lb./sq. ft sheet lead.
   2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet; compatible with roofing.

E. Caps: Steel, 22 gauge minimum; 16 gauge at fire resistant elements.

2.5 SLEEVES

A. Sleeves for pipe through all concrete floors and walls, all masonry walls: steel pipe or 18 gauge galvanized steel.

B. Sleeves through rated gypsum assemblies: 18 gauge galvanized steel

C. Sealant: Listed and approved type.

2.6 MECHANICAL SLEEVE SEALS

A. Manufacturers:
   1. Thunderline / Link-Seal / GPT / EnPro Industries, Inc.
   2. Or approved equal.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FORMED STEEL CHANNEL

A. Manufacturers:

1. Tolco / B-Line / Cooper Industries / Eaton.
2. Hilti Corporation.
3. Unistrut Corp / Atkore International Inc.

2.8 FIRESTOPPING

A. Manufacturers:

1. Dow Corning Corporation.
2. Hilti Corporation.
3. 3M Company.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

2.9 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

C. General:

1. Furnish UL listed products or products tested by independent testing laboratory.
2. Select products with rating not less than rating of wall or floor being penetrated.
3. Floor Penetrations subject to wet areas: prevent water from flowing floor to floor by providing W-Rating: Class 1 rating in accordance with water leakage test per UL 1479.

D. Non-Rated Surfaces:

1. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

2.10 METAL FRAMING SYSTEMS

A. Description: MFMA-3, MFMA-4, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. Tolco / B-Line / Cooper Industries / Eaton.
2. Hilti Corporation.

3. Unistrut Corp / Atkore International Inc.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.11 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. B-Line / Cooper Industries / Eaton.
b. Hilti Corporation.
c. Powers Fasteners.

2. Expansion Anchors:

a. Smooth wall, non-self-drilling internal plug expansion type.
(1) Zinc plated steel anchors – Carbon steel anchor body, nut, and washer shall have an electroplated zinc coating conforming to ASTM B633.
(2) Galvanized steel anchors – Carbon steel anchor body, nut, and washer shall be hot dipped galvanized, conforming to ASTM A153.
(3) Stainless steel anchors - Anchor body, nut, and washer shall be stainless steel conforming to F593.
b. Locate spacing and install anchors in accordance with the manufacturer's recommendations.
c. Installer to provide ICC Evaluation Service – Evaluation Reports and/or LADBS Research Reports for anchorages where applicable.

2.12 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Manufacturers:

a. ERICO International Corporation.
b. MIRO Industries, Inc.
c. Or Approved Equal.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

1. Manufacturers:

a. MIRO Industries, Inc.
b. Or Approved Equal.

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Manufacturers:

a. ERICO International Corporation.

b. MIRO Industries, Inc.
c. Portable Pipe Hangers, Inc. / also known as PHP Systems/Design.

2. Base: Stainless steel.

3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.

4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.13 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:

1. C & S Manufacturing Corporation.

2. Holdrite, Inc. / also known as Hubbard Enterprises.

3. Or approved equal.

2.14 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

B. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Obtain permission from LAWA before drilling or cutting structural members.

3.3 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated stationary pipes, NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 8.
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
    a. Inserts shall be steel, slotted type and factory-painted.
        (1) Single rod shall be equal to Anvil International Fig. 281.
        (2) Multi-rod shall be with end caps and closure strips.
        (3) Clip form nails flush with inserts.
        (4) Maximum loading including pipe, contents and covering shall not exceed 75% of rated insert capability.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
16. Supports from Steel Decks:
    a. Support piping from steel deck with metal deck ceiling bolt.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
    1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
    2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
    3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
    1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.

2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.4 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A36 / A36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.

F. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

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

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

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

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
b. NPS 4: 12 inches long and 0.06 inch thick.
c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood inserts.

6. Insert Material: Length at least as long as protective shield.

7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

N. Suspended Horizontal Piping:

1. Support piping independently from structure using heavy iron-hinged type hangers.

2. Provide electroplated solid-band hangers for 2-inch and smaller pipe.

3. Provide trapeze hangers of angles, angles bolted back-to-back, or channels to parallel lines of piping.

4. Provide wall brackets for wall-supported piping, and furnish pipe saddles for floor-mounted piping.

5. Provide supports with recommended lining for glass piping.

6. Provide supports with copper lining for uninsulated copper piping.

7. Suspend piping from inserts, using beam clamps with retaining clamp or locknut, steel fish plates, cantilever brackets or other accepted means.

8. Suspend piping by rods with double nuts.

9. Provide additional steel framing as required and accepted where overhead construction does not permit fastening hanger rods in required locations.

10. Support branch fixture water piping in chases with copper-plated metal brackets, secured to studs.

3.5 EQUIPMENT SUPPORTS

A. Mount on or support from accepted foundations and supports, all noted equipment and related piping.

B. Size, locate, and install noise and vibration isolation equipment in accordance with manufacturer's recommendations and after review.

C. Select noise and vibration isolation equipment for lowest operating speed of equipment to be isolated.

D. Ensure that lateral motion under equipment at start-up, shut-down or when unbalanced is no more than a maximum of 1/4 inch.

E. Provide corrosion resistant mounting systems when exposed to the elements and other corrosive environments. Provide hot dip galvanized metal parts of mountings (except springs and hardware). Provide cadmium-plated and neoprene-coated springs and cadmium-plated nuts and bolts.

F. Correct noise and vibration problems due to faulty equipment or poor workmanship, as directed, without additional charge to LAWA.

G. Steel Spring Type:

1. Utilize bare stable springs without restraints.
2. Provide spring with diameter not less than 80% of loaded operating height of spring.
3. Design ends of spring so that they remain parallel during and after springs are loaded to their minimum specified deflections.
4. Provide springs with 50% travel from operating deflection before reaching solid height.
5. Provide spring mounts with 1/4 inch thick waffled neoprene acoustical pad bonded to underside of base plate.

H. Provide resiliently mounted equipment bases raised to operating height with a minimum of 2 inch of clearance at bottom of base prior to installing equipment.

I. Concrete inertia blocks with adequate reinforcing steel will be provided under General Construction Work.

J. Spring-Supported, Factory-Fabricated Inertia Bases: Provide for horizontal pumps (except fire pumps), bottom-supported vertical booster pumps, jockey pumps, rotary air compressors and vacuum pumps with five horsepower and larger motors.

1. Provide concrete inertia block with factory-fabricated steel structural perimeter frame, set on roofing paper, with equipment anchor bolt templates and mounting brackets supplied by vibration control manufacturer.
2. Provide and locate under brackets, spring supports with a minimum static deflection of 1 inch and with leveling device to raise entire isolation base 2 inch above foundation.
3. Provide minimum thickness required for concrete inertia bases as follows:
    a. Motor Size 5 hp to 15 hp: 6 inch.
    b. Motor Size 20 hp to 50 hp: 8 inch.
    c. Motor Size 60 hp to 100 hp: 10 inch.
    d. Motor Size Over 100 hp: 12 inch.

K. Spring supported factory fabricated structural steel bases: Provide for vertical booster pumps suspended from floor slab above and through penetration.

1. Provide equipment rigidly bolted to spring supported reinforced structural base and isolated from suitable framed structural supports erected from floor slab.
2. Provide reinforced structural steel base constructed with structural members having depth of section not less than 1/12 span between spring mountings and supplied by vibration control manufacturer.
3. Provide a framed base to permit removal of any pump mounted on structural base.
4. Provide structural supports erected from floor slab, sized and framed to accept spring mountings and supported loads.
5. Piping in projected area of isolated structural pump base may be rigidly supported from isolated pump base.
6. Provide spring mountings designed so that they are capable of supporting equipment at fixed elevation during installation, and adjusted to provide operating clearance in mountings of 1/4 inch.

L. Center of gravity (C.G.) mounted spring inertia blocks:

1. Equipment and its driving motor shall be integrally mounted on spring-supported concrete inertia blocks.
2. Provide inertia blocks sized to provide sufficient mass so that dynamic movement of equipment block assembly will be less than 1/16 inch peak-to-peak at any connection flange. Form shall be as noted for foundations.
3. Provide blocks and spring mountings arranged to accomplish dynamically symmetrical system with respect to total C.G. of spring assembly in all three major axes.
4. Provide steel spring mountings consisting of bare stable springs arranged in pendulum configuration with built-in adjustable side snubbers, leveling device and 1/4 inch thick neoprene acoustical base pad.
5. Provide mountings with a minimum static deflection corresponding to isolation efficiency of 90% at lowest equipment operating speed.

3.6 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.7 ADJUSTING

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

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.8 FIELD QUALITY CONTROL

A. All tests shall be in accordance with the City of Los Angeles and Inspector of Record.

END OF SECTION 22 05 29

SECTION 22 05 33 - HEAT TRACING FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes heat tracing for plumbing grease waste discharge piping above and below ground with self- regulating, parallel resistance electric heating cables with temperature adjustable thermostatic controller(s) capable of maintaining at least 110°F system temperature to keep fats oil and grease (FOG) in pipes liquid and flowing to the grease interceptor:

1.2 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.

1. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.

B. Shop Drawings: For electric heating cable. Include plans, sections, details, and attachments to other work.

1. Wiring Diagrams: Line power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For electric heating cables and electronic controller(s) to include in operation and maintenance manuals.

1.3 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.

B. Installing contractor shall apply for an extended 10 years warranty from the manufacturer by making an application for the extended warranty with the manufacturer and submitting copy to LAWA within 30 days from the date of certified testing and verification of proper operation after substantial completion of the Heat Tracing System.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Provide a complete UL Listed, CSA Certified, of FM approved system, labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with ANSI/IEEE Standard 515 P515.1

PART 2 - PRODUCTS

2.1 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that are certified and warranted as a complete system, which may be incorporated into the Work include, but are not limited to, the following:

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

1. Raychem by Pentair.
2. Thermon Manufacturing Co.
3. Emerson industrial Heat Trace.

C. Heating Element: Pair of parallel No. 16 AWG, nickel-coated stranded copper bus wires embedded in cross-linked conductive polymer core, which varies heat output in response to temperature along its length with a protective braided covering of tinned copper to provide a continuous ground path, and with an outer jacket of chemically resistant fluoropolymer as required per section 427-23 of the NEC. Cable shall be capable of crossing over itself once without overheating and shall be capable of being cut to length in the field.

D. Electrical Insulating Jacket: Flame-retardant and chemically resistant fluoropolymer.

E. Cable Cover: Tinned-copper braided ground path, and fluoropolymer outer jacket with UV inhibitor.

F. Maximum Operating Temperature (Power On): 150°.

G. Maximum Exposure Temperature (Power Off): 185°.

H. Capacities and Characteristics:

1. Maximum Heat Output: 8 W/ft. to 12 W/ft.
2. Volts: 208/277V without the use of transformers.
3. Phase: single phase
4. Hertz: 60
5. Circuit Protection: 30 mA Ground fault.
6. The heater, when exposed to temperatures up to 150°, shall have power output which will continuously decrease or remain unchanged. An increase in power output with increasing temperature is unacceptable.
7. Cable shall be permanently marked with manufacturer's batch or serial number for traceability and cable jackets shall be continuously and permanently marked with manufacturer's name, catalog number, and nominal supply voltage. Temporary printing or tags are unacceptable.

2.2 HEATING CABLE CONTROLS

A. Heating cable controller shall be microprocessor based digital controller with integral 30Ma ground fault equipment protection, capable of the line temperature sensing with up to two 3-wire 100 - ohm RTDs for pipe temperature sensing and proportional control PASC capable. The controller shall monitor and remote alarm for high and low temperature, low current failure, ground fault, and have an integral auto cycle test for system integrity, 100 VAC to 277 VAC with NEMA 4X FRP enclosure, digital line sensing and control capability.

B. Temperature sensors shall be 3-wire 100 – ohm resistance detectors (RTD) mounted on the waste piping with heat reflective aluminum tape, located away from the heating cable to prevent false readings, and connected to the heat tracing controller with 20 AWG stranded tinned copper, 3 conductor shielded instrument wire.

2.3 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Labels: Refer to Division 22 Section “22 05 53 Identification for Plumbing Piping and Equipment."

C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, or labels every 10 feet on alternating side of the piping system with pressure-sensitive, permanent, waterproof, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.
3. Circuit breaker alarm to notify Building Management System if heat trace circuit is de-energized.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Install the following types of electric heating cable for the applications described:

1. Exposed waste piping, subject to clogging and drainage piping containing grease: Self-regulating and thermostatically controlled parallel-resistance heating cable.

3.3 INSTALLATION

A. Install electric heating cable across expansion, construction, and control joints according to manufacturer's written recommendations using cable protection conduit and slack cable to allow movement without damage to cable.

B. Electric Heating Cable Installation for Grease Waste for Piping:

1. Install electric heating cables after piping has been tested and before insulation is installed.
2. Install electric heating cables according to IEEE 515.1.

3. Install insulation over piping with electric cables according to Division 22 Section “22 07 00 Plumbing Insulation", or as specified in this Section.
4. Insulation for Above-Ground Heat Traced Piping: Preformed Fiberglass or Mineral Wool insulation designed for piping system, jacketed with aluminum or PVC with vapor or moisture barrier, as specified for each location.
5. Insulation for Under- Ground Heat Traced Piping: Preformed rigid Polyisocyanurate , Calcium Silicate, or Foam Glass insulation designed for piping systems with waterproof wrap and jacketed with PVC, as specified for underground applications.
6. The installing contractor shall be responsible to ensure that the selected insulation size allow sufficient room to enclose the heating cable and pipe without efficiency robbing openings or compression of insulation material.
7. Install warning tape or label every 10 feet on alternating side of the piping system on piping insulation where piping is equipped with electric heating cables.
8. Specified following temperature must be maintained using only one type cable throughout system, regardless of pipe size:
9. 110^{O}F for grease waste stoppage protection with insulation.
10. Refer to the manufacturer’s installation instructions and design guide for proper installation and layout methods. Where riser piping extends more than 30 vertical feet, obtain engineering design assistance from manufacturer. Deviations from these instructions could result in performance characteristics different than intended.
11. All installations and terminations must be made to conform to the National Electrical Code and any applicable other national or local code requirements.
12. Heating cable circuits shall be protected by a 30 mA ground- fault device in accordance with NEC Section 427-22. Circuit breakers supplying power to the heat tracing must be equipped with 30 mA ground-fault equipment protection similar to Square D Q0-EPD, or 30 mA ground-fault equipment protection shall be integral to the heat tracing cable controller(s) 5 mA GFCI should not be used as nuisance tripping may result.
13. The piping insulation shall not be installed with staples. Piping insulation jackets should be closed with tape or adhesive to avoid damage to the heating cable.
14. The General Contractor and/or the Construction Manager will coordinate with the heat trace cable installing contractor and the Electrical Contractor to ensure that the heat trace system is power connected, energized, terminated and tested by the Electrical Contractor for proper installed performance. See Division 26 – Electrical.

C. Electric Heating Cable Installation for Temperature Maintenance for Domestic Hot Water:
   1. Install electric heating cables after piping has been tested and before insulation is installed.
   2. Install insulation over piping with electric heating cables according to Division 22, Section “22 07 00 Plumbing Insulation".
   3. Install warning tape on piping insulation where piping is equipped with electric heating cables.

D. Set field-adjustable switches and circuit-breaker trip ranges.

E. Protect installed heating cables, including nonheating leads, from damage.

F. The manufacturer shall have over five years of experience with self-regulating heater cable in the grease waste protection application, and shall submit the names, locations, and telephone numbers of five projects that have used their product for five years or more. Each project shall involve at least 1,000 feet of heater cable.

G. Manufacturer shall warranty the tracing material for a period of thirty years.

3.4 CONNECTIONS

A. Grounding equipment according to Division 26 Section "26 05 27 Grounding and Bonding for Electrical Systems." Connection kit shall be factory rated NEMA 4X rated, or shall be contained in NEMA 4X rated junction boxes with approved factory warranted connection kit to prevent water ingress and corrosion. All components shall be UV stabilized.

B. Connect piping temperature sensors to the heating cable controller(s), and/or the BMS monitoring and control wiring and /or alarm notification signal wiring with shielded instrument wiring according to Division 26 Section "26 05 19 Low-Voltage Electrical Power Conductors and Cables."

3.5 FIELD QUALITY CONTROL

A. Testing: Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.

1. Test cables for electrical continuity and insulation integrity before energizing.
2. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
3. Heating cable should be tested with a 2,500 Vdc megohmeter (megger) between the heating cable bus wires and the heating cable's metallic braid. While 2,500 Vdc megger test is recommended, the minimum acceptable level for testing is 1,000 Vdc. This test should be performed a minimum of three times:
    a. While the cable is still on the reel(s), prior to installation;
    b. After installation of heating cable and completion of circuit fabrication kits (including and splice kits) but prior to installation of thermal insulation;
    c. After installation of thermal insulation but prior to installation of wall or ceiling materials.
4. The minimum acceptable level for the megger readings is 20 megohms, regardless of the circuit length.
5. Test should be witnessed by the Construction Manager for the project and the heating cable manufacturer or authorized representative. Results of the megger readings should be recorded and submitted to the Construction Manager.

B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounting cables.

C. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 22 05 33

SECTION 22 05 48 - VIBRATION & SEISMIC CONTROLS FOR PLUMBING PIPING & EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Inertia bases.
2. Vibration isolators.
3. Flexible Connectors.
4. Seismic Restraint Devices.

1.2 REFERENCES

A. Comply with appropriate standards.

1. ANSI S1.8 - Reference Quantities for Acoustical Levels.
2. ANSI S12.36 - Survey Methods for the Determination of Sound Power Levels of Noise Sources.
3. ISAT

1.3 PERFORMANCE REQUIREMENTS

A. Provide vibration isolation on motor driven equipment over 0.5 hp, plus connected piping.

B. Provide minimum static deflection of isolators for equipment as recommended by manufacturer.

C. Consider upper floor locations critical unless otherwise indicated.

D. Use concrete inertia bases for motors in excess of 40 hp and on base mounted pumps over 10 hp.

E. Maintain room maximum sound levels, in Noise Criteria (NC) as defined by ANSI S1.8.

1.4 SUBMITTALS

A. Submit data on all materials.

B. Shop Drawings: Indicate equipment bases and locate vibration isolators, with static and dynamic load on each. Indicate assembly, material, thickness, dimensional data, pressure losses, acoustical performance, layout, and connection details for sound attenuation products fabricated for this project.

C. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating, materials and dimensional data.

D. Design Data: Submit calculations indicating maximum room sound levels are not exceeded.

E. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions.

F. Manufacturer's Certificate: Certify isolators meet or exceed specified requirements.

G. Manufacturer's Field Reports: Indicate sound isolation installation is complete and in accordance with instructions.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of hangers including attachment points.

1.6 WARRANTY

A. Provide one year minimum.

PART 2 - PRODUCTS

2.1 INERTIA BASES

A. Manufacturers:

1. Mason Industries, Inc.
2. ISAT.
3. Or approved equal.

B. Structural Bases:

1. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.
2. Construction: Welded structural steel with gusset brackets, supporting equipment and motor with motor slide rails.

C. Concrete Inertia Bases:

1. Mass: Minimum of 1.5 times weight of isolated equipment.
2. Construction: Structured steel channel perimeter frame, with gusset brackets and anchor bolts, reinforced as required.
3. Connecting Point: Reinforced to connect isolators and snubbers to base.
4. Concrete: Reinforced 2,500 psi concrete minimum.
5. Minimum thickness shall be:

Motor Size (hp)	Minimum Thickness (in)
5-15	6
20-50	8
60-75	10
100-250	12
300-500	18

2.2 VIBRATION ISOLATORS

A. Manufacturers:

1. Mason Industries, Inc.
2. ISAT.

3. Or approved equal.

B. Vibration Isolator Types:

1. **Type A**: Spring isolators shall incorporate the following:

   a. Minimum diameter of 0.8 of the loaded operating height.
   b. Corrosion resistance where exposed to corrosive environment with:
      (1) Springs cadmium plated or electro-galvanized.
      (2) Hardware cadmium plated.
      (3) All other metal parts hot-dip galvanized.
   c. Reserve deflection (from loaded to solid height) of 50 percent of rated deflection.
   d. Minimum 0.25 inch thick neoprene acoustical base pad on underside, unless designated otherwise.
   e. Designed and installed so that ends of springs remain parallel and all springs installed with adjustment bolts.
   f. Non-resonant with equipment forcing frequencies or support structure natural frequencies.
   g. Spring isolators to be Mason Type SLF, or as approved equal.
   h. This isolator must be accompanied by seismic isolator Type II.

2. **Type B**: Spring isolators shall be same as Type A, except:

   a. Provide built-in vertical limit stops with minimum 0.25 inch clearance under normal operation.
   b. Tapped holes in top plate for bolting to equipment when subject to wind load.
   c. Capable of supporting equipment at a fixed elevation during equipment erection. Installed and operating heights shall be identical.
   d. Adjustable and removable spring pack with separate neoprene pad isolation.
   e. Housing shall be designed to accept 1.0g of acceleration.
   f. Mason Type SLR, or as approved equal

3. **Type C**: Spring hanger rod isolators shall incorporate the following:

   a. Spring element seated on a steel washer within a neoprene cup incorporating a rod isolation bushing.
   b. Steel retainer box encasing the spring and neoprene cup.
   c. Requires seismic restraint Type III.
   d. Mason Type HS or as approved equal.

4. **Type F**: Combination spring/elastomer hanger rod isolators to incorporate the following:

   a. Spring and neoprene isolator elements in a steel box retainer. Neoprene of double deflection type. Single deflection is unacceptable. Spring seated in a neoprene cup with extended rod bushing.
   b. Characteristics of spring and neoprene as describe in Type A and Type E isolators.
   c. Requires seismic restraint Type III.
   d. Mason Type 30N or as approved equal

5. **Type J**: Rail type spring isolators:

a. Rail type spring isolators shall provide steel members of sufficient strength to prevent flexure with equipment operation.
b. Springs shall be the same as Type A with seismic restraint Type II or seismic restraint Type I or IV isolation.
c. Mason Type ICS or as approved equal.

6. **Type K**: Pipe anchors:

a. Vibration isolator manufacturer shall provide an all directional acoustical pipe anchor, consisting of a telescopic arrangement of two sizes of steel tubing separated by a minimum half inch thickness of heavy duty neoprene and duck or neoprene isolation material.
b. Vertical restraints shall be provided by similar material arranged to prevent vertical travel in either direction.
c. Allowable loads on the isolation material shall not exceed 500 psi and the design shall be balanced for equal resistance in any direction.
d. Mason Type ADA or as approved equal

2.3 FLEXIBLE CONNECTORS

A. Elastomer Type FC-1

1. Manufactured of nylon tire cord and EPDM both molded and cured with hydraulic presses.
2. Straight connectors shall have two spheres reinforced with a molded-in external ductile iron ring between spheres.
3. Elbow shall be long radius reducing type.
4. Rated 250 psi at 170 degrees F dropping in a straight line to 170 psi at 250 degrees F for sizes 1-1/2 inch to 12 inch elbows. Elbows shall be rated no less than 90 percent of straight connections.
5. Sizes 10 inches to 12 inches to employ control cables with neoprene end fittings isolated from anchor plates by means of 0.5 inch bridge bearing neoprene bushings.
6. Minimum safety factor, 4 to 1 at maximum pressure ratings.
7. Submittals shall include test reports.
8. Mason Type MFTNC Superflex or as approved equal.

B. Flexible Stainless Hose, Type FC-2

1. Braided flexible metal hose.
2. 2 inch pipe size and smaller with male nipple fittings.
3. 2-1/2 inch and larger pipe size with fixed steel flanges.
4. Suitable for operating pressure with 4 to 1 minimum safety factor.
5. Length as required.
6. Mason Type BSS or as approved equal.

2.4 VIBRATION ISOLATION EQUIPMENT BASES

A. Manufacturers:

1. ISAT.
2. Mason Industries, Inc.
3. Or approved equal.

B. Type B1: Integral Structural Steel Base

1. Reinforced, as required, to prevent base flexure at start up and misalignment of drive and driven units. Centrifugal fan bases complete with motor slide rails. Drilled for drive and driven unit mounting template.
2. Mason Type M, WF or as approved equal.

C. Type B2: Concrete Inertia Base

1. Concrete inertia bases shall be formed in a structural steel perimeter base, reinforced as required to prevent flexure, misalignment of drive and driven unit or stress transferal into equipment. The base shall be complete with motor slide rails, pump base elbow supports, and complete with height saving brackets, reinforcing, equipment bolting provisions and isolators.
2. Minimum thickness of the inertia base shall be according to the following tabulation:

Motor Size (hp)	Minimum Thickness(in)
5-15	6
20-50	8
60-75	10
100-250	12
300-500	18

3. Mason Type K, BMK or as approved equal.

2.5 SEISMIC RESTRAINT DEVICES

A. Type I: Spring Incorporating Seismic Restraint

1. Shall comply with general characteristics of spring isolators.
2. Shall have vertical restraints and are capable of supporting equipment at fixed elevation during equipment erection. Vertical restraint shall be separate from equipment load support.
3. Shall incorporate seismic snubbing restraint in all directions at specified acceleration loadings.
4. Mason Type SSLR or as approved equal.

B. Type II: Stationary Seismic Restraint

1. Each corner or side seismic restraint shall incorporate minimum 5/8" thick pad limit stops. Restraints shall be made of plate, structural members or square metal tubing in a welded assembly, incorporating resilient pads. Angle bumpers are not acceptable. System to be field bolted to deck with minimum 1.0g acceleration capacity.
2. Seismic spring mountings as described above are an acceptable alternative providing all seismic loading requirements are met.
3. Mason Industries Type Z 1011, Type Z 1225 or as approved equal.

C. Type III: Cable Seismic Restraint,

1. Metal cable type with approved end fastening devices to equipment and structure. System to be field bolted to deck or overhead structural members or deck with aircraft cable and clamps as per ISAT guidelines or as approved equal.

D. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by LARR or an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

E. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

F. Restraint Cables: ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

G. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

H. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

I. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

J. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

K. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ICC-ES per ACI 318 appendix D which are qualified for seismic zones, and have LARR number or approval by another agency acceptable to authorities having jurisdiction. Minimum length of eight times diameter.

L. Adhesive Anchor Bolts: Adhesive anchor bolts are not permitted where seismic restraint is required. Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ICC-ES per ACI 318 appendix D which are qualified for seismic zones and have LARR number or approval by another agency acceptable to authorities having jurisdiction.

2.6 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install isolation for motor driven equipment.

B. Bases:

1. Set steel bases for 1 inch clearance between housekeeping pad and base.
2. Set concrete inertia bases for 2 inch clearance between housekeeping pad and base.

C. Adjust equipment level.

D. Install spring hangers without binding.

E. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

F. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

G. Provide pairs of horizontal limit springs on fans with more than 6.0 inch static pressure, and on hanger supported, horizontally mounted axial fans.

H. Provide resiliently mounted equipment and piping with seismic snubbers. Provide each inertia base with minimum of four seismic snubbers located close to isolators. Snub equipment designated for post disaster use to 0.05 inch maximum clearance. Provide other snubbers with clearance between 0.15 inch and 0.25 inch.

I. Support piping connections to isolated equipment resiliently as follows:

1. Up to 4 inch Diameter: First three points of support.
2. 5 to 8 inch Diameter: First four points of support.
3. 10 inch Diameter and Over: First six points of support.
4. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an LA Research Report or an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:

1. Install seismic snubbers on plumbing equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inches.
3. Install seismic-restraint devices using methods approved by LA Research Reports or an agency acceptable to authorities having jurisdiction providing required submittals for component.
4. All equipment whether isolated or not, shall be bolted to structure to allow for minimum 0.5g of acceleration. Bolt points and diameter of inserts shall be submitted and verified as part of the contractor's submission for each piece of equipment and certified by a licensed civil or structural engineer.
5. All structurally suspended overhead equipment isolated or non-isolated shall be four point independently braced within Type III seismic restraining system.
6. Where base anchoring is insufficient to resist seismic forces, supplementary restraining such as seismic restraint system Type III shall be used above systems center of gravity to suitably resist "g" force levels. Vertically mounted tanks may require this additional restraint.
7. All anchor bolts and tie-ins to structure shall be designed per the Airport Structural Design Standards.

B. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet at turns of more than 4 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.
4. Install Seismic Restraining System Type III: Taut for overhead suspended non-isolated equipment, piping and slack with 0.5 inch cable deflection for isolated systems.
5. Seismically restrain all piping with Type III restraining system in accordance with guideline as outlined below.
6. Seismic restraints are not required for the following (this does not apply to any life safety or high hazard equipment):

a. Gas piping less than 1 inch I.D.
b. Piping in Boiler and Mechanical Equipment rooms less than 1-1/4 inch I.D.
c. All other piping less than 2-1/2 I.D.
d. All piping suspended by individual hangers 12 inches in length or less from the top of the pipe to the bottom of the support for the hanger.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install seismic-restraint devices using methods approved by LA Research Reports or an agency acceptable to authorities having jurisdiction providing required submittals for component.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

H. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Set anchors to manufacturer's recommended torque, using a torque wrench.

5. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 SEISMIC RESTRAINTS FOR NON-ISOLATED EQUIPMENT

A. All ceiling suspended piping not excluded by diameter or distance required from support: Seismic Restraint Type III.

B. All ceiling mounted equipment: Seismic Restraint Type III.

C. All floor mounted equipment, including but not limited to tanks, domestic water heaters, etc.: Seismic Restraint Type V.

3.5 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements for piping flexible connections.

3.6 FIELD QUALITY CONTROL

A. Inspect isolated equipment after installation and submit report. Include static deflections.

B. After start-up, final corrections and balancing of systems take octave band sound measurements over full audio frequency range in areas adjacent to plumbing equipment rooms, duct and pipe shafts, and other critical locations. Provide one-third octave band measurements of artificial sound sources in areas indicated as having critical requirements. Submit complete report of test results including sound curves.

C. Furnish services of testing agency to take noise measurement. Use meters meeting requirements of ANSI S1.4.

3.7 PLUMBING VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE SCHEDULE

A. Supported or Suspended Equipment:

1. Pads:

a. Material: Neoprene.
b. Thickness: 0.5 inch.

Type of Equipment	**Below Grade**		**Above Grade**	
	Isolation Type	**Deflection**	**Isolation Type**	**Deflection**
Heat Exchangers	D	0.4 inch	B and Base Type B-1	1 inch
Pumps up to 15 HP	D-J	0.4 inch	B or SR Type I and Base Type J	1 inch
All Piping	Type I and SR Type III	1 inch	Type I and SR Type III	2 inches
Piping Flexible Connectors for Pumps	FC-1	--	FC-1	--

END OF SECTION 22 05 48

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Stencils.
4. Pipe markers.
5. Ceiling tacks.
6. Labels.
7. Lockout devices.
8. Warning Signs and Labels.
9. Warning Tag.

1.2 REFERENCES

A. American Society of Mechanical Engineers: ASME

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

1.3 SUBMITTALS

A. Product Data: Submit manufacturers catalog literature for each product required.

B. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:

1. Craftmark Pipe Markers
2. Safety Sign Company.
3. Seton Identification Products / Tricor Direct / Brady Corporation.
4. Kolbi Pipe Marker Company.

B. Product Description: Laminated three-layer plastic with engraved white letters on blue contrasting background color.

1. Plastic Labels for Equipment:

a. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

b. Letter Color: White.
c. Background Color: Blue.
d. Maximum Temperature: Able to withstand temperatures up to 180 deg F.
e. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
f. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
g. Fasteners: Stainless-steel rivets or self-tapping screws.
h. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Metal Labels for Equipment:

1. Material and Thickness: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless-steel rivets or self-tapping screws.

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

2.2 TAGS

A. Plastic Tags:

1. Manufacturers:

a. Seton Identification Products / Tricor Direct / Brady Corporation.
b. Brady Worldwide Inc.
c. Kolbi Pipe Marker Company.

2. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum: 2 inches square.

B. Metal Tags:

1. Manufacturers:

a. Seton Identification Products / Tricor Direct / Brady Corporation.
b. Brady Worldwide Inc.
c. Kolbi Pipe Marker Company.

2. Stainless steel, 0.025” min. thickness and having predrilled holes or stamped roles for attachment hardware, with stamped or engraved letters. Tag size minimum: 2 inches square, with finished edges.

2.3 STENCILS

A. Manufacturers:

1. Seton Identification Products / Tricor Direct / Brady Corporation.
2. Brady Worldwide Inc..
3. Kolbi Pipe Marker Company.

B. Stencils: With clean cut symbols and letters of following size:

1. Up to 2 inches Outside Diameter of Insulation or Pipe: 3/4 inch high letters.
2. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1 ¼ inch high letters.
3. Over 6 inches Outside Diameter of Insulation or Pipe: 2 1/2 inch high letters.
4. 10 inch and above of insulation or pipe: 3 ½ inches high letters.
5. Equipment: 1-3/4 inch high letters.

C. Stencil Paint: Semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers:

1. Manufacturers:
   a. Seton Identification Products / Tricor Direct / Brady Corporation.
   b. Brady Worldwide Inc..
   c. Kolbi Pipe Marker Company.
2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers:

1. Manufacturers:
   a. Seton Identification Products / Tricor Direct / Brady Corporation.
   b. Brady Worldwide Inc..
   c. Kolbi Pipe Marker Company.
2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Plastic Underground Pipe Markers:

1. Manufacturers:
   a. Seton Identification Products / Tricor Direct / Brady Corporation.
   b. Brady Worldwide Inc..
   c. Kolbi Pipe Marker Company.
2. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.5 CEILING TACKS

A. Manufacturers:

1. Seton Identification Products / Tricor Direct / Brady Corporation.
2. Brady Worldwide Inc..
3. Kolbi Pipe Marker Company.

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

C. Color code as follows:

1. Plumbing valves: Green.

2.6 LABELS

A. Manufacturers:

1. Seton Identification Products / Tricor Direct / Brady Corporation.
2. Brady Worldwide Inc..
3. Kolbi Pipe Marker Company.

B. Description: Stainless steel, size 2 ½ x 3/4 inches, adhesive backed with printed identification and bar code.

2.7 LOCKOUT DEVICES

A. Lockout Hasps:

1. Manufacturers:

a. Seton Identification Products / Tricor Direct / Brady Corporation.
b. Brady Worldwide Inc..
c. Kolbi Pipe Marker Company.

2. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

B. Valve Lockout Devices:

1. Manufacturers:

a. Seton Identification Products / Tricor Direct / Brady Corporation.
b. Brady Worldwide Inc..
c. Kolbi Pipe Marker Company.

2. Steel device preventing access to valve operator, accepting lock shackle.

2.8 WARNING SIGNS & LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 180 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater

viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.9 WARNING TAG

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.

2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Apply stencil painting.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

E. Install tags using corrosion resistant chain. Number tags consecutively by location.

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

G. Identify water heaters, pumps, tanks, and water treatment devices with stencil painting. Identify in-line pumps and other small devices with tags.

H. Identify control panels and major control components outside panels with plastic nameplates.

I. Identify valves in main and branch piping with tags.

J. Identify piping, concealed or exposed, with plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. 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.

K. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.2 PIPE LABEL INSTALLATION

A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, maintenance holes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 10 feet along each run.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
8. Where removable ceiling tiles are provided, install buttons, tabs, or markers to identify location of concealed work and/or valves.

C. Pipe Label Color Schedule:

1. Domestic Water Piping:
   a. Background Color: Blue.
   b. Letter Color: White.
2. Sanitary Waste and Storm Drainage Piping:
   a. Background Color: Yellow.
   b. Letter Color: Black.

3.3 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:
   a. Cold Water: 2 inches, round.
   b. Hot Water: 2 inches, round.
2. Valve-Tag Color:
   a. Cold Water: Blue.
   b. Hot Water: Red.

3. Letter Color:

   a. Cold Water: White.
   b. Hot Water: White.

3.4 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53

SECTION 22 07 00 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plumbing piping insulation, jackets and accessories.
2. Plumbing equipment insulation, jackets and accessories.

1.2 REFERENCES

A. Comply with appropriate standards.

1. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
2. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
3. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
4. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
5. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Product Data: Submit product description, thermal characteristics and list of materials and thickness and jackets for each service, and location.

B. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

1.4 QUALITY ASSURANCE

A. Mockup: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by LAWA. Use materials indicated for the completed Work.

1. Piping Mockups:
    a. One 10-foot section of NPS 2 straight pipe.
    b. One each of a 90-degree threaded, welded, and flanged elbow.
    c. One each of a threaded, welded, and flanged tee fitting.
    d. One NPS 2 or smaller valve, and one NPS 2-1/2 or larger valve.
    e. Four support hangers including hanger shield and insert.
    f. One threaded strainer and one flanged strainer with removable portion of insulation.
    g. One threaded reducer and one welded reducer.
    h. One pressure temperature tap.
    i. One mechanical coupling.

2. Equipment Mockups: One tank or vessel.
3. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
4. Notify LAWA seven days in advance of dates and times when mockups will be constructed.
5. Obtain LAWA's approval of mockups before starting insulation application.
6. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless LAWA specifically approves such deviations in writing.
7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
8. Demolish and remove mockups when directed.

1.5 WARRANTY

A. Furnish one-year minimum.

B. Furnish five-year manufacturer warranty for manmade fiber.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:

1. Knauf Insulation
2. Johns Manville.
3. Owens-Corning.

2.2 PIPE INSULATION

A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation. Conform to ASTM C795 for application on Austenitic stainless steel.

1. Thermal Conductivity: 0.23 at 75 degrees F.
2. Operating Temperature Range: 0 to 850 degrees F.
3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
4. Jacket Temperature Limit: minus 20 to 150 degrees F.

B. TYPE P-2: ASTM C547, molded glass fiber pipe insulation. Conform to ASTM C795 for application on Austenitic stainless steel.

1. Thermal Conductivity: 0.23 at 75 degrees F.
2. Operating Temperature Range: 0 to 850 degrees F.

C. TYPE P-3: ASTM C612; semi-rigid, fibrous glass board noncombustible, end grain adhered to jacket. Conform to ASTM C795 for application on Austenitic stainless steel.

1. Thermal Conductivity: 0.27 at 75 degrees F.

2. Operating Temperature Range: 0 to 650 degrees F.
3. Vapor Barrier Jacket: ASTM C1136, Type II, factory applied reinforced foil kraft with self-sealing adhesive joints.
4. Jacket Temperature Limit: minus 20 to 150 degrees F.

D. TYPE P-4: ASTM C612; semi-rigid, fibrous glass board noncombustible. Conform to ASTM C795 for application on Austenitic stainless steel.
1. Thermal Conductivity: 0.27 at 75 degrees F.

E. TYPE P-5: ASTM C534, Type I, Grade 2, flexible, closed cell elastomeric insulation, tubular.
1. Thermal Conductivity: 0.27 at 75 degrees F.
2. Operating Temperature Range: Minus 70 to 180 degrees F.

F. TYPE P-6: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
1. Thermal Conductivity: 0.30 at 75 degrees F.
2. Maximum Service Temperature: 300 degrees F.
3. Operating Temperature Range: Minus 58 to 300 degrees F.

G. TYPE P-7: ASTM C534, Type I, flexible, non-halogen, closed-cell elastomeric insulation, tubular.
1. Thermal Conductivity: 0.27 at 75 degrees F.
2. Maximum Service Temperature: 250 degrees F.
3. Operating Temperature Range: Minus 58 to 250 degrees F.

H. TYPE P-8: ASTM C547, Type I or II, mineral fiber preformed pipe insulation, noncombustible.
1. Thermal Conductivity: 0.23 at 75 degrees F.
2. Maximum Service Temperature: 1200 degrees F.
3. Canvas Jacket: UL listed, 6 oz/sq yd, plain weave cotton fabric treated with fire retardant lagging adhesive.

I. TYPE P-9: ASTM C591, Type IV, ASTM C1289, polyisocyanurate foam insulation, formed into shapes for use as pipe insulation.
1. Density: 4.0 pounds per cubic foot.
2. Thermal Conductivity: 180 day aged value of 0.19 at 75 degrees F.
3. Operating Temperature Range: Minus 297 to 300 degrees F.
4. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied film of 4 mils thickness and water vapor permeance of 0.02 perms.

J. TYPE P-10: ASTM C578, Type XIII, extruded polystyrene insulation, formed into shapes for use as pipe insulation.
1. Thermal Conductivity: 180 day aged value of 0.259 at 75 degrees F.
2. Operating Temperature Range: Minus 297 to 165 degrees F.

3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied film of 4 mils thickness and water vapor permeance of 0.02 perms.

K. TYPE P-11: ASTM C533; Type I, hydrous calcium silicate pipe insulation, rigid molded white; asbestos free.

1. Thermal Conductivity: 0.45 at 200 degrees F.
2. Operating Temperature Range: 140 to 1200 degrees F.

2.3 PIPE INSULATION JACKETS

A. Vapor Retarder Jacket:

1. ASTM C921, ASTM C1136, white Kraft paper with glass fiber yarn, bonded to aluminized film.
2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.

B. PVC Plastic Pipe Jacket:

1. Product Description: ASTM D1785, one piece molded type fitting covers and sheet material, off-white color.
2. Thickness: 30 mil.
3. Connections: Brush on welding adhesive with VOC content of 50 g/l according to CFR 59, Subpart D (EPA Method 24).

C. ABS Plastic Pipe Jacket:

1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
2. Minimum service temperature: -40 degrees F.
3. Maximum service temperature of 180 degrees F.
4. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.
5. Thickness: 30 mil.
6. Connections: Brush on welding adhesive.
7. Connections: Brush on welding adhesive with VOC content of 50 g/l according to CFR 59, Subpart D (EPA Method 24).

D. Aluminum Pipe Jacket:

1. ASTM B209.
2. Thickness: 0.020 inch thick sheet.
3. Finish: Smooth Embossed.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.2 inch thick die shaped fitting covers with factory attached protective liner.
6. Metal Jacket Bands: 1/2 inch wide; 0.015 inch thick aluminum. 0.020 inch thick stainless steel.

E. Stainless Steel Pipe Jacket:

1. ASTM A240 / A240M OR ASTM 666 Type 304 stainless steel.

2. Thickness: 0.016 inch thick.
3. Finish: Smooth.
4. Metal Jacket Bands: 1/2 inch wide; 0.020 inch thick stainless steel.

F. Field Applied Glass Fiber Fabric Jacket System:

1. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
2. Glass Fiber Fabric:
   a. Cloth: Untreated; 9 oz/sq yd weight.
   b. Blanket: 1.0 lb/cu ft density.
3. Indoor Vapor Retarder Finish:
   a. Cloth: Untreated; 9 oz/sq yd weight.
   b. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.4 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

D. Piping 2 inches diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.

E. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum single piece construction with closure. Thickness to match pipe insulation.

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

G. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449 / C449M.

H. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.

I. Adhesives: Compatible with insulation.

2.5 EQUIPMENT INSULATION

A. TYPE E-1: ASTM C553; glass fiber, flexible or semi-rigid, noncombustible.

1. Thermal Conductivity: 0.24 at 75 degrees F.
2. Operating Temperature Range: 0 to 450 degrees F.
3. Density: 1.65 pound per cubic foot.

B. TYPE E-2: ASTM C612; glass fiber, rigid board, noncombustible with factory applied kraft reinforced aluminum foil jacket.

1. Thermal Conductivity: 0.24 at 75 degrees F.
2. Operating Temperature Range: 0 to 450 degrees F.
3. Density: 3.0 pound per cubic foot.
4. Jacket Temperature Limit: minus 20 to 150 degrees F.

C. TYPE E-3: ASTM C612; semi-rigid, fibrous glass board noncombustible, end grain adhered to jacket.

1. Thermal Conductivity: 0.27 at 75 degrees F.
2. Operating Temperature Range: 0 to 650 degrees F.
3. Vapor Barrier Jacket: ASTM C1136, Type II, factory applied reinforced foil kraft with self-sealing adhesive joints.
4. Jacket Temperature Limit: minus 20 to 150 degrees F.

D. TYPE E-4: ASTM C612; semi-rigid, fibrous glass board noncombustible.

1. Thermal Conductivity: 0.27 at 75 degrees F.
2. Operating Temperature Range: 0 to 650 degrees F.

E. TYPE E-5: ASTM C612manmade mineral fiber, noncombustible, Classes 1-4.

1. Thermal Conductivity: 0.25 at 100 degrees F.
2. Maximum Service Temperature: 1200 degrees F.
3. Density: 4 pound per cubic foot.

2.6 EQUIPMENT INSULATION JACKETS

A. PVC Plastic Equipment Jacket:

1. Product Description: ASTM D1785, sheet material, off-white color.
2. Minimum Service Temperature: -40 degrees F.
3. Maximum Service Temperature: 150 degrees F.
4. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.
5. Thickness: 30 mil.
6. Connections: Brush on welding adhesive with VOC content limits per agency having jurisdiction.

B. Aluminum Equipment Jacket:

1. ASTM B209.
2. Thickness: 0.020 inch thick sheet.
3. Finish: Embossed.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.02 inch thick die shaped fitting covers with factory attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum. 0.020 inch thick stainless steel.

C. Canvas Equipment Jacket: UL listed, 6 oz/sq yd, plain weave cotton fabric with fire retardant lagging adhesive compatible with insulation.

D. Vapor Retarder Jacket:

1. ASTM C921, ASTM C1136, white Kraft paper with glass fiber yarn, bonded to aluminized film.

2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.

E. Field Applied Glass Fiber Fabric Jacket System:

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

2. Glass Fiber Fabric:

a. Cloth: Untreated; 9 oz/sq yd weight.
b. Blanket: 1.0 lb/cu ft density.

3. Indoor Vapor Retarder Finish:

a. Cloth: Untreated; 9 oz/sq yd weight.
b. Vinyl emulsion type acrylic, compatible with insulation, black white color.

2.7 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.

1. Manufacturers:

a. Childers / H.B. Fuller Construction Products, Inc; CP-97.
b. Foster / H.B. Fuller Construction Products, Inc; 81-27/81-93.
c. Marathon Industries / Eagle Bridges Company; 290.

2. For indoor applications, use adhesive that has a VOC content limits per agency having jurisdiction.

C. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers / H.B. Fuller Construction Products, Inc; CP-96.
b. Foster / H.B. Fuller Construction Products, Inc; 81-33.

2. Calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Flexible Elastomeric & Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Manufacturers:

a. Aeroflex USA Inc.; Aeroseal.
b. Armacell LLC; 520 Adhesive.
c. Foster / H.B. Fuller Construction Products, Inc; 85-75.

2. For indoor applications, use adhesive that has a VOC content limits per agency having jurisdiction.

E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers:

a. Childers / H.B. Fuller Construction Products, Inc; CP-82.
b. Foster / H.B. Fuller Construction Products, Inc; 85-20.

c. Marathon Industries / Eagle Bridges Company; 225.

2. For indoor applications, use adhesive that has a VOC content limits per agency having jurisdiction.

F. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Manufacturers:

a. Childers / H.B. Fuller Construction Products, Inc; CP-82.
b. Foster / H.B. Fuller Construction Products, Inc; 85-20.
c. Marathon Industries / Eagle Bridges Company; 225.

2. For indoor applications, use adhesive that has a VOC limits per agency having jurisdiction.

G. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Manufacturers:

a. Dow Chemical Co.; 739, Dow Silicone.
b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. Speedline Corporation; Speedline Vinyl Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.8 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content that meets the requirement of the South Coast Air Quality Management District Rule #1168. VOC limits per agency having jurisdiction.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Manufacturers:

a. Childers / H.B. Fuller Construction Products, Inc; CP-35.
b. Foster / H.B. Fuller Construction Products, Inc; 30-90.
c. Marathon Industries / Eagle Bridges Company; 590.

2. Water-Vapor Permeance: ASTM E96, Procedure B, 0.013 perm at 43-mil dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.

4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.

5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Manufacturers:

a. Childers / H.B. Fuller Construction Products, Inc; CP-30.
b. Foster / H.B. Fuller Construction Products, Inc; 30-35.

c. Marathon Industries / Eagle Bridges Company; 501.

2. Water-Vapor Permeance: ASTM F1249, 0.05 perm at 35-mil dry film thickness.

3. Service Temperature Range: 0 to 180 deg F.

4. Solids Content: ASTM D1644, 44 percent by volume and 62 percent by weight.

5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Manufacturers:

a. Childers / H.B. Fuller Construction Products, Inc; Encacel.
b. Foster / H.B. Fuller Construction Products, Inc; 60-95/60-96.
c. Marathon Industries / Eagle Bridges Company; 570.

2. Water-Vapor Permeance: ASTM F1249, 0.05 perm at 30-mil dry film thickness.

3. Service Temperature Range: Minus 50 to plus 220 deg F.

4. Solids Content: ASTM D1644, 33 percent by volume and 46 percent by weight.

5. Color: White.

6. For outdoor aluminum finish, use 60-39 mastic.

2.9 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products - Manufacturers:

a. Childers / H.B. Fuller Construction Products, Inc; CP-76.
b. Foster / H.B. Fuller Construction Products, Inc; 30-45.
c. Marathon Industries / Eagle Bridges Company; 405.

2. Joint Sealant for Polystyrene Products - Manufacturers:

a. Childers / H.B. Fuller Construction Products, Inc; CP-70.
b. Foster / H.B. Fuller Construction Products, Inc; 30-45/30-46.
c. Marathon Industries / Eagle Bridges Company; 405.

3. Materials shall be compatible with insulation materials, jackets, and substrates.

4. Permanently flexible, elastomeric sealant.

5. Service Temperature Range: Minus 100 to plus 300 deg F.

6. Color: White or gray.

7. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers:

a. Childers / H.B. Fuller Construction Products, Inc; CP-76-8.
b. Foster / H.B. Fuller Construction Products, Inc; 95-44.
c. Marathon Industries / Eagle Bridges Company; 405.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Manufacturers:
   a. Childers / H.B. Fuller Construction Products, Inc; CP-76.
   b. Or approved equal.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.10 FIELD APPLIED FABRIC – REINFORCING MASH

A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.

1. Manufacturers:
   a. Vimasco Corporation; Elastafab 894.
   b. Or approved equal.

B. Woven Glass-Fiber Fabric for Equipment Insulation: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.

1. Manufacturers:
   a. Childers / H.B. Fuller Construction Products, Inc; Chil-Glas No. 5.
   b. Or approved equal.

C. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for equipment and pipe.

1. Manufacturers:
   a. Foster / H.B. Fuller Construction Products, Inc; Mast-A-Fab.
   b. Vimasco Corporation; Elastafab 894.
   c. Or approved equal.

2.11 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

1. Manufacturers:

a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.
b. Or approved equal.

2.12 SECUREMENTS

A. Bands:

1. Manufacturers:

a. Childers Metals / ITW Insulation Systems / Illinois Tool Works, Inc.; Bands.
b. PABCO Metals / ITW Insulation Systems / Illinois Tool Works, Inc.; Bands.
c. RPR Products, Inc.; Bands.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with closed seal.

3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with closed seal.

4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

5. Copper clad annealed steel wire having a minimum 16 gauge thickness.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.

a. Manufacturers:
(1) AGM Industries / a JORDAHL GmbH Company; CWP-1.
(2) GEMCO; CD.
(3) Midwest Fasteners, Inc.; CD.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

b. Manufacturers:
(1) AGM Industries / a JORDAHL GmbH Company; CWP-1.
(2) GEMCO; Cupped Head Weld Pin.
(3) Midwest Fasteners, Inc.; Cupped Head.

3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

c. Manufacturers:
(1) AGM Industries / a JORDAHL GmbH Company; RC-150.
(2) GEMCO; R-150.
(3) Midwest Fasteners, Inc.; WA-150.

d. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

4. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

    e. Manufacturers:
        (1) GEMCO.
        (2) Midwest Fasteners, Inc.
        (3) Or approved equal.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy.

2.13 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A167 or ASTM A240 / A240M, Type 304 or 316.

PART 3 - EXECUTION

3.1 INSTALLATION - PIPING SYSTEMS

A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.

B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. For penetrations of assemblies with fire resistance rating greater than one hour. See all sections in Division.

C. Piping Systems Conveying Fluids Below Ambient Temperature:

1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.

3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

D. Glass Fiber Board Insulation:

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

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

3. Cover wire mesh or bands with cement to a thickness to remove surface irregularities.

E. Polyisocyanurate Foam Insulation Extruded Polystyrene Insulation:

1. Wrap elbows and fitting with vapor retarder tape.

2. Seal butt joints with vapor retarder tape.

F. Hot Piping Systems 140 degrees F or less:

1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.

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.

3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.

G. Inserts and Shields:

2. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.

1. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.

   a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
   b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.

2. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.

H. Insulation Terminating Points:

1. Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the control valve.

2. Condensate Piping: Insulate entire piping system and components to prevent condensation.

I. Closed Cell Elastomeric Insulation:

1. Push insulation on to piping.

2. Miter joints at elbows.

3. Seal seams and butt joints with manufacturer’s recommended adhesive.

4. When application requires multiple layers, apply with joints staggered.

5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

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

K. Piping Exterior to Building: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal piping.

L. Buried Piping: As per insulation Manufacturer's recommendation.

M. Heat Traced Piping Interior to Building: As recommended by Heat Trace System Manufacturer.

N. Heat Traced Piping Exterior to Building: As recommended by Heat Trace System Manufacturer.

O. Prepare pipe insulation for finish painting.

3.2 INSTALLATION - EQUIPMENT

A. Factory Insulated Equipment: Do not insulate.

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

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

D. Equipment Containing Fluids Below Ambient Temperature:

1. Insulate entire equipment surfaces.

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

3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.

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

E. Equipment Containing Fluids 140 degrees F Or Less:

1. Do not insulate flanges and unions, but bevel and seal ends of insulation.

2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.

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

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

G. Equipment Located Exterior to Building: Install vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal equipment.

H. Cover insulation with aluminum jacket.

I. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.

J. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

K. Prepare equipment insulation for finish painting.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies.

3.4 SCHEDULES

A. Water Supply Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Domestic Hot Water Supply and Recirculation	P-1	1-1/4 inches and smaller 1-1/2 inches and larger	1.5 2.0
Domestic Hot Water Supply and Recirculation systems with domestic water temperature maintenance cable	P-1	1 inch and smaller 1-1/4 inches to less than 4 inches 4 inches and larger	1.0 1.5 2.0
Domestic Cold Water (Exposed)	P-1 or P-5	1-1/4 inches and smaller 1-1/2 inches and larger	0.75 1.0
Deionized Water	P-1 or P-5	All sizes	1.0

B. Drainage Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Storm Piping (horizontal above ground within building)	P-1 or P-5	All sizes	1.0
Sanitary Sewer Piping (Exposed)	P-1 or P-5	All sizes	1.0

C. Equipment Insulation Schedule:

EQUIPMENT	INSULATION TYPE	INSULATION THICKNESS inches
Roof Drain Bodies	E-2	1.0
Domestic Hot Water Storage Tanks	E-1 E-2	2.0
Domestic Water Storage Tanks	E-1, E-2,	2.0
Domestic Water Booster Pump Bodies	E-5	1.0
Water Softeners and Tanks	E-1, E-2,	2.0

3.5 DOMESTIC WATER HEAT EXCHANGER INSULATION SCHEDULE

A. Round, exposed or concealed breeching and connector insulation shall be the following:

1. Calcium Silicate: 4 inches thick.

2. High-Temperature Mineral-Fiber Blanket: 3 inches thick and 3-lb/cu. ft. nominal density.
3. High-Temperature Mineral-Fiber Board: 3 inches thick and 6-lb/cu. ft. nominal density.

B. Rectangular, exposed or concealed breeching and connector insulation shall be the following:

1. Calcium Silicate: 4 inches thick.
2. High-Temperature Mineral-Fiber Blanket: 3 inches thick and 3-lb/cu. ft. nominal density.
3. High-Temperature Mineral-Fiber Board: 3 inches thick and 6-lb/cu. ft. nominal density.

3.6 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Grease Waste Piping, All Sizes, where Heat Tracing Is Installed: Cellular glass, 2 inches thick.

3.7 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 22 07 00

SECTION 22 08 00 - COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plumbing commissioning description.
2. Plumbing commissioning responsibilities.

1.2 REFERENCES

A. CALGreen / Los Angeles Green Building Code (LAGBC).

1.3 COMMISSIONING DESCRIPTION

A. Plumbing commissioning process includes the following tasks:

1. Testing and startup of Plumbing equipment and systems.
2. Equipment and system verification checks.
3. Assistance in functional performance testing to verify balancing of pumping equipment and water distribution system performance.
4. Provide qualified personnel to assist in commissioning tests.
5. Complete and endorse functional performance test checklists provided by Commissioning Authority to assure equipment and systems are fully operational and ready for functional performance testing.
6. Provide equipment, materials, and labor necessary to correct deficiencies found during commissioning process to fulfill contract and warranty requirements.
7. Provide operation and maintenance information and record drawings to Commissioning Authority for review verification and organization, prior to distribution.
8. Provide assistance to Commissioning Authority to develop, edit, and document system operation descriptions.
9. Provide training for systems specified in this Section with coordination by Commissioning Authority.

B. Equipment and Systems to Be Commissioned:

1. Domestic Cold and Hot Water Pumps
2. Domestic Cold and Hot Water Piping systems.
3. Variable frequency drives for pumps .
4. Domestic Hot Water Heat exchangers.
5. Plumbing Fixtures.
6. Domestic Hot Water Heaters.
7. Sanitary Waste and Vent.
8. Storm Water System.

9. Grease Interceptors, grease piping and heat tracing systems.
10. Sewage Ejectors.
11. Sump Pumps.
12. Natural Gas Systems.
13. Fuel Systems.
14. Recycled Water System.
15. Filtration System.
16. Plumbing Instrumentation and Controls.

1.4 COMMISSIONING SUBMITTALS

A. Draft Forms: Submit draft of system verification form and functional performance test checklist.

B. Test Reports: Indicate data on system verification form for each piece of equipment and system as specified.

C. Field Reports: Indicate deficiencies preventing completion of equipment or system verification checks equipment or system to achieve specified performance.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record revisions to equipment and system documentation necessitated by commissioning.

B. Operation and Maintenance Data: Submit revisions to operation and maintenance manuals when necessary revisions are discovered during commissioning.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with LAWA Guide Specifications, Contract Documents and Industry Standards.

1.7 COMMISSIONING RESPONSIBILITIES

A. See General Commissioning Requirements, Section 01 91 00.

1.8 COMMISSIONING MEETINGS

A. Attend initial commissioning meeting and progress commissioning meetings as required by Commissioning Authority.

1.9 SCHEDULING

A. Prepare schedule indicating anticipated start dates for the following:

1. Plumbing system pressure testing.
2. Plumbing system flushing and cleaning.
3. Plumbing equipment and fixtures startups.
4. Hot water temperature control system checkout.
5. Testing, adjusting, and balancing.
6. Operation and maintenance manual submittals.

7. Training sessions.

B. Schedule occupancy sensitive tests of equipment and systems during conditions of both minimum and maximum occupancy and use.

1.10 COORDINATION

A. Notify Commissioning Authority minimum of four weeks in advance of the following:

1. Scheduled equipment and system startups.
2. Scheduled automatic temperature control system checkout.
3. Scheduled start of testing, adjusting, and balancing work.

B. Coordinate programming of automatic temperature control system with construction and commissioning schedules.

PART 2 - PRODUCTS

2.1 DESIGN DOCUMENT AND SUBMITTAL REVIEWS

A. General:

1. Submit design documents.

2.2 SEQUENCE OF OPERATIONS OF PLUMBING SYSTEM

A. General:

1. Sequences of Operation submitted shall describe in detail operation of Plumbing system and its components. The sequences provided in the contract drawings and specifications provide a good overview, but they shall be supplemented by finalized sequences used to program the system.
2. Controls system components and hardware.

2.3 START-UP AND TESTING, ADJUSTING AND BALANCING REPORTS

A. Start-up and testing reports shall be generated by the installing Contractor for all equipment/systems and submitted to Contractor who provides a copy to CxA.

B. TAB reports shall be created for designated systems by a certified TAB provider and submitted to Contractor who provides a copy to CxA.

2.4 FUNCTIONAL PERFORMANCE TESTS

A. General:

1. Provide Functional Performance Test forms for LAWA approval.

2.5 OPERATION & MAINTENANCE MANUAL

A. Submit O&M Manuals, Personnel Training Plan and Training Requirements

2.6 SYSTEMS MANUAL

A. Submit Systems Manuals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install additional balancing valves, access doors, test ports, and pressure and temperature taps required by Commissioning Authority or Commissioning Plan.

B. Place Plumbing systems and equipment into full operation and continue operation during each working day of commissioning.

C. Install balancing valves as requested by Commissioning Authority and as indicated on the drawing on the domestic cold and hot water piping.

3.2 COMMISSIONING

A. The CxA and GC are responsible to participate in initial and alternate peak season test of systems required to demonstrate performance.

B. Occupancy Sensitive Functional Performance Tests:

1. Test equipment and systems affected by occupancy variations at minimum and peak loads to observe system performance.

2. Participate in testing delayed beyond Final Completion to test performance with actual occupancy conditions.

3.3 DEMONSTRATION AND TRAINING.

A. See LAWA Guide Specification Section 01 79 00 “Demonstration and Training” for demonstration and training requirements.

B. Furnish services of the Commissioning trained representative to instruct LAWA on operation and maintenance of Plumbing Equipment, System and Plumbing Fixtures. Training to include minimum of 8 LAWA personnel for 40 hours training, 16 hours shall be classroom training per person and 24 hours shall be hands-on training per person.

END OF SECTION 23 08 00

SECTION 22 11 00 - FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes:

1. Domestic water piping, within 5 feet of building.
2. Domestic water piping, above grade.
3. Pressure gages.
4. Pressure gage taps.
5. Thermometers.
6. Flow control valves.
7. Water pressure reducing valves.
8. Relief valves.
9. Strainers.
10. Hose bibbs.
11. Hydrants.
12. Wall box outlet.
13. Backflow preventers.
14. Water hammer arrestors.
15. Thermostatic mixing valves.
16. Pressure balanced mixing valves.

1.2 REFERENCES

A. Comply with appropriate standards.

1. American Water Works Association: AWWA
2. Underwriters Laboratories Inc.: U.L.

1.3 SUBMITTALS

A. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturer's catalog information.
2. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

B. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.5 WARRANTY

A. Furnish one-year minimum warranty.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Tubing: ASTM B88, Type K, hard drawn.

1. Fittings: ASME B16.18, cast copper alloy ASME B16.22, wrought copper and bronze Annex G NSF/ANSI 61.

2. Joints:

a. Soldered – ASTM B32 E & HB lead-free allow, with water soluble flux per ASTM B-13.

b. Press-connect Fittings: Bronze or copper shall conform to the material requirements of ASME B16.18 or ASME B16.22, and the performance requirements of IAPMO PS117, and ICC/ANSI LC1002 and NSF/ANSI 61-pw (if used in a potable water system.) Press-connect fittings ½-inch thru 4-inch for use with ASTM B88 copper tube shall have an EPDM sealing element, and an un-pressed fitting, leak identification feature. 2-1/2-inch thru 4-inch shall have a 420 stainless steel grip ring, PBT separator ring, and EPDM sealing element. Sealing elements shall be verified for the intended use. Contractor shall be trained by a factory authorized representative and provide verification of training to the LAWA Inspector.

B. Copper Tubing: ASTM B88 Type L, annealed soft copper, to trap primers – fittings and joints not allowed.

C. Ductile-Iron Pipe And Fittings

1. Mechanical-Joint, Thickness Class 54, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

a. Standard-Pattern, Mechanical-Joint Fittings: AWWA C110, ductile or gray iron.

b. Compact-Pattern, Mechanical-Joint Fittings: AWWA C153, ductile iron.

(1) Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.2 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L hard drawn.

1. Fittings: ASME B16.18, cast copper alloy ASME B16.22, wrought copper and bronze Annex G NSF/ANSI 61.

2. Joints:

a. Soldered – ASTM B32 E & HB lead-free allow, with water soluble flux per ASTM B-13.

b. Press-connect Fittings: Bronze or copper shall conform to the material requirements of ASME B16.18 or ASME B16.22, and the performance requirements of IAPMO PS117, and ICC/ANSI LC1002 and NSF/ANSI 61-pw (if used in a potable water system.) Press-connect fittings ½-inch thru 4-inch for use with ASTM B88 copper tube shall have an EPDM sealing element, and an un-pressed fitting, leak identification feature. 2-1/2-inch thru 4-inch shall have a 420 stainless steel grip ring, PBT separator ring, and EPDM sealing element. Sealing elements shall be verified for the intended use. Contractor shall be trained by a factory authorized representative and provide verification of training to the LAWA Inspector.

B. Copper Tubing: ASTM B88, Type L, rolled grooved ends.

1. Fittings: ASME B16.18 cast copper alloy, or ASME B16.22 wrought copper and bronze, grooved ends.

2. Joints: Grooved mechanical couplings meeting ASTM F1476.

a. Housing Clamps: ASTM A395/A395M and ASTM A536 ductile iron, enamel coated, compatible with copper tubing sizes, to engage and lock designed to permit some angular deflection, contraction, and expansion.
b. Gasket: Elastomer composition for operating temperature range to 200 degrees F.
c. Accessories: Stainless steel bolts, nuts, and washers.

2.3 PIPE JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 CORROSION PROTECTION PIPING ENCASEMENT

A. Encasement for Underground Metal Piping:

1. Standards: ASTM A674 or AWWA C105.

2. Form: Sheet or tube.

3. Material: LLDPE film of 0.008-inch minimum thickness.

4. Material: LLDPE film of 0.008-inch minimum thickness, or high-density, cross-laminated PE film of 0.004-inch minimum thickness.

5. Material: High-density, cross-laminated PE film of 0.004-inch minimum thickness.

6. Color: Black.

2.5 WATER SUB-METERS

A. Displacement-Type Water Meters:

1. Manufacturers:

    a. Badger Meter, Inc.
    b. Neptune Technology Group, Inc.
    c. Sensus.

2. Description:

    a. Standard: AWWA C700, and C710 Standards.
    b. Pressure Rating: 150 psig working pressure.
    c. Temperature Rating: -40° to + 150° F.
    d. Registration: In gallons or cubic feet as required by LAWA.
    e. Case: Bronze.
    f. End Connections: Threaded.
    g. Remote read per AWWA Standard C706.

3. Magnetic drive, type meter with 150 psig bronze body, lined cast iron frost proof body, threaded ends, internal strainer, wheel encoder register and receptacle.

B. Remote Registration System: Direct-reading type complying with AWWA C706; modified with signal transmitting assembly, low-voltage connecting wiring, and remote register assembly capable of being connected to CUP FMCS.

C. Remote Registration System: Encoder type complying with AWWA C707; modified with signal transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by LAWA.

2.6 UNIONS AND FLANGES

A. Unions for Pipe 2-1/2 inches and Smaller:

1. Ferrous Piping: Class 150, malleable iron, threaded.

2. Copper Piping: Class 150, bronze unions with brazed joints.

3. Dissimilar Materials: Brass ball valve and 6 inch long Brass nipple.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.

2. Copper Piping: Class 150, slip-on bronze flanges.

3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

4. Dissimilar Materials: Brass ball valve and 6 inch long Brass nipple.

2.7 PRESSURE GAGES

A. Manufacturers:

1. AMETEK, Inc.

2. H.O. Trerice Co.

3. Weiss Instruments.

B. Gage: ASME B40.1, with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.

1. Case: Cast aluminum.

2. Bourdon Tube: Copper plated brass.
3. Dial Size: 6 inch diameter.

2.8 PRESSURE GAGE TAPS

A. Manufacturers:
1. AMETEK, Inc.
2. H.O. Trerice Co.
3. Weiss Instruments.

2.9 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.

C. One Piece, Deep Pattern: Deep-drawn, box-shaped brass with chrome-plated finish.

D. One Piece, Stamped Steel: Chrome-plated finish with setscrew.

E. Split Casting, Cast Brass: Polished, chrome-plated finish with concealed hinge and setscrew.

F. Split Plate, Stamped Steel: Chrome-plated finish with concealed hinge.

G. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

H. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.10 WALL PENETRATION SYSTEMS

A. Manufacturer:
1. SIGMA Corporation.
2. Or approved equal.

B. Description: Wall-sleeve assembly, consisting of housing and gland, gaskets, and pipe sleeve.
1. Carrier-Pipe Deflection: Up to 5 percent without leakage.
2. Housing: Ductile-iron casting with hub, waterstop, anchor ring, and locking devices. Include gland, bolts, and nuts.
3. Housing-to-Sleeve Gasket: EPDM rubber.
4. Housing-to-Carrier-Pipe Gasket: AWWA C111, EPDM rubber.
5. Pipe Sleeve: AWWA C151, ductile-iron pipe or ASTM A53 / A53M, Schedule 40, zinc-coated steel pipe.

2.11 STEM TYPE THERMOMETERS

A. Manufacturers:
1. Ashcroft Inc.
2. H.O. Trerice Co.
3. Weiss Instruments.

B. Thermometer: ASTM E1, red appearing mercury, lens front tube, cast aluminum case with enamel finish.

1. Size: 6" scale.
2. Window: Clear glass.
3. Stem: Copper plated brass, 3/4 inch NPT, 3-1/2 inch long.
4. Accuracy: ASTM E77. Plus or minus 1 percent to 1.5 max of range.
5. Calibration: Degrees F.

2.12 FLOW CONTROL VALVES

A. Manufacturers:

1. Bell & Gossett / Xylem Inc.
2. Griswold Controls.
3. FLOCON / Precision Instruments Company.

B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, combination blow-down or back-flush drain.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 5 psi.

2.13 WATER PRESSURE REDUCING VALVES

A. Manufacturers:

1. Zurn-Wilkins / Zurn Industries, LLC / Rexnord Corporation.
2. Conbraco Industries / Apollo Valves / Aalberts Industries N.V.
3. Watts Water Technologies Company.

B. 2 inches and Smaller: MSS SP 80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded and single union double union ends.

C. 2 inches and Larger: MSS SP 85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.14 TEST PLUGS

A. Manufacturers:

1. Petersen Products Company.
2. Sisco Manufacturing Company, Inc.
3. Watts Water Technologies Company.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

D. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for water service at 20 to 200 deg F shall be CR.
2. Insert material for water service at minus 30 to plus 275 deg F shall be EPDM.

E. Test Kit: Furnish two test kit(s) containing one pressure gage and adaptor, two thermometer(s), and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.

1. Pressure Gage: Small bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be 0 to 200 psig.

2. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F.

3. Carrying case shall have formed instrument padding.

2.15 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers:

a. Watts Water Technologies Company.
b. Zurn Indistries, LLC / Rexnord Corporation.
c. Conbraco / Apollo Valves / Aalberts Industries, N.V.

2. Standard: ASSE 1001.

3. Equal to Watts No. 288A.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers:

a. Watts Water Technologies Company.
b. Zurn Indistries, LLC / Rexnord Corporation.
c. Conbraco / Apollo Valves / Aalberts Industries, N.V.

2. Standard: ASSE 1011.

3. Equal to Watts No. NF8 or No. 8A.

C. Pressure Vacuum Breakers:

1. Manufacturers:

a. Watts Water Technologies Company.
b. Zurn Indistries, LLC / Rexnord Corporation.
c. Conbraco / Apollo Valves / Aalberts Industries, N.V.

2. Standard: ASSE 1020.

3. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

D. Spill-Resistant Vacuum Breakers:

1. Manufacturers:

2. Watts Water Technologies Company.

3. Zurn Indistries, LLC / Rexnord Corporation.

4. Conbraco / Apollo Valves / Aalberts Industries, N.V.

5. Standard: ASSE 1056.

6. Operation: Continuous-pressure applications.

7. Accessories:
8. Valves: Ball type, on inlet and outlet.

2.16 RELIEF VALVES

A. Manufacturers:
   1. Conbraco / Apollo Valves / Aalberts Industries, N.V.
   2. Watts Water Technologies Company.
   3. Zurn-Wilkins / Zurn Industries, LLC / Rexnord Corporation.

B. Pressure Relief:
   1. ANSI Z21.22 certified, bronze body, Teflon seat, steel stem and springs, automatic, direct pressure actuated.

C. Temperature and Pressure Relief:
   1. ANSI Z21.22 certified, bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME certified and labeled.

2.17 STRAINERS

A. Manufacturers:
   1. Conbraco / Apollo Valves / Aalberts Industries, N.V.
   2. Watts Water Technologies Company.
   3. Zurn-Wilkins / Zurn Industries, LLC / Rexnord Corporation.

B. 2 inch and Smaller: Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

C. 3 inch and Larger: Class 125, flanged iron body, basket pattern with type 304 1/8 inch stainless steel perforated screen.

2.18 HOSE BIBBS

A. Manufacturers:
   1. Acorn Engineering Company, Inc. / Morris Group International.
   2. MIFAB, Inc.
   3. Jay R. Smith Mfg. Co. / Morris Group International.

B. Rough-Bronze body with integral wall flange, threaded or soldered end, replaceable disc, hose thread spout, with lock shield and removable key integral and non-removable vacuum breaker in conformance with ASSE 1011.

C. Provide rough-chrome or polished chrome finish as required.

2.19 HYDRANTS

A. Manufacturers:
   1. Acorn Engineering Company, Inc. / Morris Group International.
   2. MIFAB, Inc.

3. Zurn Industries, LLC / Rexnord Corporation.

B. Wall Hydrant: ASSE 1019; non-freeze, self-draining type with chrome plated, or polished bronze; wall plate lockable recessed box hose thread spout, hand wheel lock shield and removable key, and integral non-removable vacuum breaker.

C. Floor Hydrant: ASSE 1019; chrome plated polished bronze; lockable recessed box, hose thread spout, lock shield and removable key, or non-removable vacuum breaker.

2.20 RECESSED VALVE BOX

A. Manufacturers:

1. IPS Corporation.
2. Sioux Chief Manufacturing Company.
3. Or approved equal.

B. Washing Machine: Water tight recessed plastic, preformed rough-in box, ½" copper connections with chrome ¼ turn ball valves; integral water hammer arrestors; 2" center drain outlet.

C. Refrigerator: Plastic water-tight recessed plastic, preformed rough-in box, ½" copper connection with chrome ¼ turn ball valve preformed rough-in box with brass valves with wheel handle slip finishing cover.

2.21 BACKFLOW PREVENTERS

A. Manufacturers:

1. Conbraco / Apollo Valves / Aalberts Industries, N.V.
2. Watts Water Technologies Company.
3. Zurn-Wilkins / Zurn Industries, LLC / Rexnord Corporation.

B. Reduced Pressure Principle Backflow Preventers:

1. Comply with ASSE 1013 for continuous pressure operations.
2. Bronze body, with bronze internal parts and stainless steel springs.
3. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; integral with two gate valves, strainer, and four test cocks.

C. Double Check Valve Assemblies: Comply with ASSE ASSE 1015 or AWWA C510; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

2.22 WATER HAMMER ARRESTORS

A. Manufacturers:

1. MIFAB, Inc.
2. Watts Water Technologies Company.
3. Zurn-Wilkins / Zurn Industries, LLC / Rexnord Corporation.

B. ASSE 1010; copper construction, bellows or piston type sized in accordance with PDI WH-201.

C. Pre-charged suitable for 35 to 100 degrees temperature range, working pressure.

D. Provide distribution box as required.

2.23 THERMOSTATIC MIXING VALVES

A. Manufacturers:

1. Watts Water Technologies Company.
2. Zurn Industries, LLC / Rexnord Corporation
3. Symmons Industries, Inc.

B. Master Mixing Valves

1. Bronze body and cap with replaceable corrosion-resistant stainless steel piston and liner.
2. Factory assembly shall include: Check stops, thermometer removable strainers, inlet and outlet ball-type shut-off valves.
3. Provide recessed or surface mounted cabinet, stainless steel or white enamel.
4. Hi-low or standard type valve assembly shall comply with ASSE 1017, U.P.C. and C.S.A. for 125 PSI maximum operating pressure, 200 degrees maximum inlet temperature, for 5 G.P.M. minimum flow.

C. Point-of-Use Mixing Valves

1. For lavatory or sink faucets – 0.5 G.P.M. minimum flow capacity.
2. Integral adjustable set-point and in-line check stops.
3. 105 degree maximum outlet temperature.

2.24 PRESSURE BALANCED MIXING VALVES

A. Manufacturers:

1. Symmons Industries, Inc.
2. Watts Water Technologies Company.
3. Zurn Industries, LLC / Rexnord Corporation.

B. Valve: Chrome plated cast brass body, stainless steel cylinder and integral temperature adjustment.

C. Accessories:

1. Volume control shut-off valve on outlet.
2. Stem thermometer on outlet.
3. Strainer stop checks on inlets.

D. Provide recessed or surface mounted cabinet, stainless steel or white enamel, as required.

2.25 WATER FILTERS

A. In-line cold water filter for up to 1.3 GPM capable of removing dirt/rust, odor and scale.

1. Manufacturer:
    a. Everpure / Pentair Inc.
    b. Or approved equal.

B. On cold water lines for the following:
1. Coffee makers.
2. Electric water coolers.
3. Refrigerators.
4. Ice makers.

2.26 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:
1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Inlet: Threaded or solder joint.
5. Outlet: Threaded, short nipple with garden-hose threads complying with ASME B1.20.7.

2.27 TRAP SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:
1. Manufacturers:
    a. Precision Plumbing Products (PPP) Inc. Solo Prime for single traps.
    b. Precision Plumbing Products (PPP) Inc. Mini Prime for up to four traps.
    c. Or approved equal.
2. Standard: ASSE 1044,
3. Piping: NPS 3/4, ASTM B88, Type L; copper, water tubing.
4. Cabinet: Recessed-mounting steel box with stainless-steel cover.
5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
6. Vacuum Breaker: ASSE 1001.
7. Size Outlets: NPS 1/2.

PART 3 - EXECUTION

3.1 INSTALLATION - ABOVE GROUND PIPING

A. Install Brass Ball Valve and 6” brass nipple connections wherever joining dissimilar metals.

3.2 INSTALLATION - SERVICE CONNECTIONS

A. Provide new water service complete with approved reduced pressure double check back-flow preventer and water meter with by-pass valves pressure reducing valve, and strainer as required.

B. Provide sleeve in wall for service main and support at wall with reinforced-concrete bridge. Caulk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.

C. Provide 18 gauge 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.

3.3 INSTALLATION – PRESS-CONNECT FITTINGS

A. Press-connect Fittings: Pipe ends shall be cut on a right angle (square) to the pipe. Pipe ends shall be reamed and chamfered, all grease, oil or dirt shall be removed from the pipe end with a clean rag. Visually examine the fitting sealing element to insure there is no damage and it is properly seated into the fitting. Insert pipe fully into the fitting. Make a mark with a felt tip pen on the pipe at the face of the fitting. Always examine the tube to insure it is fully inserted into the fitting prior to pressing the joint. Fittings shall be installed according to the most current edition of the manufacturer's installation guidelines using manufacturer recommended tools. Sealing elements shall be verified for the intended use.

END OF SECTION 22 11 00

SECTION 22 13 00 - FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sanitary sewer piping buried beyond 5 feet of building.
2. Sanitary sewer piping buried within 5 feet of building.
3. Sanitary sewer piping above grade.
4. Chemical resistant sewer piping.
5. Unions and flanges.
6. Floor drains.
7. Floor sinks.
8. Cleanouts.
9. Backwater valves.
10. Sumps.
11. Interceptors.
12. Maintenance Holes.
13. Sewage ejectors.
14. Bedding and cover materials.

1.2 REFERENCES

A. General: Comply with appropriate standards.

1. Plumbing and Drainage Institute: PDI.

1.3 SUBMITTALS

A. Submit data on all materials, fittings, accessories and equipment.

B. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sewage-ejectors and Maintenance Holes.

D. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
2. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
3. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include

NPSH curve when applicable. Include electrical characteristics and connection requirements.

E. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

F. Product Data: For grease interceptor indicated. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.

G. Shop Drawings: For each type and size of interceptor indicated.

1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

2. Include calculations for aircraft loading.

3. See LAWA Airport Structural Design Standards for additional requirements.

H. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Interceptors.

2. Piping connections. Include size, location, and elevation of each.

3. Interface with underground structures and utility services.

4. Coordinate installation with site utility and site paving contractor to prevent interceptor damage.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of equipment and clean-outs.

B. Operation and Maintenance Data: Submit frequency of treatment required for interceptors. Include, spare parts lists, exploded assembly views for pumps and equipment.

1.5 WARRANTY

A. Furnish one-year minimum warranty.

PART 2 - PRODUCTS

2.1 SANITARY SEWER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Coordinate with Civil Engineer.

B. Ductile-Iron Pipe and Fittings

1. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.

a. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
b. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.

a. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
b. Gaskets: AWWA C111, rubber.

3. Flanges: ASME 16.1, Class 125, cast iron.

C. Vitrified Clay Pipe: Pipe and fittings shall be extra strength or high strength manufactured in accordance with ASTM C700.

D. ABS Pipe: Pipe, fittings and joints shall comply with codes and standards in effect at time of installation.

E. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.

F. Pressure Fittings:

1. Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.

2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.

3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.

4. Cast-Iron Flanges: ASME B16.1, Class 125.

5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.

2.2 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Soil Pipe: CISPI, ASTM A888 service weight, hubless, aboveground.

1. Fittings: Cast iron, ASTM A888 and CISPI – with stainless steel clamp and shield assembly.

2. Joints: CISPI ASTM C564, rubber gasket joint devices.

3. Manufacturers – Heavy Duty Stainless Steel Couplings

a. Husky / Anaco / McWane Inc.: Husky SD 4000.
b. Clamp-All Products / NORMA Group
c. Ideal-Tridon / Ideal Clamp Products, Inc.

4. Manufacturers – Heavy Duty Cast or Ductile Iron Couplings

a. MG Coupling / MG Piping Products Company.
b. Victaulic Company.
c. OR Approved Equal.

B. Ductile-Iron Pipe and Fittings

1. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.

a. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
b. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.

a. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
b. Gaskets: AWWA C111, rubber.

3. Flanges: ASME 16.1, Class 125, cast iron.

C. ABS Pipe: Pipe, fittings and joints shall comply with codes and standards in effect at time of installation.

2.3 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI, ASTM A888, hub-less, service weight, hubless.

1. Fittings: Cast iron, CISPI, ASTM A888.

2. Joints: CISPI, ASTM C564, rubber gaskets and stainless steel clamp-and-shield assemblies.

2.4 CHEMICAL RESISTANT SEWER PIPING

A. ABS Pipe: ASTM D2751 or ASTM F628, Acrylonitrile-Butadiene-Styrene (ABS) material.

1. Fittings: ABS, ASTM D2661.

2. Joints: ASTM D2235, solvent weld.

B. Glass Pipe: ASTM C1053, borosilicate glass material.

1. Fittings: ASTM C1053, borosilicate glass.

2. Joints: Stainless steel compression couplings with tetra-fluoroethylene seal ring.

C. PP / PPFR Pipe: Polypropylene Pipe / Polypropylene Flame Retardant Pipe.

1. Fittings: Polypropylene.

2. Joints: Electrical resistance fusion.

2.5 SPECIAL PIPE FITTINGS

A. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

1. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

a. EBAA Iron, Inc.
b. Romac Industries, Inc.
c. Star Pipe Products.

B. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

1. Manufacturers:

a. SIGMA Corporation.
b. Or Approved Equal.

2.6 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Description: ASTM A674 or AWWA C105, LLDPE film of 0.008-inch minimum thickness.

B. Form: Tube.

C. Color: Black.

2.7 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Copper Piping: Class 150, bronze unions with soldered brazed joints.

2. Brass Ball Valve and a 6" Nipple: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. Copper Piping: Class 150, slip-on bronze flanges.

2. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.8 FLOOR DRAINS

A. Manufacturers:

1. Jay R. Smith Mfg. Co. / Morris Group International.

2. Zurn Industries, LLC / Rexnord Corporation.

3. MIFAB, Inc.

B. Floor Drain: Shall be ductile, cast or grey iron body with double drainage flange, weep holes, anchor flange, round or square, adjustable nickel-bronze strainer, trap primer inlet, white acid resistant interior-size as required.

C. Provide heavy-duty traffic weight grate, sediment bucket, or stainless steel type where required.

D. Furnish materials in accordance with Sate of California Codes and City of Los Angeles Department of Building and Safety Standards.

E. Cast-Iron Floor Drains:

1. Manufacturers:

a. Jay R. Smith Mfg. Co. / Morris Group International
b. MIFAB, Inc.
c. Zurn Industries, LLC / Rexnord Corporation

2. Standard: ASME A112.6.3.

3. Pattern: Floor drain.

4. Body Material: Gray iron.

5. Outlet: Bottom.

6. Backwater Valve: Integral, ASME A112.14.1, swing-check type.

7. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.

8. Top or Strainer Material: Nickel bronze.

9. Top of Body and Strainer Finish: Nickel bronze.
10. Top Shape: Round.
11. Top Loading Classification: Heavy Duty.
12. Trap Material: Cast iron.
13. Trap Pattern: Deep-seal P-trap.
14. Trap Features: Trap-seal primer valve drain connection.

F. General:

1. In accordance with ANSI A112.21.1 and where required for the following construction types. For built up membrane, provide a flashing clamp. For liquid membrane, provide a four inch wide flange. For elastomeric type floor, provide a four inch wide top flange at required height. Provide strainers with a nickel bronze finish except as noted.
2. Provide a coated cast iron body, except as noted, with integral double drainage flange and weep holes, inside caulked outlet or hub outlet for compression gasket connection, or hubless outlet except as noted.
3. Type, General, Shown Round: An adjustable extension neck and 6-inch diameter cast strainer, flashing clamp for membrane, equal to MIFAB 1100C, Smith No. 2010-A or Zurn ZN-415-6B. Floor drains with back water valves, equal to MIFAB 1100C-B, Smith No. 2010-AV or Zurn ZN415-6B-V. 6-inch x 6-inch strainers in kitchens equal to Smith No. 2010-B or Zurn ZN-415-6S, MIFAB F1100C-X.
4. Type, Showers: 6-inch diameter strainers for 3-inch outlet size and five-inch diameter strainers for 2-inch outlet size.
5. Type, In machinery rooms and unfinished areas shown round, adjustable cast iron extension neck and tractor type top grate, equal to MIFAB F1320C, Smith No. 2320 or Zurn Z520.
6. Type, In machinery rooms and unfinished areas shown square, adjustable cast iron extension neck and maximum diameter bottom bar strainer on short legs, equal to MIFAB F1320C, Smith No. 2320 or Zurn Z520 for 3-inch outlet and MIFAB 1340, Smith 2340 for 4 inch and 6-inch outlet modified without top grate.
7. Type, Shown square in kitchens and where noted. As noted above for floor drains in kitchens shown round or square, plus funnel where required.
    a. For drains receiving single indirect waste, provide strainer with matching 4-inch diameter x 3-1/4 inch high secured funnel, equal to MIFAB F4, Smith No. 3580 or Zurn Z-328-4.
    b. For drains receiving multiple indirect wastes, provide with matching 83 inch x 33 inch x 3 inch high secured funnel, equal to MIFAB G, Smith No. 3591 or Zurn Z-329-9.
    c. Where indirect waste is too low for standard funnel, provide strainer with matching 6 inch x 2½ inch x 1 inch high secured funnel, equal to MIFAB-J, Smith No. 3590 or Zurn-Z329-7.
8. Type, Vegetable Peeler Drain: An adjustable cast iron extension neck and deep removable bucket, equal to MIFAB F1340-14-5, Smith No. 2360 or Zurn Z526-Y.

9. Type, Can Wash Area: An adjustable cast iron extension neck and deep removable bucket, equal to MIFAB F1480-5, Smith No. 2630 (less top grate) or Zurn Z566-6T-Y-L6.
10. Type, Pit Wall Drain: Side outlet body and brass flap type backwater valve and bronze wall grate, equal to MIFAB BV1210, Smith No. 7000 or Zurn Z-629.
11. Type, Walk in Areaway Drain: Bottom outlet and flat strainer, equal to MIFAB F1320-Y-14, Smith No. 2110 or Zurn Z550 and with side outlet and flat strainer, equal to MIFAB F-1320C-90-Y-14, Smith No. 2115 or Zurn Z550-90.
12. Type, For Other Areaways: Bottom outlet and dome strainer, equal to MIFAB F1320C-Y-14-18, Smith No. 2110 D or Zurn 2550-D and with side outlet and dome strainer, equal to MIFAB F1320C-Y-14-18, Smith No. 2115-D or Zurn Z550-D-90.
13. Type, for Elastomeric Type Floors: Four-inch wide top flange at required depth. Shown round provide drain equal to MIFAB F1320-Y-14-5-2, Smith No. DX 2565 or Zurn Z-531 less bucket. Shown square Type, provide with maximum diameter bottom bar strainer, MIFAB F1340-Y-2-5-14, equal to Smith No. DX-2566 or Zurn Z532-LG modified without top grate.
14. Type, Flushing Rim Floor Drain: Acid resistant porcelain enamel inside and flushing connection and brass flushing rim top with.

2.9 FLOOR SINKS

A. Manufacturers:

1. Jay R. Smith Mfg. Co. / Morris Group International
2. Zurn Industries, LLC / Rexnord Corporation.
3. MIFAB, Inc.

B. Floor Sink: Shall be ductile, cast or gray iron body with double drainage flange, weep holes, anchor flange, round or square, or ½ or ¾ nickel-bronze grate, trap primer inlet, white acid resistant enamel interior-size as required.

C. Provide heavy-duty traffic weight grate, sediment bucket, or stainless steel type where required.

D. Cast-Iron Floor Sinks Except as Noted:

1. Manufacturers:
   a. Jay R. Smith Mfg. Co. / Morris Group International
   b. MIFAB, Inc.
   c. Zurn Industries, LLC / Rexnord Corporation
2. Standard: ASME A112.6.3.
3. Pattern: Indirect waste receptors.
4. Body Material: Gray iron.
5. Outlet: Bottom.
6. Backwater Valve: Integral, ASME A112.14.1, swing-check type.

7. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
8. Top or Strainer Material: Cast iron.
9. Top of Body and Strainer Finish: Cast iron.
10. Top Shape: Round, square.
11. Top Loading Classification: Heavy Duty.
12. Trap Material: Cast iron.
13. Trap Pattern: P-trap.
14. Trap Features: Trap-seal primer valve drain connection.

E. General:

1. In accordance with ANSI A112.21.1 and where required for the following construction types. For built up membrane, provide a flashing clamp. For liquid membrane, provide a four inch wide flange. For elastomeric type floor, provide a four inch wide top flange at required height. Provide strainers with a nickel bronze finish except as noted.
2. Provide a coated cast iron body, except as noted, with integral double drainage flange and weep holes, inside caulked outlet or hub outlet for compression gasket connection, or hubless outlet except as noted.
3. Type FS-1, General, Shown Square: An adjustable extension neck and 6-inch diameter cast strainer, flashing clamp for membrane, adjustable cast iron extension neck and tractor type top grate, equal to MIFAB FS-1730-FL-150, Smith No. 3150-Y-C-12 or Zurn Z520,
4. Type FS-2, In plumbing chases shown round, adjustable cast iron extension neck, bottom dome strainer, equal to MIFAB FS-1750-FL or Smith No. 3040-Y.
    a. For floor sinks receiving indirect waste, provide ½ grate strainer and frame.
    b. For round floor sinks, provide full round strainer and grate.

2.10 CLEANOUTS

A. Manufacturers:

1. Jay R. Smith Mfg. Co. / Morris Group International
2. Zurn Industries, LLC / Rexnord Corporation
3. MIFAB, Inc.

B. Exterior Surfaced Areas: Round or Square lacquered cast iron body with anchor flange, neoprene gasket, adjustable access cover and plug top assembly.

C. Exterior Unsurfaced Areas: Line type with lacquered cast iron body and round epoxy coated cover with gasket.

D. Interior Finished Floor Areas: Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round scored cover with gasket in service areas and round square depressed cover with gasket to accept floor finish in finished floor areas.

E. Interior Finished Wall Areas: Cast bronze or cast iron body raised head plug, gasket, round or square stainless steel access cover secured with machine screw.

F. Interior Unfinished Accessible Areas: Threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.11 BACK WATER VALVES

A. Manufacturers:

1. Jay R. Smith Mfg. Co. / Morris Group International
2. Zurn Industries, LLC / Rexnord Corporation
3. MIFAB, Inc.

B. Cast Iron: ASME A112.14.1; cast iron body and cover, removable bronze swing valve, extension sleeve as required, Bolted access cover, horizontal or vertical type, threaded or hubless ends.

2.12 SUMPS

A. Manufacturers:

1. Pro-Cast Product Inc.
2. Jensen Precast.
3. Zoeller Company.

B. Water-tight, factory fabricated; reinforced fiberglass or concrete; sleeved inlet, outlet and vent openings. Provide sidewall openings for pipe and vent connections.

C. Cover shall have integral seals, gaskets and bushings, sized for sump access.

D. Exterior locations shall have hinged and lockable traffic weight covers.

2.13 GREASE INTERCEPTORS

A. Manufacturers:

1. Pro-Cast Product Inc.
2. Jensen Precast.
3. Proceptor / Green Turtle Technologies Ltd. / Zurn Industries, LLC / Rexnord.

B. Comply with LAC – industrial waste division requirements.

C. Construction:

1. Material: Per equipment schedule and details.
2. Rough in: Below grade.

D. Accessories: Integral baffle, deep seal trap, sample box.

E. Cover: Heavy duty steel with gasket, liquid tight, bolt-down frame.

2.14 OIL INTERCEPTORS

A. Manufacturers:

1. Zurn Industries, LLC / Rexnord Corporation.
2. Pro-Cast Product Inc.
3. Jensen Precast.

B. Construction:

1. Material: Epoxy coated fabricated steel, or pre-cast concrete.
2. Rough in: Flush with floor (suspended) installation with anchor flange.

C. Accessories: Integral deep seal trap, removable, adjustable draw-off assembly, sediment bucket.

D. Cover: Steel, epoxy coated, non-skid with gasket, securing handle.

E. Cover shall have integral seals, gaskets and bushings, sized for sump access.

F. Exterior locations shall have hinged and lockable traffic weight covers.

2.15 SEDIMENT INTERCEPTORS

A. Manufacturers:

1. Zurn Industries, LLC / Rexnord Corporation.
2. Pro-Cast Product Inc.
3. Jensen Precast.

B. Construction:

1. Material: Epoxy coated fabricated steel, or pre-cast concrete.
2. Rough in: Flush with floor (suspended) installation with anchor flange.

C. Accessories: Integral deep seal trap, removable, adjustable draw-off assembly, sediment bucket.

D. Cover: Steel, epoxy coated, non-skid with gasket, securing handle.

E. Cover shall have integral seals, gaskets and bushings, sized for sump access.

F. Exterior locations shall have hinged and lockable traffic weight covers.

2.16 MAINTENANCE HOLES

A. Coordinate with Civil Engineer.

2.17 PRECAST CONCRETE MAINTENANCE HOLE RISERS

A. Extra-Heavy Duty Precast Concrete Maintenance Hole Risers: ASTM C478, with rubber-gasket joints.

1. Structural Design Loads:
   a. Extra-Heavy Duty -Traffic Load, Aircraft Rated.
2. Length: From top of underground concrete structure to grade.
3. Riser Sections: 3-inch minimum thickness and 36-inch diameter.
4. Top Section: Eccentric cone, unless otherwise indicated. Include top of cone to match grade ring size.
5. Gaskets: ASTM C443, rubber.

B. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of Maintenance Hole frame and cover.

C. Extra-Heavy Duty Maintenance Hole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch- minimum width flange and 26-inch- diameter cover.

1. Ductile Iron: ASTM A536-80, Grade 100-70-03, or stronger, rated at 100,000 pounds.

2. Include indented top design with lettering cast into cover, using wording equivalent to the following:

a. Grease Interceptors in Sanitary Sewerage System: "GREASE INTERCEPTOR."

2.18 SEWAGE EJECTORS

A. Manufacturers:

1. PACO / Grundfos CBS Inc.

2. Zoeller Company.

3. Or approved equal.

B. Type: Vertical centrifugal, direct connected, duplex arrangement.

C. Casing: Cast iron volute with radial clearance around impeller, slide away couplings.

D. Impeller: Cast iron; open non-clog, keyed and secured to stainless steel shaft.

E. Support: Cast iron pedestal motor support on steel floor plate with gas tight gaskets.

F. Bearings: Oil 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 sump with inspection opening and cover, and alarm fittings.

I. Controls (Duplex): Float operated mechanical alternator with float rod, stops, and corrosion resistant float to alternate operation of pumps. Cut-in second pump on rising level or lead pump failure. Furnish separate pressure switch high level alarm with transformer, alarm bell, and standpipe, and extra set of wired terminals for remote alarm circuit and emergency float switch with float rod, stops, and corrosion resistant float to operate both pumps on failure of alternator. Provide NEMA 250, Type 1 enclosure.

2.19 SUBMERSIBLE SEWAGE EJECTORS

A. Manufacturers:

1. PACO / Grundfos CBS Inc.

2. Zoeller Company.

3. Or approved equal.

B. Type: Completely submersible, vertical, centrifugal.

C. Casing: Cast iron pump body and oil filled motor chamber.

D. Impeller: Cast iron; open non-clog, stainless steel shaft.

E. Bearings: Ball bearings.

F. Sump: Fiberglass, steel or concrete with steel cover plate.

G. Accessories: Oil resistant cord and plug, with three-prong connector, for connection to electric wiring system including grounding connector.

H. Servicing: Slide-away coupling consisting of discharge elbow secure to sump floor, movable bracket, guide pipe system, lifting chain and chain hooks.

I. Controls: Integral level controls, with separate high level alarm.

J. Controls: Motor control panel containing across-the-line electric motor starters with ambient compensated quick trip overloads in each phase with manual trip button and reset button, circuit breaker, control transformer, electro-mechanical alternator, hand-off-automatic selector switches, pilot lights, high water alarm pilot light, reset button and alarm horn. Furnish mercury switch liquid level controls, steel shell switch encased in polyurethane foam with cast iron weight for pump on (each pump), pump off (common), and alarm. Provide NEMA 250, Type 1 enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

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.

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

E. Field verify that connection to existing piping systems sizes, locations, and invert are as required.

F. Establish elevations of buried piping with not less than allowed per code.

G. Establish minimum separation of from other piping services in accordance with code.

3.2 PIPING APPLICATION

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:

1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.

2. Steel pipe, drainage fittings, and threaded joints.

3. Stainless-steel pipe and fittings, gaskets, and gasketed joints.

C. Aboveground, soil and waste piping NPS 5 and larger shall be the following:

1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.

2. Steel pipe, drainage fittings, and threaded joints.

D. Aboveground, vent piping NPS 4 and smaller shall be the following:

1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
2. Steel pipe, drainage fittings, and threaded joints.
3. Stainless-steel pipe and fittings gaskets and gasketed joints.

E. Aboveground, vent piping NPS 5 and larger shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Steel pipe, drainage fittings, and threaded joints.
3. Stainless steel pipe and fittings gaskets, and gasketed joints

F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:

1. Extra-Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, cast-iron couplings; and hubless-coupling joints.
3. Stainless-steel pipe and fittings, gaskets, and gasketed joints.

G. Underground, soil and waste piping NPS 5 and larger shall be the following:

1. Extra-Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, cast-iron couplings; and hubless-coupling joints.

H. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 shall be the following:

1. Hot dipped Galvanized Steel Pipe schedule 40, pressure fittings, and threaded joints.

I. Aboveground sanitary-sewage force mains NPS 2-1/2 to NPS 6 shall be the following:

1. Hot dipped Galvanized Steel Pipe schedule 40, pressure fittings, and threaded joints.

J. Underground sanitary-sewage force mains NPS 4 and smaller shall be the following:

1. Hot dipped Galvanized Steel Pipe schedule 40, pressure fittings, and threaded joints.

K. Above ground condensate shall be the following:

1. Hard copper ASTM B88 with pressure fittings or DWV copper ASTM B306 with drainage fittings.

3.3 PIPING INSTALLATION

A. Sanitary sewer piping beyond five feet outside the building is specified in “Civil Utility Section”.

B. Provide basic piping installation as required.

C. Install seismic restraints on piping.

D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

E. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

F. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside the building between wall and floor penetrations and connection to

sanitary sewer piping outside the building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

1. Install encasement on piping according to ASTM A674 or AWWA C105.

G. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Provide sleeves and mechanical sleeve seals as required.

H. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.

I. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A674 or AWWA C105.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe.
3. Straight tees, elbows, and crosses may be used on vent lines.
4. Do not change direction of flow more than 90 degrees.
5. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
6. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 6 and smaller.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow NPS 2 (DN80) and smaller at 1/4 inch per foot minimum.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

N. Hubless piping shall be installed in a rigid, linear, and plumb system without any deflection at the joints either horizontally or vertically. The system shall be supported and secured to the building structure to prevent movement induced by a ten-foot head of water and its associated thrust forces.

1. When horizontal hubless CI piping is suspended in excess of 18 inch by means of non-rigid hangers, provide sway bracing to prevent horizontal movement.
2. For all horizontal hubless CI piping 5-inch and larger, provide sway bracing to prevent horizontal movement at every branch opening and change of direction by securing to building structure, or provide pipe clamps and rodding across coupling.

O. Exterior exposed vent terminations to be stainless steel at through exterior wall penetrations.

3.4 HANGER & SUPPORT INSTALLATION

A. Pipe hangers and supports - Install the following:

1. Vertical Piping: MSS Type 8 or Type 42 clamps.
2. Install individual, straight, horizontal piping runs according to the following:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer than 100 Feet, if indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports as required.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 10 feet, 0 inches with 3/8-inch rod.
2. NPS 3: 10 feet, 0 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 10 feet, 0 inches with 5/8-inch rod.
4. NPS 6: 10 feet, 0 inches with 3/4-inch rod.
5. NPS 8 to NPS 12: 10 feet, 0 inches with 7/8-inch rod.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

H. Install supports for vertical steel piping every 15 feet.

I. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2: 84 inches with 3/8-inch rod.
2. NPS 3: 96 inches with 1/2-inch rod.
3. NPS 4: 108 inches with 1/2-inch rod.
4. NPS 6: 10 feet with 5/8-inch rod.

J. Install supports for vertical stainless-steel piping every 10 feet.

K. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

L. Install supports for vertical copper tubing every 10 feet.

M. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 SANITARY PIPING INSTALLATION

A. Install backwater valves in building main sewer piping as required. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at its upper terminal, and at every 75 feet of developed length, or fraction thereof.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.

G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

H. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

I. Install through-penetration firestop assemblies in plastic at floor penetrations.

J. Assemble open drain fittings and install with top of hub 2 inches above floor.

K. Install deep-seal traps on floor drains and other waste outlets, if indicated.

L. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

M. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

N. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

O. Install vent caps on each vent pipe passing through roof.

P. Do not install vent caps at wall penetrations.

Q. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

R. Install grease interceptors, including trapping, venting, and sampling box, according to authorities having jurisdiction and with clear space for servicing.

S. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

T. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

U. Install electric self-regulating temperature maintenance cable (Heat Trace cable) on all grease waste piping.

3.6 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.

2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.

2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.

3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings as required.

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.7 SANITARY INTERCEPTORS INSTALLATION

A. Install interceptor inlets and outlets at elevations indicated.

B. Place concrete for cast-in-place interceptors according to ACI 318/318R and ACI 350R.

C. Install precast concrete interceptors according to ASTM C891. Set level and plumb.

D. Install maintenance risers from top of underground concrete interceptors to Maintenance Holes and gratings at finished grade.

E. Set tops of maintenance frames and covers coordinated with site paving contractor and LAWA requirements.

F. Clean and prepare concrete surfaces to be field painted. Remove loose efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen surface as required to remove glaze. Paint the following concrete surfaces as recommended by paint manufacturer:

1. Precast Concrete Interceptors: All exterior and interior.

3.8 SEWERAGE PUMPS INSTALLATION

A. Provide excavating, trenching, and backfilling as required.

B. Install sewage pumps according to applicable requirements in ANSI/HI 1.4.

C. Install pumps and arrange to provide access for maintenance including removal of motors, impellers, couplings, and accessories.

D. Set submersible sewage pumps on basin floors. Make direct connections to sanitary drainage piping.

1. Anchor guide-rail supports to basin bottoms and sidewalls or covers. Install pumps so pump and discharge pipe disconnecting flanges make positive seals when pumps are lowered into place.

E. Install sewage pump basins and connect to drainage and vent piping. Brace interior of basins according to manufacturer's written instructions to prevent distortion or collapse during concrete placement. Set basin cover and fasten to basin top flange. Install cover so top surface is flush with finished floor.

F. Construct sewage pump pits and connect to drainage and vent piping. Set pit curb frame recessed in and anchored to concrete. Fasten pit cover to pit curb flange. Install cover so top surface is flush with finished floor.

G. Install packaged, submersible sewage pump units and make direct connections to drainage and vent piping.

H. Install packaged, wastewater pump unit basins on floor or concrete base unless recessed installation is indicated. Make direct connections to drainage and vent piping.

I. Support piping so weight of piping is not supported by pumps.

3.9 START UP SERVICE

A. Engage a factory –authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer’s written instructions.

2. Verify sewage basin is clear and no large debris before sewage pump start up.

B. Start sewage pumps ejectors without exceeding safe motor power.

C. Test and adjust sewage pumps controls and safeties.

D. Remove and replace damaged and malfunctioning components.

E. Occupancy Adjustments: When requested within 12 months from date of LAWA acceptance, provide on-site assistance in adjusting sewage pumps system to suit actual occupied conditions. Provide up to two visits to Projects outside normal occupancy hours for this purpose.

3.10 TRAINING

A. See LAWA DCH Guide Specifications 01 79 00 “Demonstration and Training” for demonstration and training requirements.

B. Provide minimum of 12 hours (3 shifts total) classroom and hands on training to LAWA Maintenance personnel.

END OF SECTION 22 13 00

SECTION 22 14 00 - FACILITY STORM DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Storm water piping buried beyond 5 feet of building.
2. Storm water piping buried within 5 feet of building.
3. Storm water piping above grade.
4. Unions and flanges.
5. Roof drains.
6. Parapet drains.
7. Canopy and cornice drains.
8. Special purpose downspout covers.
9. Downspout nozzles.
10. Area drains.
11. Exterior planter drains.
12. Cleanouts.
13. Sumps.
14. Interceptors.
15. Catch basins.
16. Maintenance holes.
17. Sump pumps.
18. Bedding and cover materials.

1.2 REFERENCES

A. General: Comply with Appropriate Standards.

1. Plumbing and Drainage Institute: PDI.

2. Standard Urban Stormwater Mitigation Plan: SUSMP.

1.3 SUBMITTALS

A. Submit data on all materials, fittings, accessories and equipment.

B. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sump pumps, and maintenance holes.

D. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sump-pumps, catch basins and maintenance holes.

E. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.

2. Storm Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

3. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

F. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 WARRANTY

A. Furnish one-year minimum warranty.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of equipment and clean-outs.

B. Operation and Maintenance Data: Submit spare parts lists, exploded assembly views for pumps and equipment.

PART 2 - PRODUCTS

2.1 STORM WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Coordinate with Civil Engineer.

B. Cast Iron Soil Pipe: CISPI, ASTM A888 service weight, hubless.

1. Fittings: Cast iron, ASTM A888 and CISPI – with stainless steel clamp and shield assembly.

2. Joints: CISPI ASTM C564, rubber gasket joint devices.

3. Manufacturers – Heavy Duty Stainless Steel Couplings

   a. Husky / Anaco / McWane Inc.; Husky SD 4000.
   b. Clamp-All Products / NORMA Group.
   c. Ideal-Tridon / Ideal Clamp Products, Inc.

4. Manufacturers – Heavy Duty Cast Iron or Ductile Iron Couplings

   a. MG Coupling / MG Piping Products Company.
   b. Victaulic Company.
   c. Or Approved Equal.

C. Ductile-Iron Pipe and Fittings

1. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.

   a. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   b. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.

   a. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   b. Gaskets: AWWA C111, rubber.

3. Flanges: ASME 16.1, Class 125, cast iron.

D. ABS Pipe: Pipe, fittings and joints shall comply with codes and standards in effect at time of installation.

2.2 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Soil Pipe: CISPI, ASTM A888 service weight, hubless.

1. Fittings: Cast iron, ASTM A888 and CISPI – with stainless steel clamp and shield assembly.

2. Joints: CISPI ASTM C564, rubber gasket joint devices.

3. Manufacturers – Heavy Duty Stainless Steel Couplings

   a. Husky / Anaco / McWane Inc.; Husky SD 4000.
   b. Clamp-All Products / NORMA Group.
   c. Ideal-Tridon / Ideal Clamp Products, Inc.

4. Manufacturers – Heavy Duty Cast Iron or Ductile Iron Couplings

    a. MG Coupling / MG Piping Products Company.
    b. Victaulic Company.
    c. Or Approved Equal.

B. Ductile-Iron Pipe and Fittings

1. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.

    a. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
    b. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.

    a. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
    b. Gaskets: AWWA C111, rubber.

3. Flanges: ASME 16.1, Class 125, cast iron.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A53 / A53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.

B. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.

C. Pressure Fittings:

1. Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.

2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.

3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.

4. Cast-Iron Flanges: ASME B16.1, Class 125.

5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.

D. Grooved-Joint Systems:

1. Manufacturers:

    a. Anvil International / Mueller Water Products, Inc.
    b. Star Pipe Products.
    c. Victaulic Company.
    d. Ward Manufacturing, Inc.

2. Grooved-End, Steel-Piping Fittings: ASTM A47/A47M, galvanized, malleable-iron casting; ASTM A106, galvanized-steel pipe; or ASTM A536, galvanized, ductile-iron casting; with dimensions matching steel pipe.

3. Grooved-End, Steel-Piping Couplings: AWWA C606, for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

2.4 SPECIAL PIPE FITTINGS

A. Rigid, Unshielded, Non-pressure Pipe Couplings: ASTM C1461, sleeve-type reducing or transition-type mechanical coupling molded from ASTM C1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

a. Anaco / McWane Inc.
b. Or Approved Equal.

B. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Dresser, Inc.; General Electric Company.
c. EBAA Iron, Inc.

2. Center-Sleeve Material: Ductile iron or malleable iron.

3. Gasket Material: Natural or synthetic rubber.

4. Metal Component Finish: Corrosion-resistant coating or material.

C. Flexible Ball Joints: Ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball-joint section and ductile-iron gland, rubber gasket, and steel bolts.

1. Manufacturers:

a. **EBAA Iron, Inc.**
b. **Or Approved Equal.**

D. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

1. Manufacturers:

a. SIGMA Corporation.
b. Or Approved Equal.

2.5 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Description: ASTM A674 or AWWA C105, high-density, cross laminated PE film of 0.004-inch or LLDPE film of 0.008-inch minimum thickness.

B. Form: Sheet or tube.

C. Color: Black.

2.6 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe CISPI: ASTM A888, service weight, hubless.

1. Fittings: Cast iron, ASTM A888.

2. Joints: ASTM C564, rubber gasket and stainless steel clamp and shield assemblies.

3. Unions for Pipe 2 inches and Smaller:

a. Copper Piping: Class 150, bronze unions with soldered brazed joints.
b. Brass Ball valve and 6" nipple: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

4. Flanges for Pipe 2-1/2 inches and Larger:

a. Copper Piping: Class 150, slip-on bronze flanges.
b. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.7 ROOF DRAINS

A. Manufacturers:

1. Jay R. Smith Mfg. Co. / Morris Group International

2. Zurn Industries, LLC / Rexnord Corporation.

3. MIFAB, Inc.

B. Roof Drain (RD-1):

1. Assembly: ASME A112.21.2M.

2. Body: Lacquered stainless steel with sump.

3. Strainer: Removable cast iron dome with vandal proof screws.

4. Accessories: Coordinate with roofing type as required.

C. Roof Drain (RD-2): Overflow type.

1. Same as RD-1, with 2" min. height water dam.

2.8 PARAPET DRAINS

A. Manufacturers:

1. Jay R. Smith Mfg. Co. / Morris Group International
2. Zurn Industries, LLC / Rexnord Corporation.
3. MIFAB, Inc.

B. Lacquered cast iron body with flashing clamp collar and nickel bronze grate.

2.9 CANOPY AND CORNICE DRAINS

A. Manufacturers:

1. Jay R. Smith Mfg. Co. / Morris Group International
2. Zurn Industries, LLC / Rexnord Corporation.
3. MIFAB, Inc.

B. Lacquered cast iron body with flashing clamp collar and nickel bronze flat strainer.

2.10 SPECIAL PURPOSE DOWNSPOUT COVER

A. Manufacturers:

1. Jay R. Smith Mfg. Co. / Morris Group International
2. Zurn Industries, LLC / Rexnord Corporation.
3. MIFAB, Inc.

B. Product Description: Brass or Stainless steel with stainless steel mesh liner, vandal proof lock nut, and pipe clamp.

2.11 DOWNSPOUT NOZZLES

A. Manufacturers:

1. Jay R. Smith Mfg. Co. / Morris Group International
2. Zurn Industries, LLC / Rexnord Corporation.
3. MIFAB, Inc.

B. Product Description: Nickel or Polished bronze body and round wall flange with straight bottom section and screened outlet.

2.12 AREA DRAINS

A. Manufacturers:

1. Jay R. Smith Mfg. Co. / Morris Group International
2. Zurn Industries, LLC / Rexnord Corporation.
3. MIFAB, Inc.

B. Area Drain (AD-1): Lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

C. Area Drain (Trench Drain) (AD-2): Lacquered cast iron ductile iron or stainless steel; with drainage flange, heavy duty grate 6 inches 12 inches wide, 12 inches 24 inches long, dome strainer, end plates with gaskets; end, middle or bottom outlet.

2.13 EXTERIOR PLANTER DRAINS

A. Manufacturers:

1. Jay R. Smith Mfg. Co. / Morris Group International
2. Zurn Industries, LLC / Rexnord Corporation.
3. MIFAB, Inc.

B. Lacquered cast iron body with sump.

C. Strainer: Removable polyethylene dome with stainless steel screen.

D. Accessories: Membrane flange and membrane clamp with integral gravel stops.

2.14 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.

B. Downspout Boots:

1. Description: ASTM A48/A48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 outlet; and shop-applied bituminous coating.
2. Description: ASTM A74, Service class, hub-and-spigot, cast-iron soil pipe.

C. Conductor Nozzles:

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.

D. Overflow Outlet:

1. Stainless steel type 304 with hinged perforated cover similar to J.R. Smith 1775, vandal proof.

2.15 FLASHING MATERIALS

A. Copper Sheet: ASTM B152/B152M, 12 oz./sq. ft. thickness.

B. Zinc-Coated Steel Sheet: ASTM A653/A653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B32, lead-free alloy.

G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.16 CLEANOUTS

A. Exterior Surfaced Areas (CO-1): Round or square cast nickel bronze access frame and non-skid cover.

B. Exterior Unsurfaced Areas (CO-2): Line type with lacquered cast iron body and round epoxy coated cover with gasket.

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

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

E. Interior Unfinished Accessible Areas (CO-5): Caulked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.17 SUMPS

A. Manufacturers:

1. Pro-Cast Product Inc.

2. Jensen Precast.

3. Zoeller Company.

B. Water-tight, factory fabricated; reinforced fiberglass or concrete; sleeved inlet, outlet and vent openings, and any other sidewall openings for pipe connections.

C. Cover shall be cast iron, airtight and have integral seals, gaskets and bushings, sized for sump access.

D. Exterior locations shall have hinged and lockable traffic weight covers.

2.18 SEDIMENT INTERCEPTORS

A. Manufacturers:

1. Jay R. Smith Mfg. Co. / Morris Group International

2. Zurn Industries, LLC / Rexnord Corporation.

3. Or Approved Equal.

B. Sediment Interceptor: Epoxy coated cast iron, Stainless steel or Precast concrete body and secured cover with removable stainless steel sediment bucket.

2.19 SUMP PUMPS

A. Manufacturers:

1. PACO / Grundfos CBS, Inc.

2. Zoeller Company.

3. Or Approved Equal.

B. Pump Type: Vertical centrifugal, direct connected, duplex 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 stainless steel shaft.

E. Support: Cast iron pedestal motor support on steel floor plate with gas tight gaskets.

F. Bearings: Oil 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 sump with inspection opening and cover, and alarm fittings.

I. Controls (Duplex): Float operated mechanical alternator with float rod, stops, and corrosion resistant float to alternate operation of pumps. Cut-in second pump on rising level or lead pump failure. Furnish separate pressure switch high level alarm with transformer, alarm bell, and standpipe, and extra set of wired terminals for remote alarm circuit and emergency float switch with float rod, stops, and corrosion resistant float to operate both pumps on failure of alternator. Provide NEMA 250, Type 1 enclosure.

2.20 SUBMERSIBLE SUMP PUMPS

A. Manufacturers:

1. PACO / Grundfos CBS, Inc.

2. Zoeller Company.

3. Or Approved Equal.

B. Pump Type: Completely submersible, vertical, centrifugal.

C. Casing: Cast iron pump body and oil filled motor chamber.

D. Impeller: Cast iron; closed, stainless steel.

E. Bearings: Ball bearings.

F. Sump: Fiberglass steel or concrete, basin with steel cover plate.

G. Accessories: Oil resistant cord and plug with three-prong connector for connection to electric wiring system including grounding connector.

H. Servicing: Slide-away coupling consisting of discharge elbow secure to sump floor, movable bracket, guide pipe system, lifting chain and chain hooks.

I. Integral level controls with separate level alarm.

J. Controls: Motor control panel containing across-the-line electric motor starters with ambient compensated quick trip overloads in each phase with manual trip button and reset button, circuit breaker, control transformer, electro-mechanical alternator, hand-off-automatic selector switches, pilot lights, high water alarm pilot light, reset button and alarm horn. Furnish mercury switch liquid level controls, steel shell switch encased in polyurethane foam with cast iron weight for pump on (each pump), pump off (common), and alarm. Provide NEMA 250, Type 1 enclosure.

2.21 BUILDING AUTOMATION SYSTEM INTERFACE

A. Provide auxiliary contacts in pump controllers for interface to building automation system. Include the following:

1. On-off status of each pump.

2. Alarm status.

3. Pump failure.

2.22 ALARM PANEL

A. Remote-mounted alarm panel shall consist of a single NEMA 1 enclosure complete with 3 indicating lights, reset buttons, alarm horn or bell and silencing switch. Lights shall be normally dim-glow and shall change to full-glow and sound the alarm under any of the following conditions:

1. Power failure to the pump control panel.

2. High water condition.

3. Simultaneous two pump operation.

4. Failure of either pump.

B. Coordinate location and wiring of alarm panel with electrical contractor

C. Wiring diagrams:

1. Furnish and turn over to LAWA, complete wiring diagrams showing full details of the factory wiring.

2.23 CONTROL PANEL

A. Combination unfused disconnect switch and across-the-line magnetic starter with overload protection for each phase leg, for each pump.

1. Under voltage protection.

2. 120 volt control circuit transformer, fused on primary, and grounded on secondary, with automatic transfer between each pump's incoming supply in the event of failure or shutdown of power supply to any pump. Connections to pump incoming supplies shall be made downstream of controller disconnect devices.

3. Momentary contact push buttons marked MANUAL, for bypassing automatic control when held in (JOGGING).

4. Automatic electric alternator (four lead units).

5. Moisture sensing audible and visual alarm.

PART 3 - EXECUTION

3.1 INSTALLATION

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.

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

E. Field verify connection to existing piping systems sizes, locations, and invert are as required.

F. Establish elevations of buried piping with not less than allowed per code.

G. Establish minimum separation of from other piping services in accordance with code.

3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground storm drainage piping NPS 6 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.

3. Galvanized steel pipe, drainage fittings, and threaded joints.

4. Grooved end galvanized malleable iron fittings and bolted clamp type malleable iron couplings with rubber sealing gaskets for grooved end pipe equal to Victaulic Style 75 or 77.

5. Dissimilar Pipe-Material Couplings: Shielded, non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

C. Aboveground, storm drainage piping NPS 8 and larger shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.

3. Steel pipe, drainage fittings, and threaded joints.

4. Dissimilar Pipe-Material Couplings: Shielded, non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

D. Underground storm drainage piping NPS 6 and smaller shall be the following:

1. Extra-heavy class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.

3. Galvanized steel pipe, drainage fittings, and threaded joints.

4. Dissimilar Pipe-Material Couplings: Shielded, non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

E. Underground, storm drainage piping NPS 8 and larger shall be the following:

1. Extra-Heavy class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel and heavy-duty shielded, cast-iron couplings; and coupled joints.

3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

F. Aboveground storm drainage force mains NPS 2-1/2 to NPS 6 shall be the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.

2. Galvanized steel pipe, pressure fittings, and threaded joints.

3. Grooved-end galvanized steel pipe, grooved-joint system fittings and couplings, and grooved joints.

G. Underground storm drainage force mains NPS 4 and smaller shall be the following:

1. Galvanized steel pipe, pressure fittings, and threaded joints.
   a. Include grooved-joint system fittings and couplings and grooved joints where indicated.
2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile-iron fittings; glands, gaskets, and bolts; and mechanical joints.
   a. Include grooved-joint system fittings and couplings and grooved joints where indicated.
3. Pressure pipe couplings if dissimilar pipe materials or piping with small difference in OD must be joined.

3.3 PIPING INSTALLATION

A. Install seismic restraints on piping as required.

B. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers as required.

C. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.

D. Install underground, steel, force-main piping. Install encasement on piping according to ASTM A674 or AWWA C105.

E. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to storm sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

1. Install encasement on piping according to ASTM A674 or AWWA C105.

F. Install underground, ductile-iron, special pipe fittings according to AWWA C600.

1. Install encasement on piping according to ASTM A674 or AWWA C105.

G. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight.

H. Install wall-penetration fitting system at each service pipe penetration through foundation wall. Make installation watertight.

I. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A674 or AWWA C105.

J. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

L. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:

1. Building Storm Drain: 2 percent downward in direction of flow for all piping.

2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.

M. Install force mains at elevations indicated.

N. Install engineered controlled-flow storm drainage piping in locations indicated.

O. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Hubless piping shall be installed in a rigid, linear and plumb system without any deflection at the joints either horizontally or vertically. The system shall be supported and secured to the building structure to prevent movement induced by a ten-foot head of water and its associated thrust forces.

1. When horizontal hubless CI piping is suspended in excess of 18 inch by means of non-rigid hangers, provide sway bracing to prevent horizontal movement.

2. For all horizontal hubless CI piping 5-inch and larger, provide sway bracing to prevent horizontal movement at every branch opening and change of direction by securing to building structure, or provide pipe clamps and rodding across coupling.

3.4 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports - Install the following:

1. Vertical Piping: MSS Type 8 or Type 42 clamps.

2. Individual, Straight, Horizontal Piping Runs: According to the following:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer than 100 Feet, if indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports as required.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.

2. NPS 3: 60 inches with 1/2-inch rod.

3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.

4. NPS 6: 60 inches with 3/4-inch rod.

5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.

6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.

2. NPS 1-1/2: 108 inches with 3/8-inch rod.

3. NPS 2: 10 feet with 3/8-inch rod.

4. NPS 2-1/2: 11 feet with 1/2-inch rod.

5. NPS 3: 12 feet with 1/2-inch rod.

6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.

7. NPS 6: 12 feet with 3/4-inch rod.

8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

H. Install supports for vertical steel piping every 15 feet.

3.5 PIPING SPECIALTIES INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.

2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet for piping.

4. Locate at base of each vertical storm drain riser.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.

E. Assemble non-ASME A112.3.1, stainless-steel channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

F. Install roof drains at low points of roof areas and where indicated according to roof membrane manufacturer's written installation instructions.

1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.

2. Position roof drains for easy access and maintenance.

3. Coated cast iron body roof drains with an inside caulked bottom outlet, except as noted and in accordance with ANSI A112.21.2.

4. For liquid membrane roofs, use four inch wide flange, for built up membrane roofs, a combined flashing flange and gravel stop; and, for steel or precast decks, a deck clamp.

5. Where insulation is applied over a structural roof deck, provide an extension collar with weep holes.

6. For IRMA type roofs, 4 inch high, brass gravel guard, 16 inch diameter perforated with 1/4 inch holes.

7. Provide tops of drains for decks and canopies with a bronze, nickel bronze, statuary bronze finish.

G. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

H. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

I. Install manufactured, gray-iron downspout boots at grade with top 12 inches above grade. Secure to building wall.

J. Install cast-iron soil pipe downspout boots at grade with top of hub 12 inches above grade.

K. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.

L. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.6 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.

2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.

2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.

3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.7 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.8 SUMP PUMP INSTALLATION

A. Install sump pumps according to applicable requirements in ANSI/HI 1.4.

B. Install pumps and arrange to provide access for maintenance including removal of motors, impellers, couplings, and accessories.

C. Set submersible sump pumps on basin or pit floor. Make direct connections to storm drainage piping.

D. Install sump pump basins and connect to drainage piping. Brace interior of basins according to manufacturer's written instructions to prevent distortion or collapse during concrete placement. Set basin cover and fasten to basin top flange. Install cover so top surface is flush with finished floor.

E. Support piping so weight of piping is not supported by pumps.

3.9 START UP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Verify sump basin is clear and no large debris before pump start up.

B. Start pumps without exceeding safe motor power:

C. Test and adjust controls and safeties.

D. Remove and replace damaged and malfunctioning components.

E. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sump pump system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

3.10 TRAINING

A. See LAWA Guide Specification 01 79 00 "Demonstration and Training" for demonstration and training requirements.

B. Provide minimum of 12 hours (3 shifts total) classroom and hands on training to LAWA Maintenance personnel.

END OF SECTION 22 14 00

SECTION 22 32 00 - DOMESTIC WATER FILTRATION EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following types of filtering equipment:

1. Centralized softener, reverse osmosis or carbon filtering.
2. Point of use filters.

1.2 REFERENCES

A. General: Comply with appropriate standards.

1. American Society of Mechanical Engineers: ASME.
2. Underwriters Laboratories Inc.: UL
3. California AB 1953 Lead Free.

1.3 SUBMITTALS

A. Submit data on all materials, fittings, accessories and equipment.

B. Shop Drawings: Indicate pipe materials used, joining methods, supports, floor and wall penetrations seals. Indicate installation, layout, weights, mounting and support details, and piping connections. Provide detail water filtration assemblies and indicate dimensions, weight loads, and required clearances.

C. Product Data: Submit capacity, electrical characteristics and connection requirements. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, taps, drains, controls, and operating sequence. Identify center of gravity and locate and describe mounting and anchorage provisions

D. Startup service test reports.

E. Operation and Maintenance Data: For water filtration equipment to include in emergency, operation, and maintenance manuals.

1. Do not install water filtration media until final water piping systems have been flushed and cleaned.
2. Prepare filter media per manufacturer requirements.

1.4 WARRANTY

A. Furnish five-year manufacturer warranty.

PART 2 - PRODUCTS

2.1 CENTRALIZED FILTERING EQUIPMENT

A. Manufacturers:

1. Filtrine Manufacturing Company.
2. WaterSoft Inc.

3. Culligan International Co.

B. Equipment capacities and related piping as required.

2.2 POINT OF USE FILTERS

A. Manufacturers:

1. Everpure / Pentair Inc.
2. Filtrine Manufacturing Company.
3. WaterSoft Inc.

B. Sizes, flow capacities, and type as required.

2.3 CATRIDGE FILTER

A. Off-Floor Cartridge Filters:

1. Manufacturers:

a. Everpure / Pentair Inc.
b. Filtrine Manufacturing Company.
c. WaterSoft Inc.

2. Description: Simplex, in-line wall-mounting housing with replaceable element for removing suspended particles from water (1/2 micron).

a. Housing: Corrosion resistant; designed to separate feed water from filtrate and to direct feed water through water filter element; with element support.
(1) Pipe Connections: Threaded according to ASME B1.20.1.
(2) Support: Wall bracket.
b. Element: Replaceable; of shape to fit housing.

2.4 CARBON FILTER

A. Description: Simplex carbon filter, with media tank, media, and automatic backwash for removing chlorine from and improving color, odor, and taste of water.

1. Manufacturers:

a. Everpure / Pentair Inc.
b. Culligan International Co.
c. CUNO / 3M Company.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the following piping accessories on water conditioning equipment domestic water piping connections.

1. On inlet:

a. Thermometer.
b. Strainer.
c. Pressure gage.

d. Shut-off valve.

2. On outlet:

a. Shut-off valve.

B. Install drain piping from tanks to nearest approved receptor.

END OF SECTION 22 32 00

SECTION 22 33 00 - ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial grade electric water heaters.

1.2 REFERENCES

A. Comply with appropriate standards.

1. American Society of Mechanical Engineers: ASME.
2. California Energy Commission: C.E.C.

1.3 SUBMITTALS

A. Submit data on all materials.

B. Shop Drawings: Indicate heat exchanger dimensions, size of taps, and performance data. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, taps, and drains.

C. Product Data: Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Submit electrical characteristics and connection locations.

D. Manufacturer's Installation Instructions: Submit mounting and support requirements.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 WARRANTY

A. One year standard warranty.

PART 2 - PRODUCTS

2.1 COMMERCIAL GRADE ELECTRIC WATER HEATERS – TANK TYPE

A. Manufacturers:

1. Lochinvar, LLC / A.O. Smith Water Products Company.
2. Rheem Manufacturing Company.
3. Bradford White Corporation.

B. Type: Automatic, electric, vertical storage.

C. Tank: Glass lined welded steel, thermally insulated with one inch Non-CFC foam, encased in corrosion-resistant steel jacket with baked-on enamel finish, no dielectric fittings, brass ball valve and 6 inch nipple to connect to dissimilar pipes, brass drain valve, T&P relief valve.

D. Controls: Automatic water thermostat with adjustable temperature range from 120 to 170 degrees F, flanged or screw-in nichrome elements, enclosed controls and electrical junction

box and operating light. Wire double element units so elements do not operate simultaneously.

E. Accessories: Seismic anchoring straps, State of California listed and approved.

2.2 COMMERCIAL GRADE ELECTRIC WATER HEATERS – INSTANTANEOUS/POINT-OF-USE

A. Manufacturers:

1. Eemax Inc.
2. Rinnai Corporation.
3. Stiebel-Eltron.

B. Type: Factory-assembled and wired, electric, non-storage type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install tank type water heater on concrete housekeeping pad, minimum 4 inches high and 6 inches larger than water heater base on each side or on listed and approved shelf.

B. Connect domestic hot water and domestic cold water piping to supply and return water heater connections mixing valves and/or circulating pump as required.

C. Install point-of-use type below counter height, adjacent to fixture on tank type.

D. Install the following piping accessories.

1. On supply:
    a. Thermometer well and thermometer.
    b. Strainer.
    c. Pressure gage.
    d. Shutoff valve.
2. On return:
    a. Thermometer well and thermometer.
    b. Pressure gage.
    c. Shutoff valve.

E. Install electrical devices furnished loose for field mounting.

3.2 TRAINING

A. See LAWA DCH Guide Specification section 01 79 00 “Demonstration and Training” for demonstration and training requirements.

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain heat exchangers.

C. Provide minimum of 4 hours each (3 shifts) of classroom and hands on training to LAWA Maintenance personnel.

END OF SECTION 22 33 00

SECTION 22 34 00 - FUEL-FIRED DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial gas-fired water heaters.
2. Packaged water heating systems.
3. Domestic hot water storage tanks.

1.2 REFERENCES

A. Comply with appropriate standards.

1. American Society of Mechanical Engineers: ASME.
2. Southern California Air Quality Control Management District: SCAQMD Rule 1121 Low NOx Emission Standards.

1.3 SUBMITTALS

A. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1 when tested in accordance with all required standards.

1.5 WARRANTY

A. One year standard warranty.

PART 2 - PRODUCTS

2.1 COMMERCIAL GAS FIRED WATER HEATERS

A. Manufacturers:

1. Lochinvar, LLC / A.O. Smith Corporation.
2. Rheem Manufacturing Company.
3. A.O. Smith Water Products Company / A.O. Smith Corporation.

B. Type: Automatic, natural gas-fired, vertical storage.

1. Maximum working pressure: 150 psig.
2. Certification: ANSI Z21.10.1.

C. Tank: Glass lined welded steel with single flue passage, flue baffle and draft hood; thermally insulated with Non-CFC foam and encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs, no dielectric fittings, brass ball valve and 6 inch nipple to connect dissimilar pipes, brass drain valve, T&P relief valve.

D. Controls: Automatic water thermostat and built-in gas pressure regulator; temperature range adjustable from 120 to 170 degrees F, cast iron or stainless steel burner, safety pilot and thermocouple, electronic ignition and power vent if required.

E. Accessories: Brass dip tube, drain valve, magnesium anode, anchoring straps, State of California listed and approved.

2.2 PACKAGED WATER HEATING SYSTEMS

A. Manufacturers:

1. Rheem Manufacturing Company.
2. A.O. Smith Water Products Company / A.O. Smith Corporation.
3. Lochinvar, LLC / A.O. Smith Corporation.

B. System: Gas-fired circulating pump, factory controls, piping and valves, storage tank, all mounted on skid or equipment pad as required.

C. Boiler:

1. Type: natural gas-fired water tube boiler, with copper finned tube heat exchanger, one inch minimum diameter, 13 gage steel boiler tubes and copper tube heat exchanger with bronze heads, 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.

D. Vertical or Horizontal storage tank:

1. Working pressure: 150 psi ASME labeled.
2. Lining: 15 mils thick epoxy lining extended through flanges and couplings.
3. Support: Two factory 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.
4. Connection: No dielectric unions shall be used. Use brass ball valve and 6 inch long Brass nipple to connect dissimilar pipes between tank and piping system.
5. Insulation: 3 inch glass fiber insulation with aluminum jacket.

E. Pump:

1. Type: All bronze, in-line circulation pump mounted on boiler, between heater and storage tank, controlled by tank mounted immersion thermostat set at max. Outlet temperature as required.
2. Pump Capacity: As required.
3. Electrical Characteristics: As required.

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 maximum inlet temperature. Outlet temperature as required.

2.3 DOMESTIC HOT WATER STORAGE TANKS

A. Manufacturers:

1. Rheem Manufacturing Company.
2. A.O. Smith Water Products Company / A.O. Smith Corporation.
3. Lochinvar, LLC / A.O. Smith Corporation.

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

C. Lining: Corrosion-resistant concrete approximately 3/4 inch thick. Glass-lined or as provided as manufacturer.

D. Openings: Up to 3 inches, copper-silicone threaded; over 4 inches, flanged; flanged collar for heat exchanger; man-way 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.

F. Insulation: Factory furnished 2 inch minimum glass fiber insulation with steel aluminum jacket.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install water heater on concrete housekeeping pad, minimum 4 inches high and 6 inches larger than water heater base on each side.

B. Seismic Bracing: Provide approved anchoring straps – two (2) minimum.

C. Install the following piping accessories.

1. On supply:
    a. Thermometer well and thermometer.
    b. Strainer.
    c. Pressure gage.
    d. Shutoff valve.
2. On return:
    a. Thermometer well and thermometer.
    b. Pressure gage.
    c. Shutoff valve.

D. Install the following piping accessories on natural gas piping connections.

1. Shutoff valve.
2. Pressure reducing valve as required.

E. Install discharge piping from relief valves and drain valves to nearest approved receptor.

F. Install circulator and diaphragm expansion tank on water heater.

G. Install electrical devices furnished loose for field mounting.

H. Connect flue to water heater outlet, full size of outlet.

I. Domestic Hot Water Storage Tanks:

1. Provide piping support, independent of building structural framing members.
2. Clean and flush after installation. Seal until pipe connections are made.
3. Provide seismic bracing.

END OF SECTION 22 34 00

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water closets.
2. Urinals.
3. Lavatories.
4. Sinks.
5. Service sinks.
6. Electric water coolers.
7. Wash fountains.

1.2 REFERENCES

A. General: comply with appropriate standards.

1. International Association of Plumbing and Mechanical Officials: IAPMO.
2. California State AB 1953.

1.3 SUBMITTALS

A. Submit data on all materials, fittings, accessories and equipment. Indicate materials, finishes, dimensions, construction details and flow control roles.

B. Manufacturer's Installation Instructions: Submit installation methods and procedures.

C. Los Angeles Green Building Code Submittal/Tier Level Performance Requirements: Obtain LAWA requirements for the project.

D. Shop Drawings: Diagram power, signal and control wiring.

E. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

F. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.

1.4 WARRANTY

A. Furnish five-year minimum warranty.

PART 2 - PRODUCTS

NOTE: * - Already complies with Los Angeles Green Building Code Tier 1
** - Already complies with Los Angeles Green Building Code Tier 1 & 2

2.1 GENERAL

The following gallons per flush or flow in gallons per minute are required water use baseline for project:

Plumbing Fixture	**LAWA/LAGBC - Baseline Flow**	**LAWA/LAGBC – Tier 1**
Water Closets Flushometer valve	1.28 gallons per flush	1.12 gallons per flush
Urinals Flushometer valve	0.125 gallons per flush	0.11 gallons per flush
Lavatory Faucet	0.5 gallons per minute at 60 psi	0.35 gallons per minute at 60 psi
Showers Heads	1.5** gallons per minute	1.5** gallons per minute
Pantry Sinks	1.5 gallons per minute	1.5 gallons per minute
Mop Sinks	Per ASME A112.18.1, 4.0 gallons per minute	Per ASME A112.18.1, 4.0 gallons per minute
Water Closet Gravity tank	1.28 gallons per flush	1.12 gallons per flush
Kitchen Faucets	1.8 gallons per minute at 60 psi	1.5 gallons per minute at 60 psi
Metering Faucets	0.20 gallons per cycle	0.18 gallons per cycle
Wash Fountains	1.8 gallons per minute at 60 psi	1.5 gallons per minute at 60 psi
Metering Faucets for Wash Fountains	0.20 gallons per minute at 60 psi	0.18 gallons per minute at 60 psi
NOTE: When applicable, the more stringent requirement is shown in this table.		

2.2 FLUSH VALVE WATER CLOSETS

A. Manufacturers: Vitreous China.

1. American Standard / American Standard Brands.* Afwall Model Number 2257.001 (Basis of Design Product)

2. Kohler Company.

3. Zurn Industries.*

B. Manufacturers: Type 304 stainless steel

1. Zurn Industries, LLC / Rexnord Corporation.

2. Willoughby Industries, Inc.

3. Or approved equal.

C. Manufacturers: Flush Valves.

1. Sloan Valve Company.

2. Zurn Industries, LLC / Rexnord Corporation.*

3. Toto USA.

D. Bowl: ASME A112.19.2M; wall hung, siphon jet, with elongated rim, exposed top spud, size per flush valve requirements, bolt caps; floor anchored carrier.

E. Bowl: ASME A112.19.2M; floor mounted, siphon jet, or blow out, with elongated rim, exposed top spud, or concealed back-size per flush valve requirements; bolt caps.

F. Disabled Access: Where required.

G. Exposed Flush Valve: ASME A112.18.1; exposed Chrome Plated (C.P.), diaphragm type with oscillating handle, escutcheon, seat bumper, integral screwdriver stop, and vacuum breaker 1.28 maximum gallons per flush per Table listed in sub-section 2.1 above. If Tier 1 is required in the project, maximum gallon per flush shall be 12% less, Tier 2 20% less, than the baseline flow listed in the Table.

H. Water Closet Flushometers:

1. Sensor Operated - Hard Wired:

a. Exposed diaphragm type, chrome plated, sensor operated flushometer valve.
b. Low consumption valves shall have dual filtered type diaphragm kit for flush discharge accuracy.
c. Valve shall be non-hold-open, solenoid operator, skirted high back pressure vacuum breaker with bottom hex coupling nut, back-check control stop will have free spinning vandal resistant stop cap and sweat solder adapter kit with cast set screw all flange.
d. Valve shall include self-adaptive infrared sensor with indicator light, courtesy flush override button, chrome plated wall mounted sensor cover plates (for 2-gang electrical box) or exposed top mounted sensor, and vandal resistant screws.
e. Valve body, cover tailpiece and control stop will be in conformance with ASTM Alloy Classification for Semi-Red Brass.
f. Valve shall be in compliance with the applicable sections of ASSE 1037, ANSI/ASME 112.19.6, and Military Specification V-29193 Standards. Sloan Valve Company Royal 113-1.28 ESS OR.

I. Seats:

1. Manufacturers:

a. Olsonite / Bemis 95CT (Basis of Design Product)
b. American Standard / American Standard Brands.

c. Kohler Company.

2. Seat: Shall be white heavy-duty plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.

J. Carriers:

1. Manufacturers:

a. Jay R. Smith Mfg. Co. / Morris Group International 0600 (Basis of Design Product)
b. Zurn Industries, LLC / Rexnord Corporation.
c. MIFAB, Inc.

2. Carrier: ASME A112.6.1; adjustable or non-adjustable, cast iron or ductile iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers; single, double, vertical or horizontal type as required. When the distance from the carrier to the face of wall stud exceeds 7", an M40 Wide Chase Pipe Support (Basis of Design) shall be installed

K. Water-Closet Supports:

1. Description: Combination carrier designed for accessible and standard mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

2. Concealed adjustable extra heavy cast iron combination drainage fitting and chair carriers with an adjustable base anchored to slab using all base support holes, rear anchor foot assembly for stud walls, adjustable cast iron outlet nipple and/or coupling, neoprene gasket and steel supporting bolts with chrome plated washers and cap nuts, equal to Smith Series No. 100, No. 200, No. 400, or No. 500 for siphon jet.

3. For employee use bariatric supports for a 1,000 pound load rating.

4. Set bowls for physically handicapped with top of seat 17 to 19 inches above floor per ADA requirements and provide carrier, equal to Smith No. 600. For blowout, use Smith No. 620.

2.3 WALL HUNG URINALS

A. Manufacturers: Vitreous China

1. American Standard / American Standard Brands 6590.001 (Basis of Design Product)

2. Sloan Valve Company

3. Kohler Company

B. Manufacturers: Flush Valves.

1. Sloan Valve Company OPTIMA 186-0.125 ESS OR (Basis of Design Product)

2. Zurn Industries, LLC / Rexnord Corporation

3. Toto USA

C. Urinal: ASME A112.19.2M or ANSI Z124.9, wall hung washout or siphon jet, integral trap, exposed top spud type, size per flush valve requirements, floor anchored carrier.

1. Waterless urinals are unacceptable.

D. Exposed Flush Valve: ASME A112.18.1; exposed chrome plated, diaphragm type with oscillating handle, or push plate, escutcheon, integral screwdriver stop, vacuum breaker; equal to 0.125 gallon per flush.

E. Sensor Operated Flush Valve: ASME A112.18.1; exposed chrome plated, diaphragm type with low voltage solenoid operator, infrared sensor and over-ride button in wall mounted chrome plated plate or top mounted, wheel handle stop and vacuum breaker; equal to 0.13 gallon per flush.

F. Urinal Flushometers:

1. Sensor-Operated Hard-Wired:

a. Exposed diaphragm type, chrome plated, sensor operated flushometer valve.
b. Low consumption valves shall have dual filtered type diaphragm kit for flush discharge accuracy.
c. Valve shall be non-hold-open, solenoid operator, skirted high back pressure vacuum breaker with bottom hex coupling nut, back-check control stop will have free spinning vandal resistant stop cap and sweat solder adapter kit with cast set screw wall flange.
d. Valve shall include Optima EL-1500 self-adaptive infrared sensor with indicator light, chrome plated wall mounted sensor cover plates (for 2-gang electrical box) or top mounted sensor, with vandal resistant screws.
e. Valve, body, cover, tailpiece and control stop shall be in conformance with ASTM Alloy Classification for Semi-Red Brass.
f. Valve shall be Sloan Valve Company OPTIMA 186-0.125 ESS OR.

G. Flush (Metering) Valve: ASME A112.18.1; exposed chrome plated, porous felt type for 1/2 inch supply with oscillating handle, or push button, screwdriver stop and vacuum breaker.

H. Carriers:

1. Manufacturers:

a. Jay R. Smith Mfg. Co. / Morris Group International. 0636 or 0637 (Basis of Design Product)
b. Zurn Industries, LLC / Rexnord Corporation.
c. MIFAB, Inc.

2. Wall Mounted Carrier: ASME A112.6.1; cast iron or ductile iron frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs, elastomeric gasket or approved setting compound, for fixture to flange connection.

I. Disabled Access: Approved type where required.

2.4 LAVATORIES

A. Manufacturers: Vitreous China/Porcelain Enameled Cast Iron.

1. American Standard / American Standard Brands.

2. Kohler Company.

3. Crane Plumbing / American Standard Brands.

B. Manufacturers: Integral basin type.

1. Corian / E. I. du Pont de Nemours and Company (DuPont) self-draining with integral bowl or approved equal

C. Manufacturers:

1. Deck mounted Faucets. Sensor-Operated Solar Powered with Battery Backup
   a. Sloan Valve Company* Solis EAF-275 Chrome Plated (Basis of Design Product)
   b. Chicago Faucets / the Geberit Group.*
   c. American Standard / American Standard Brands.*
2. Deck mounted Faucets. Push Operated
   a. Chicago Faucets / the Geberit Group.* 844-E2605-665 PSHABCP (Basis of Design Product)

D. Wall Hung Basins: size as required, with 4 inch high back; drillings on 4 inch or 8 inch centers or single hold punch, rectangular basin with splash lip, front overflow, and soap depression.

E. Counter Top Basins: self-rimming lavatory-size as required with drillings on 4 inch or 8 inch centers, front overflow, soap depression, seal of putty, caulking, or concealed vinyl gasket.

F. Undercounter Lavatory: unglazed rim for under counter mount with rear overflow, size as required with drillings on 4 inch or 8 inch centers or single hole.

G. Manufacturers:

1. American Standard / American Standard Brands.

2. BrassCraft Mfg. / Masco Corporation.

3. Chicago Faucets / the Geberit Group.

H. Metered Faucet: ASME A112.18.1; chrome plated metered manual mixing faucet low voltage or battery operated solenoid operator and infrared sensor, water economy aerator spray and cover plate.

I. Disabled Access: Approved type where required with insulated stops, supplies, trap and drain outlet, offset grid strainer.

J. Carriers: where required.

1. Manufacturers:

a. Jay R. Smith Mfg. Co. / Morris Group International.
b. Zurn Industries, LLC / Rexnord Corporation.
c. MIFAB, Inc.

K. Lavatory insulation kit where required: Tru-Bro, Plumerex, or approved equal.

L. Waste Outlets:

1. Manufacturers:

a. American Standard / American Standard Brands.
b. Brasscraft Mfg. / Masco Corporation.
c. Chicago Faucets / the Geberit Group.

2. Descriptions:

a. All Lavatory Types Unless Otherwise Noted:
(1) Description: Lavatory waste outlets with open strainer waste & trap shall have a cast brass waste connection with brass compression ring and brass slip unit connected to concealed piping in wall. Connect to concealed piping using cast brass waste connection with brass compression ring and brass slip unit.
(2) C.P. brass open strainer waste outlet with 17-gauge 1-1/4 inch tail piece, unless otherwise noted.
(3) 1-1/4 inch by 1-1/2 inch cast brass P-trap without cleanout.
(4) 17 gauge copper tubing wall outlet with set-screw type cast brass escutcheon.
(5) Waste Outlets for handicap lavatories: Open strainer waste outlet with offset waste.

M. Fixture Supports:

1. Manufacturers:

a. Jay R. Smith Mfg. Co. / Morris Group International.
b. American Standard / American Standard Brands.
c. Chicago Faucets / the Geberit Group.

2. Descriptions:

a. All Lavatory Types Unless Otherwise Noted:
(1) Description: For lavatories, provide concealed adjustable iron uprights with concealed arm chair carriers.
(2) Locations: All lavatories.

(3) For stud walls, supports with 3-inch x 1-inch rectangular uprights welded to base.
(4) For Handicap Accessible Lavatories: Provide concealed adjustable iron arm chair carriers.

2.5 SINKS

A. Manufacturers: Fixtures.

1. Stainless Steel:

a. Elkay Manufacturing Company.
b. Franke.
c. Just Manufacturing.

B. Manufacturers: Faucets.

1. Chicago Faucets / the Geberit Group.*

2. Sloan Valve Company.

3. American Standard / American Standard Brands.*

C. Warewashing Sink:

1. Two compartment, self-rimming, counter-mounting, stainless-steel commercial sink with two integral metal drain boards in counter with five (5) holes, faucet openings eight 8) inches on centers.

2. Sink shall be No. 18 USSG genuine 18-8 solid stainless steel and shall be bonded to and reinforced with heavy gauge formed metal.

3. Underside shall be sound deadened.

4. Provide one piece with bowls welded integrally to tops.

5. Horizontal and vertical corners of bowls shall be rounded to 1-3/4 inch radius.

6. Joints shall be welded and ground smooth.

7. Bottom shall be pitched to drain outlet and drilled for trim as required.

8. Provide wood strips for fastening top to cabinets.

9. Type SK1:

a. Size: 33 inch x 21 ¼ inch x 5 ½ inch deep with five (5) holes, four (4) faucet openings one (1) stainless steel air-gap fitting (8) inches on centers.

D. Supplies, Stops, Fittings:

1. Chrome plated combination rigid supply fitting with grid strainer or crumb strainer, loose key stops, chrome plated trap and drain outlet.

2. Manufacturers:

    a. Brasscraft Mfg. / Masco Corporation.
    b. Chicago Faucets / the Geberit Group.
    c. Zurn Industries, LLC / Rexnord Corporation.

E. Waste Outlets:

1. Manufacturers:

    a. American Standard / American Standard Brands.
    b. Brasscraft Mfg. / Masco Corporation.
    c. Chicago Faucets / the Geberit Group.

2. Descriptions:

    a. Type: All Sinks.
        (1) Provide 316 stainless steel open strainer waste with 1 ½ inch 17 gauge copper tubing tailpiece.
        (2) 1-1/2 in. x 2 in., cast brass P-trap without cleanout, with 17 gage copper tubing.
        (3) Connect to concealed waste piping using C.P. cast brass wall outlet nipple with C.P. brass set screw and escutcheon.
        (4) Waste outlets for handicap stainless steel sinks: Provide open strainer waste.
    b. Traps for handicap accessible fixtures shall run close to backwall to clear knees (if more than six [6] inches off wall). Provide ½ inch insulation on exposed drainage piping.

2.6 ELECTRIC WATER COOLERS

A. Manufacturers:

1. Elkay Manufacturing Company.

2. Haws Corporation.

3. Halsey Taylor.

B. Furnish materials in accordance with LADBS.

C. Fountain:

1. ARI 1010; stainless steel, single or dual height, type as required; with stainless steel top, stainless steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket, or floor anchored carrier refrigerated with integral air cooled condenser and stainless steel grille.

2. Capacity: 8 gph of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F.

3. Electrical: 115/1/60 compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.

2.7 WALL MOUNTED DRINKING FOUNTAINS

A. Drinking Fountains (combination high-low fountains at new construction):

1. Manufacturers:

   a. Elkay Manufacturing Company.
   b. Halsey Taylor.
   c. Haws Corporation.

2. Type wall mount.

3. Description: Accessible, ARI 1010, Type PB, pressure with bubbler, Style W, wall-mounting drinking fountain for adult, child and ADA-mounting height.

   a. Cabinet: Single, all stainless steel.
   b. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
   c. Control: Push button.
   d. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.
   e. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
   f. Drain(s): Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.1.
   g. Support: Type I, drinking fountain carrier.

2.8 BOTTLE FILLING STATIONS:

A. Manufacturers:

1. Elkay Manufacturing Company.

2. Halsey Taylor.

3. Haws Corporation.

B. Type: Wall mounted and recessed.

C. Description: Accessible, recessed in wall, with stainless steel finish preferred

1. Locations: There shall be a minimum of 1 bottle filling station per terminal, post-security.

   a. At or directly adjacent to restroom entry
   b. Above drinking fountain, recessed into wall, and/or
   c. Directly adjacent to drinking fountains, recessed into wall.

2. All electrical to be hardwired, with no plug in for power.

3. No advertising allowed other than manufacturer name.

4. No batteries allowed for any function.

5. No sensors. Manual operation only for dispensing water into bottles.

6. Station to include drain connected to drinking fountain.

7. Station shall have filter.

2.9 FIXTURE SUPPORTS

A. Manufacturers:

1. Jay R. Smith Mfg. Co. / Morris Group International.

2. MIFAB, Inc.

3. Zurn Industries, LLC / Rexnord Corporation.

B. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.

1. Type I: Hanger-type carrier with two vertical uprights.

2. Type II: Bilevel, hanger-type carrier with three vertical uprights.

3. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

2.10 MOP SINKS

A. Enameled Cast Iron or Terrazzo

B. Manufacturers:

1. Commercial Enameling Company (CECO) 871 (Basis of Design Product)

2. American Standard / American Standard Brands.

3. Kohler Company.

C. Floor Mounted Basin: 28”x28”x12” high minimum chrome plated strainer, rim guard, 3” cast iron P-trap with adjustable floor flange.

D. Faucet:

1. Exposed wall type supply with lever handles, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.

2. Manufacturers:

a. Chicago Faucets / the Geberit Group 305-VB-R (Basis of Design Product)
b. Speakman.
c. T & S Brass and Bronze Works, Inc.

E. Accessories:

1. 5 feet of 1/2 inch diameter plain end reinforced plastic rubber hose.

2. Hose clamp hanger.

3. Mop hanger.

2.11 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers:

a. Engineered Brass Company.
b. Truebro / IPS Corporation.
c. Zurn Industries, LLC / Rexnord Corporation.

2. Description: Manufactured insulating wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.12 GARBAGE DISPOSER

A. Garbage disposer to be stainless steel grinder, chamber and blades, fully sound insulated, 1-horsepower, 120-volt, 1 phase, InSinkErator, Evolution Excel Series 3-stage grind, Jam-sensor circuit and sound baffle collar or approved equal.

B. Provide stainless steel or chrome plated air gap fitting at dishwasher only.

PART 3 - EXECUTION

3.1 INSTALLATION

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

B. Install and secure fixtures in place with wall supports, carriers and bolts.

C. Seal fixtures to wall and floor surfaces with sealant color to match fixture.

3.2 PLUMBING FIXTURE INSTALLATION

A. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.

2. Use carrier supports without waste fitting for fixtures with tubular waste piping.

3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

4. Lag fixture carrier base plates or feet to slab with lead expansion shields and insert bolts in all bolt holes.

5. Where wall hung water closets are supported adjacent to stud walls, provide rear anchor foot assembly bolted to slab.

B. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball or gate valves if supply stops are not specified with fixture. Valves as required.

C. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

D. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

E. Install toilet seats on water closets.

F. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

G. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

H. Install shower flow-control fittings with specified maximum flow rates in shower arms.

I. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.

2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

J. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

3.3 APPLICATIONS

A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.

B. Use mounting frames for recessed water coolers, unless otherwise indicated.

C. Set remote water coolers on floor, unless otherwise indicated.

D. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

3.4 DRINKING FOUNTAINS AND WATER COOLERS INSTALLATION

A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.

B. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.

1. On block walls, fasten wall hanger to 18 inch by 4 inch built-in iron backing plates,

2. Fasten wall hanger to concealed adjustable iron chair carrier. For block walls, use supports

3. For stud walls, use supports

C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, or gate valve. Install valves in locations where they can be easily reached for operation.

D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

E. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

F. Do not install filter until after domestic water piping system has been disinfected and flushed.

END OF SECTION 22 40 00

SECTION 22 70 00 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Natural gas piping buried within 5 feet of building.
2. Natural gas piping above grade.
3. Unions and flanges.
4. Strainers.
5. Natural gas pressure regulators.
6. Natural gas pressure relief valves.
7. Underground pipe markers.
8. Bedding and cover materials.

1.2 REFERENCES

A. General: Comply with appropriate standards.

1. American National Standards Institute: ANSI.
2. American Society of Mechanical Engineers: ASME.
3. American Society for Testing and Materials: ASTM.
4. American Welding Society: AWS.
5. American Water Works Association: AWWA.
6. Manufacturers Standardization Society of the Valve and Fittings Industry: MSS.
7. National Fire Protection Association: NFPA.
8. Underwriters Laboratories Inc.: U.L.
9. American Gas Association: AGA.

1.3 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints.

B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded connections to valves, equipment.

C. Provide pipe hangers and supports in accordance with other sections.

D. Use plug, ball, or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

1.4 SUBMITTALS

A. Product Data:

1. Submit data on all pipe materials, fittings specialties, and accessories.

B. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Submit data on all materials, fittings, accessories and equipment.

C. Manufacturers Installation Instructions: Submit installation instructions for material and equipment.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

F. Shop Drawings - Provide product data for each type of the following:

1. Piping.
2. Fittings.
3. Joints.
4. Piping specialties.
5. Corrugated, stainless-steel tubing with associated components.
6. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
7. Pressure regulators. Indicate pressure ratings and capacities.
8. Service meters including supports.
9. Mechanical sleeve seals.
10. Escutcheons.
11. Supports.
12. Remote meter reading accessories.
13. Seismic gas shut off valves.

G. Seismic-Design Submittal: Provide for natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of seismic restraints.
2. Design Calculations: Calculate requirements for selecting seismic restraints.

H. Operation and Maintenance Data: Submit for valves and gas pressure regulators installation instructions, spare parts lists, and exploded assembly views.

1.5 WARRANTY

A. Furnish one-year minimum warranty.

PART 2 - PRODUCTS

2.1 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.

1. Fittings: ASTM A234/A234M forged steel welding type.
2. Joints: ASME B31.9, welded for 3" and larger; threaded for 2" and smaller.
3. Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

B. Plastic Pipe: ASTM D-2513 Schedule 40 Polyethylene.

1. Fittings: PE 2406 butt-fused.
2. Joints: PE 2406 butt-fused.

2.2 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, 150 psig.
2. Joints: Threaded for pipe 2 inches and smaller; welded for pipe 2-1/2 inches and larger.

2.3 PIPING

A. Inside steel piping:

1. For low pressure 0.5 psig or less use standard weight black steel pipe with 150 psig threaded malleable iron fittings for piping 4 in. and smaller.
2. For pressure above 5 psig, all piping shall be welded.

B. Underground piping:

1. Steel pipe with Dresser type and steel welding fittings. Pre-wrap with Mill-wrapped corrosion protection extruded polyolefin coating in accordance with Gas Company requirements, equal to Energy Coating Co. or PlexCo.
2. High density polyethylene pipe and fittings in accordance with ASTM D-2513, Grades 2306, 3306, and 3408 with fusion joints only, equal to Driscopipe 8100-DRII Series.

C. Underground drips shall be AGA and local gas company approved and shall be cast iron or tar coated welded steel pots with adjustable tar coated cast iron extension shaft and flush box with lock type extra heavy cast iron cover marked GAS DRIP.

D. In no case shall any gas pipe be less than ¾ inch.

2.4 REGULATOR VENT PIPING, ABOVE GRADE

A. Indoors: Same as natural gas piping, above grade.

B. Outdoors: PVC pipe, tubing, and fittings, UL 651.

2.5 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Ferrous Piping: Class 150, malleable iron, threaded.

2. Copper Piping: Class 150, bronze unions with soldered brazed joints.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
2. Copper Piping: Class 150, slip-on bronze flanges.
3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.6 STRAINERS

A. Manufacturers:

1. Mueller Steam Specialty.
2. O.C. Keckley Company.
3. Spirax Sarco, Inc.

B. 2 inch and Smaller: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. 2-1/2 inch to 4 inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

D. 5 inch and Larger: Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.7 NATURAL GAS PRESSURE REGULATORS

A. Manufacturers:

1. Equimeter.
2. American.
3. Sensus.

B. Product Description: Spring loaded, general purpose, self-operating service regulator including internal relief type diaphragm assembly and vent valve. Diaphragm case can be rotated 360 degrees in relation to body.

1. Comply with ANSI Z21.80.
2. Temperatures: minus 20 degrees F to 150 degrees F.
3. Body: Cast iron with neoprene gasket.
4. Spring case, lower diaphragm casing, union ring, seat ring and disk holder: Aluminum.
5. Disk, diaphragm, and O-ring: Nitrile.
6. Minimum Inlet Pressure: 5 psi.
7. Furnish sizes 2 inches and smaller with threaded ends. Furnish sizes 2-1/2 inches and larger with flanged ends.

C. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers:

a. Equimeter.
b. American.

c. Sensus.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 60 psig.

2.8 NATURAL GAS PRESSURE RELIEF VALVES

A. Manufacturers:

1. Fisher.
2. American.
3. Or Approved Equal

B. Product Description: Spring loaded type relief valve.

1. Body: Aluminum.
2. Diaphragm: Nitrile.
3. Orifice: Stainless steel.
4. Maximum operating temperature: 150 degrees F.
5. Inlet Connections: Threaded.
6. Outlet or Vent Connection: Same size as inlet connection.

2.9 UNDERGROUND LABELING & IDENTIFYING

A. Detectable Warning Tape: Acid and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

2.10 GAS VENT TERMINALS

A. ¾ in. and one (1) in. aluminum threaded vent terminal with 16 x 16 mesh 0.018 gauge stainless steel screen.

B. 1¼ in. to 4 in. standard pipe threaded elbow with 12 x 12 mesh stainless steel screen.

1. Equal to Upsco Inc.

C. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.

2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.

3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

a. Material Group: 1.1.
b. End Connections: Threaded or butt welding to match pipe.
c. Lapped Face: Not permitted underground.
d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

2.11 VALVES

A. Manual Shut-off Valves Inside Building.

1. Manufacturer:

a. Nordstrom.
b. Fisher
c. Grinnel

1. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
d. CWP Rating: 125 psig.
e. Threaded Ends: Comply with ASME B1.20.1.
f. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
g. Tamperproof Feature: Locking feature for valves where required by Con. Ed.
h. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
i. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
j. Threaded cast iron body, 125 PSIG WOG.

2. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
    a. CWP Rating: 125 psig.
    b. Flanged Ends: Comply with ASME B16.5 for steel flanges.
    c. Tamperproof Feature: Locking feature for valves where required by Con. Ed.
    d. Service Mark: Initials "WOG" shall be permanently marked on valve body.
    e. 2½ in. to 4-in.: Flanged cast iron body lubricated tapered plug type, 175 psig WOG.
    f. 6 in. and larger: Flanged cast iron body lubricated tapered plug type, 200 psig WOG, worm gear operated.
3. Provide 2 wrenches for each size used.
    a. Attach wrench to each valve.

B. Ball Valves
1. Manufacturer:
    a. Contromatics.
    b. Cornbraco
    c. NIBCO
2. On local branches three inches and smaller, provide threaded three piece full port wafer-type ball valve with bronze body, ball stem, Teflon seats, and level handles, 300 psig WOG.

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. 2 inch and smaller: Threaded brass ball valves with full port TFE sears and blowout proof stem, 600 psig WOG.
2. Manufacturers:
    a. BrassCraft.
    b. Conbraco.
    c. NIBCO.
3. Body: Bronze, complying with ASTM B 584.
4. Ball: Chrome-plated bronze.
5. Stem: Bronze; blowout proof.
6. Seats: Reinforced TFE; blowout proof.
7. Packing: Threaded-body packnut design with adjustable-stem packing.
8. Ends: Threaded, flared, or socket.
9. CWP Rating: 600 psig.
10. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
11. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Bronze Plug Valves: MSS SP-78.

1. Manufacturers:

   a. Hammond.
   b. Lee Brass Company.
   c. NIBCO.

2. Body: Bronze, complying with ASTM B 584.

3. Plug: Bronze.

4. Ends: Threaded, socket, or flanged.

5. Operator: Square head or lug type with tamperproof feature where indicated.

6. Pressure Class: 125 psig.

7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.

8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Cast-Iron, Non-lubricated Plug Valves: MSS SP-78.

1. Manufacturers:

   a. McDonald.
   b. Mueller Co.
   c. Xomox Corporation.

2. Body: Cast iron, complying with ASTM A126, Class B.

3. Plug: Bronze or nickel-plated cast iron.

4. Seat: Coated with thermoplastic.

5. Stem Seal: Compatible with natural gas.

6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

7. Operator: Square head or lug type with tamperproof feature where indicated.

8. Pressure Class: 125 psig.

9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.

10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Cast Lubricated Plug Valves Inside Building:

1. 2-inch and smaller: Cast iron body, threaded, equal to Nordstrom Valves, Inc. Figure 114.

2. 2½ inch to 4-inch: Flanged cast iron body lubricated tapered plug type, 175 psig WOG, equal to Nordstrom Valves, Inc. Figure 115.

3. 6 inch and larger: Flanged cast iron body lubricated tapered plug type, 200 psig WOG, worm gear operated, equal to Nordstrom Valves, Inc. Figure 165.

4. Valves 2 ½ inch and larger shall be flanged.

5. Provide 2 wrenches for each size used.
6. Attach wrench to each valve.
7. Gas Cocks:
    a. Gas cocks shall be for use only as manual gas shut-off valves at each piece of gas burning equipment; shall be of the plug type, bronze construction with check, nut and washer bottom and tee handle.
    b. Gas cocks shall be Figure 10596 as manufactured by A.Y. McDonald Mfg. Co., or Series 52 as manufactured by Conbraco Industries, Inc.
    c. Gas cocks shall only be used on piping 1 inch and smaller.

G. Valves Underground (Curb Type)
1. Provide welding end steel body tapered lubricated plug type with iron plug high head extension.
    a. 2 inch to 4 inch: 200 psig WOG, equal to Nordstrom No. 1943.
    b. 6 inch and larger: 275 psig WOG, equal to Nordstrom No. 4185.
2. Provide with adjustable tar coated cast iron extension shaft and flush box with lock type extra heavy cast iron cover marked GAS. Provide two operating wrenches.

H. Valve Boxes:
1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.12 EARTHQUAKE VALVES

A. Earthquake Valves: Comply with ASCE 25.
1. Manufacturers:
    a. Pacific Seismic Products, Inc.
    b. Quake Defense, Inc.
    c. Strand Earthquake.
2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: 60 psi,
4. Cast-aluminum body with stainless-steel internal parts.
5. Nitrile-rubber, reset-stem o-ring seal.
6. Valve position, open or closed, indicator.
7. Composition valve seat with clapper held by spring or magnet locking mechanism.
8. Level indicator.

9. End Connections: Threaded for valves NPS 2 inches and smaller; flanged for valves NPS 2-1/2 inches and larger.

2.13 GAS SAFETY SHUTOFF VALVES

A. Gas safety shut-off valves shall be FM & UL listed, electric motor operated, normally closed, manual reset type. Valves shall be rising stem design with a straight through flow path with metal-to-metal seat and disc arrangement. The valve seat shall be stainless steel and the disc ductile iron. Valves shall be provided with a NEMA 4 enclosure modified for Class I, Division II hazardous locations, be provided with an electrical terminal block and shall operate on 120 V AC., 60 Cycles, single phase. Valves shall meet ANSI Class VI leakage standard and shall be provided with a visual indicator to note the position of the valve whether "OPEN" or "SHUT"

B. Gas safety shut-off valves 2 inches and smaller shall be threaded, 2 1/2 inches and larger shall be flanged. Flanged valves shall be provided with companion flange set by valve manufacturer.

1. Gas safety shut-off valves 2 inches and smaller

a. Manufacturer:
(1) Maxon Corporation Series 808.
(2) Or Approved Equal.

2. 2 1/2 inches and larger. All valves shall be provided with trim package 1-1.

a. Manufacturer:
(1) Maxon Corporation Series 808-CP.
(2) Or Approved Equal.

C. Gas safety shut-off valves shall be installed in the following locations:

1. On the firm gas line downstream of its meter and before any branch take-offs.

D. Gas safety shut-off valves shall be wired to the gas leak detection system and shall function to shut off all gas supply to the building upon:

1. Action of the gas leak detection system (alarm condition), and,

2. Loss of normal electrical power.

2.14 GAS TENANT METERS

A. Body and cover:

1. Die cast aluminum alloy factory painted.

B. Temperature compensation

1. Bi-metallic element that automatically corrects changes in gas temperature.

C. Gas Meter Register

1. UV stabilized clear polycarbonate index box to measure in cubic feet.

2. Gas register transmitter for remote reading to the building automation system.

D. Manufacturers:

1. Equimeter.

2. Sensus.

3. American Meter.

2.15 SLEEVES

A. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.16 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico Inc.
c. Metraflex Company.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.

3. Pressure Plates: Carbon steel.

4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.17 MECHANICAL GAS SLEEVES

A. Carbon steel, zinc chromate bolts and nuts with corrosion inhibiting coating.

B. Seal material EPDM, black in color.

C. Pressure pates of reinforced nylon polymer.

D. Equal to Thunderline Link Seal Model ‘C’.

2.18 ESCUTCHEONS

A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.

B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Escutcheons: With set screw.

2. Finish: Polished chrome-plated or rough brass.

D. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.

3. Finish: Polished chrome-plated or rough brass.

E. One-Piece, Stamped-Steel Escutcheons: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Escutcheons: With concealed hinge, set screw, and chrome-plated finish.

G. One-Piece, Floor-Plate Escutcheons: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

2.19 PRESSURE GUAGES

A. 4½ in. diameter, black enamel coated steel case ring with shatterproof glass, ½ in. bronze bellows with brass socket, blow out on back of case, ¼ in. bottom outlet connection, similar to Trerice No. 860 or Weksler Instruments Corp. No. BL14-PWE4-LWXX with 0 to 27 in. of water column dial, brass pressure snubber and brass tee-handle cock.

B. Locate pressure gauges on inlet and outlet of gas booster pressure pump, at farthest point in system and as noted.

2.20 REMOTE METER READING EQUIPMENT

A. Electronic hard wired transmitter to provide gas consumption readings for every individual tenant and concession to the building management system.

2.21 CATHODIC PROTECTION

A. Provide a complete electrically isolated, cathodic protection system for entire length of underground gas line, including all components, suitable for temperatures and pressures involved.

B. Prior to installation, conduct a corrosion site survey using a qualified corrosion engineer to evaluate soil conditions and establish system requirements.

C. System shall be the sacrificial magnesium anode type with 17 lb anodes, spacing based upon soil resistivity readings, with a maximum spacing of 300 feet Pack anodes in permeable cloth bag in backfill: 75% ground hydrated gypsum, 20% powdered Wyoming bentonite, 5% anhydrous sodium sulfate.

D. Magnesium anodes shall be high current type with magnesium wall having the following composition:

1.	Aluminum:	5.3 to 6.7%.
2.	Manganese:	0.15% minimum.
3.	Zinc:	2.5 to 3.5%.
4.	Silicone:	0.3% maximum.
5.	Copper:	0.02% maximum.
6.	Nickel:	0.003% maximum.
7.	Iron:	0.003% maximum.
8.	Other impurities:	0.3% maximum.
9.	Magnesium:	Remaining.

E. Anodes shall be cast with perforated galvanized steel strap core. One end of anode shall be recessed so one end of strap is accessible for lead wire connection. Anode lead wires shall be 25 feet long, silver soldered to strap core and with a minimum 1 turns of wire at connection. Fill anode recess connection with electrical potting compound. Conductors shall be No. 12 AWG Type TW copper wire.

F. Connectors shall be brazing type elements for mechanically bonding conductors to steel pipe. Moisture-proof all connections to piping. Splices shall be made with split bolt compression connectors and suitable protection tape.

G. For pipe installed in sleeves, provide insulators, equal to Maloney Model 57, spaced 10-feet on centers, installed in accordance with manufacturer's recommendations. Provide insulating coupling for pipe penetrating building wall.

H. Provide test stations housed in electrical conduit terminated in cast iron, waterproof junction boxes at ground surface. Embed in 12-inches x 12-inches x 6-inches concrete marker.

PART 3 - EXECUTION

3.1 INSTALLATION

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.

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

E. Field verify that connection to existing piping systems sizes, locations, and invert are as required.

F. Establish elevations of buried piping with not less than allowed per code.

G. Establish minimum separation of from other piping services in accordance with code.

3.2 NATURAL FUEL GAS SYSTEMS INSTALLATION

A. Install piping free from traps and with drain pocket consisting of nipple and cap at low points for inside building and drip pot for underground piping.

B. Install shut-off valves at connection to each piece of equipment. Provide union or right and left nipple and coupling at equipment side of individual shut-off valve.

C. Install gas meter in a well-ventilated and accessible location. Gas meter room (3 hr. rated enclosure) with explosion-proof fixtures.

D. Threaded Joints:

1. Make-up joints with U.L. listed gas resistant Teflon tape or Teflon paste, suited for gas piping.

E. Provide a two elbow-swing on all branches taken from a riser.

F. Provide valve tags for piping systems indicating the operating system pressure.

G. Color code piping at different pressures within the gas meter room. Paint fifteen (15) to five (5) psi system brown and reduced pressure piping yellow.

H. Welders must be qualified in accordance with either API 1104 or ASME IX Boiler and Pressure Vessel Code and as required by local code.

I. Provide sign on the exterior of the gas meter door shall be provided with bold lettering at least 1 in. high and properly spaced with lettering and background in contrasting colors reading “Gas Meter Room - No Storage Permitted.”

J. Support horizontal gas piping as follows:

1. ½ in. - 6 ft. on center.

2. ¾ in. or 1 in. - 8 ft. on center.
3. 1¼ in. or larger - 10 ft. on center.
4. Vertical piping at every floor.

K. Provide remote meter reading communication wiring to connect to building automation system. Wire gauge per manufacturer recommendation for distance required.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 22 inches below finished grade as required.

1. If natural-gas piping is installed less than 72 inches below finished grade, install it in ductile iron pipe containment conduit.
2. Coordinate with site paving contractor for finished grade location.
3. Protect exterior underground pipe from damage due to heavy equipment traffic during construction.

C. Install underground, PE, natural-gas piping according to ASTM D2774.

D. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

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

F. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

G. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

H. Install pressure gauge upstream and downstream from each service regulator as required.

3.4 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

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

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

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

G. Locate valves for easy access.

1. Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
c. Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
d. Piping in Unfinished Service Spaces: One-piece, stamped-steel type with set screw.
e. Piping in Equipment Rooms: One-piece, cast-brass type.
f. Piping in Equipment Rooms: One-piece, stamped-steel type with set screw.
g. Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

H. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials as required.

I. Verify final equipment locations for roughing-in.

J. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

K. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

L. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

M. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

N. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.

2. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
    a. Exception: Tubing passing horizontally through partitions or walls does not require striker barriers.
3. Prohibited Locations:
    a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or ventilating ducts, or dumbwaiter or elevator shafts.
    b. Do not install natural-gas piping embedded in concrete walls or partitions.

O. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

P. Connect branch piping from top or side of horizontal piping.

Q. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

R. Do not use natural-gas piping as grounding electrode.

S. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

T. Install pressure gauge upstream and downstream from each line regulator as required.

3.5 SERVICE METER ASSEMBLY INSTALLATION

A. Install service-meter assemblies aboveground, on concrete bases.

B. Install metal shutoff valves upstream from service regulators.

C. Install strainer on inlet of service-pressure regulator and meter set.

D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.

E. Install metal shutoff valves upstream from service meters.

F. Install service meters downstream from pressure regulators.

G. Install metal bollards to protect meter assemblies as required.

H. Install meters on full size gas headers.

3.6 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.7 HANGER & SUPPORT INSTALLATION

A. Install seismic restraints on piping as required.

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

C. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

END OF SECTION 22 70 00