SECTION 22 11 00
DOMESTIC WATER SYSTEMS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. General: Provide complete and operable domestic water systems within the intent of the Contract Documents; including but not limited to all materials and labor for complete installation and testing, in compliance with applicable provisions and recommendations in the Reference Standards.

B. Water service contract limit line shall be five feet from building wall unless otherwise indicated on the Drawings.

C. Make arrangements to provide domestic water services into this project.

D. The Contractor shall pay all connection fees, tap charges, and permit fees assessed by local authorities.

1.02 RELATED DOCUMENTS

A. Section 22 05 01 – Plumbing General Provisions

B. Section 22 05 16 – Expansion Compensation for Plumbing

C. Section 22 05 19 – Meters, Gauges and Thermometers for Plumbing

D. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment

E. Section 22 05 48 – Vibration Isolation and Seismic Restraints for Plumbing

F. Section 22 05 50 – Access Doors in General Construction for Plumbing

G. Section 22 11 10 – Plumbing Piping and Accessories

H. Section 22 21 01 – Hydronic Systems Specialties for Plumbing

I. Section 22 40 00 – Plumbing Fixtures

J. Section 23 09 23 – Building Management Systems (BMS)

K. Section 23 09 93 – Automatic Control Sequences

L. Division 26 – Electrical Specifications

1.03 REFERENCE STANDARDS

A. Regulatory compliance: All work performed under this Division shall comply with the latest currently adopted editions of all codes and regulations and all requirements of all Authorities Having Jurisdiction. The following references and standards are hereby made a part of this Section and work shall conform to applicable requirements herein except as otherwise specified herein or shown on the Drawings.

B. Codes and Standards: Conform to all applicable codes and standards as stated herein and as described in Division 1 of the Specifications, including the following:

1. AGA – American Gas Association
2. ANSI – American National Standards Institute
3. ASME – American Society of Mechanical Engineers
4. ASSE – American Society of Sanitary Engineering
5. ASTM – American Society for Testing and Materials
6. AWWA – American Water Works Association
7. AWS – American Welding Society
8. MSS – Manufacturers Standardization Society of the Valve and Fittings Industry
9. NSF – National Sanitation Foundation
10. PDI – Plumbing and Drainage Institute
11. UL – Underwriters Laboratories Inc.
12. USC's FCCC – Foundation for Cross-Connection Control and Hydraulic Research
13. International Plumbing Code

C. Minimum requirements: The requirements of these are the minimum that will be allowed unless such requirements are exceeded by applicable codes or regulations, in which the regulatory codes or regulation requirements shall govern.

1.04 QUALITY ASSURANCE

A. Comply with the applicable provisions and recommendations of the standards and codes listed in Paragraph 1.03 Reference Standards and the requirements of the listed related documents in Paragraph 1.02 Related Documents.

B. Valves construction shall be suitable for the pressure, temperature, and fluid quality of the service in which they are to be used.

C. All valves shall be manufactured in accordance with ANSI, AWWA, ASTM, MSS (Manufacturers Standardization Society of the Valve and Fittings Industry), standards and specifications.

D. Minimum test pressure for all valves shall be 1½ times maximum system working pressure unless noted otherwise.

E. All components used in the domestic water system shall comply with any lead-free requirements of the Authorities Having Jurisdiction.

1.05 SUBMITTALS

A. For each type of valve indicated, submit body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; pressure differential range, shipping, installed, and operating weights; furnished specialties; and accessories.

B. Submit a schedule of all major control valves for review and acceptance, complete with all pertinent data, such as manufacturer, catalog number, cold water working pressure, etc.

C. Product Data: Submit manufacturer's latest information on construction details, rated capacity data, operating characteristics and installation data.

D. Submit, for all equipment provided under this Section, dimensions, accessories, required clearances, electrical requirements and wiring diagrams specific to this project that clearly differentiate between manufacturer-installed and field-installed wiring and location and size of all required field connections.

E. Submit manufacturer's installation instructions, operation data, start-up instructions, maintenance data, parts list and controls specific to this project, accessories, and maintenance data.

F. Submit Domestic Water System cleaning and flushing test report.

G. Submit Domestic Water System chlorine residues and bacteriological samples testing.

H. Submit Operational and Maintenance (O&M) manuals.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Following is a list of manufacturers whose products may be submitted for review. All items submitted as being equal shall have same quality, finish, free area, material construction, etc., as those specified under base Specification.

B. Approved Manufacturers:

1. Copper Piping: Cambridge-Lee, Cerro, Howell Metal, or Wolverine.
2. Copper Fittings: NIBCO, Elkhart, or approved equivalent.
3. Gate Valves: Crane, NIBCO, or Stockham, or approved equivalent.
4. Ball Valves and Check Valves: Conbraco, NIBCO, Stockham, Watts Industries, or approved equivalent.
5. Balancing Valves: Armstrong, B&G, Taco, Tour & Andersson, or Victalic..
6. Stop and Drain Valves: Conbraco (Apollo), or approved equivalent.
7. Solenoid Valves: Automatic Switch Company (ASCO), Golden Anderson, or approved equivalent.
8. Strainers – "Y" Type: Conbraco (Apollo), Watts Industries, or Zurn Wilkins.
9. Strainers – "Plate" Type: Badger, or approved equivalent.
10. Water Meters: Hersey Meters, Badger Meter Inc., Invensys Sensus Metering Systems, or approved equivalent.
11. Vacuum Breakers – Atmospheric Type: Watts Industries, Zurn Wilkins, or approved equivalent.
12. Vacuum Breakers – Pressure Type: Conbraco, Watts Industries, or Zurn Wilkins.
13. Pressure Reducing Valves: Bermad, Watts Industries, or Zurn Wilkins.
14. Relief Valves: Watts Industries or Zurn Wilkins.
15. Thermostatic Mixing Valves: Bradley, Leonard, or Powers.
16. Water hammer arrestors: Precision Plumbing Products, Sioux Chief, or Zurn. Backflow Preventers: Ames, Febco, Conbraco, Watts Industries, or Zurn Wilkins.
17. Trap Primers: Precision Plumbing Products, MIFAB,or approved equivalent.
18. Air Gap Fittings: MIFAB, Jay R. Smith or Zurn Industries.
19. Expansion Tanks: Amtrol, Bell and Gossett, Wessels, Zurn Wilkins.
20. Brazing Alloys and Fluxes: Harris Products Group, Canfield, or approved equivalent.

2.02 PIPING AND FITTINGS

A. Buried Piping Systems 4 inches and larger:

1. Pipe: Cement-lined mechanical joint ductile iron pipe: ANSI/AWWA C100/A21 Series of Standards, AWWA C151/A21.51, C150/A21.50, C111/A21.11, Class 53 or 54, with Polyethylene Encasement.

    a. Interior of Pipe: Cement-lined and seal coated, AWWA C104/A21.4 and listed by approved certifying agency as conforming to requirements of NSF/ANSI 61.
    b. Outside of Pipe: Asphaltic coated, AWWA C153/A21.53.
    c. Polyethylene Encasement: AWWA C105/A21.5 Standard (American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems).

2. Fittings: Mechanical joint ductile iron fittings: Complying with applicable requirements of ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11 with exception of manufacturer's proprietary design dimensions, 350 psi working pressure rating, and flexible restrained joint ductile iron components in accordance with ANSI/AWWA C110/A21.10.

    a. Inside of Fittings: Cement-lined and seal coated, ANSI/AWWA C104/A21.4 and listed by approved certifying agency as conforming to requirements of NSF/ANSI 61.
    b. Outside of Fittings: Epoxy coating, AWWA C116/A21.16.
    c. Polyethylene Encasement: AWWA C105/A21.5 Standard (American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems).

B. Buried Piping Systems 3 inches and smaller:

1. Piping: Type "K" Tubing ASTM B88 - seamless copper water tube.
2. Fittings:

    a. Cast copper alloy complying with ASME B16.18.
    b. Wrought copper solder type pressure fittings complying with ASME B16.22.

3. Field wrap with 20-mil PVC tape or factory-applied PVC coating.
4. Joints: Brazed using AWS A5.8/A5.8M, AWS BCuP Series, copper-phosphorus alloys, unless otherwise indicated; equivalent to:

    a. "Stay- Silv 15" by Harris Products Group
    b. "Sil-Can 15" by Canfield

C. Above-Grade Piping Systems:

1. Piping: Type "L" tubing ASTM B88 - seamless copper water tube.
2. Fittings:

    a. Cast copper alloy complying with ASME B16.18.
    b. Wrought copper solder type pressure fittings complying with

ASME B16.22.

c. Class 150, flat-faced, flanges complying with ASME B16.24.

3. Joints:

a. ½ inch to 1½ inches: Soldered using ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813. 100 percent lead free, 95 percent tin and 5 percent antimony composition, silver bearing solders, unless otherwise indicated; equivalent to:

1) "Silverflo" by Canfield
2) "Bridgit" by Harris Products Group

b. 2 inches and larger: Brazed using AWS A5.8/A5.8M, AWS BCuP Series, copper-phosphorus alloys, unless otherwise indicated; equivalent to:

3) "Stay- Silv 15" by Harris Products Group
4) "Sil-Can 15" by Canfield

B. Copper Pressure-Seal-Joint Fittings:

1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Inc. or comparable product by one of the following:

a. Elkhart Products Corporation.
b. Viega.

2. Fittings for NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
3. Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

C. Copper Push-on-Joint Fittings TBC:

Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company or comparable product:

1. Description:

a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
b. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

D. Copper-Tube, Extruded-Tee Connections:

1. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. T-Drill Industries Inc.
b. <**Insert manufacturer's name**>.

2. Description: Tee formed in copper tube according to ASTM F 2014.

E. Appurtenances for Grooved-End Copper Tubing:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic

Company or comparable product by one of the following:

a. Anvil International.
b. Shurjoint Piping Products.

2. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75 (ASTM B 75M) copper tube or ASTM B 584 bronze castings.
3. Mechanical Couplings for Grooved-End Copper Tubing:

a. Copper-tube dimensions and design similar to AWWA C606.
b. Ferrous housing sections.
c. EPDM-rubber gaskets suitable for hot and cold water.
d. Bolts and nuts.
e. Minimum Pressure Rating: 300 psig (2070 kPa).

4. Pipe-Flange Gasket Materials:

a. AWWA C110/A21.10, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
b. Full-face or ring type unless otherwise indicated.
c. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

2.03 VALVES

A. General Characteristics: Provide valves with threaded or flanged ends as required by the piping system in which they are installed and as specified. All valves shall have the name of the manufacturer and working pressure cast or stamped thereon.

B. All valves used in the domestic water system shall comply with any lead free requirements of the Authorities Having Jurisdiction.

C. Shut-off Valves – 2 inches and smaller size:

1. Ball Valve: Bronze body, full port, 3-piece, extended handles that allow operation of the valve without breaking the vapor seal or disturbing the insulation, Type 316 stainless steel ball and stem, in-line repairable, rated for 600 psi non-shock WOG, TFE seats and seals, blowout-proof stem design, adjustable packing nut, extended solder connections and designed for soft solder and brazing installations; “S-595-Y-66” by NIBCO, “Apollo 82-240 Series” by Conbraco, or approved equivalent.

D. Shut-off Valves – 2½ inches and larger size:

1. Gate Valve: Iron body, resilient wedge, outside screw and yoke, 175 psi minimum working pressure, FDA approved epoxy coating inside and out, flanged pattern, meeting AWWA C509 standard; “Fig. F-619-RW” by NIBCO, or approved equivalent.

E. Check Valves:

1. Swing Type:

a. 2 inches and smaller: Bronze body ASTM B584, Y-Pattern swing-type, threaded ends, manufactured in accordance with MSS SP-139, Class 125, with TFE seat disc; conforms to MSS SP-71 Type 1, lead free, “T-413-Y-LF” by NIBCO, or approved equivalent.
b. 2½ inches and larger: Cast Iron body ASTM A126 Class B, brass or bronze disc, horizontal swing check valve, renewable seat and disc, asbestos-free gasket, stop plug for screwdriver insertion to rotate and regrind seat, flanged ends; “F-918-B by “Nibco” or approved equivalent.

2. Spring Type for vertical pumped installations:

a. 2 inches and smaller: Bronze body ASTM B584 threaded ends, manufactured in accordance with MSS SP-139, Class 125, with resilient discs; lead free, “T-480-Y-LF” by NIBCO, or approved equivalent.
b. 2½ inches and larger: Cast Iron body ASTM A126 Class B, brass or bronze disc, horizontal swing check valve, renewable seat and disc, asbestos-free gasket, stop plug for screwdriver insertion to rotate and regrind seat, spring assist, conforms to MSS SP-71 Type 1, flanged ends; “F-918-B by “Nibco” or approved equivalent.

F. Balancing Valves:

1. Bronze body, Y-Pattern multi-turn 360-degree adjustment with a micrometer type indicator located on valve handwheel, hidden memory feature which provides locking valve position after system is balanced, metering ports with Nordel check valves and gasketed caps located on both sides of valve seat; “Model CBV” by Armstrong, B&G Circuit Setter Plus, Taco Accu-Flo, Tour & Andersson STAS/STAD, or Victaulic Series 786/787.

G. Stop and Drain Valves: Bronze body, full port, ASTM B16/B 16M, chrome plated bronze ball, in-line repairable, rated for 400 psig WOG, TFE seats and seals, blowout-proof stem design, adjustable packing nut, drain cap, latch lock lever, sweat ends and designed for soft solder and brazing installations; “Apollo 95 Series” by Conbraco, or approved equivalent.

H. Pressure Reducing Valves:

1. Pressure reducing valves shall be of the same size as the line served unless indicated otherwise on drawings. Where indicated on drawings, pressure reducing valves may be up to one pipe size smaller than the branch on which is it installed.
2. 3 inches and smaller: Lead free water pressure reducing valve with integral bypass check valve; “Series 500” by Zurn Wilkins, or approved equivalent.

a. For hot water piping, provide with stainless steel trim, sealed cage, and chloramine resistant O-rings; “Series 500–HTSTSC” by Zurn Wilkins or approved equivalent.

3. 4” Automatic Control Valve (where indicated on drawings): Cast iron with FDA epoxy fusion coating, Y-Pattern, hydrodynamically designed with semi-straight flow; double-chambered diaphragm actuator, hydraulically operated with pressure reducing pilot valve with adjustable spring load with low flow bypass; “ZW209-BP” by Zurn Wilkins or approved equivalent.

I. Thermostatic Mixing Valves:

1. Thermostatic Water Mixing Valve (TMV-1): Adjustable high temperature limit stop, inlet check-stops, wall support, outlet ball valve, outlet pressure gauges, inlet manifold piping, color-coded dial thermometer 0 degrees F to 140 degrees F factory-assembled and -tested, chrome plated brass, ASSE 1017 Certified; by Bradley, Leonard, or Powers. See Plumbing Schedule for models.
2. Thermostatic Water Mixing Valve (TMV-2): Self-actuating 3-way mixing valve with vapor pressure thermal system, ANSI 125-pound Class bronze body, threaded ends; “Product No. 11 Water Mix Regulator”, by Powers Process Controls, or approved equivalent.

    a. Features:
        1) Temperature dial indicator
        2) Stem lubricator with silicone lubricant
        3) 8 feet of copper capillary tubing
        4) Copper bulb and chrome plated copper well
        5) Fixed union type bulb fitting

    b. Valve Mixed Water Capacity at 10 psi drop:
    c. Bulb Characteristics:

3. Thermostatic Mixing Valve (TMV-5) – Emergency Showers: Self-actuating, three-way valves with solid bimetal thermostat element, designed for combination eye wash and emergency shower, including primary mixing valve with bronze and stainless steel internal parts, built-in cold water bypass in case of hot water failure, and secondary thermostat cold water bypass valve to open on temperature rise, 2- to 72-gpm range; “Model TM-850” by Leonard, or approved equivalent.

J. Solenoid Valves:

1. Two-Way Control Valve: Solenoid operated, normally closed when pilot de-energized and open when pilot energized, with Class 125 flanged connections, maximum head loss at 40 gpm not greater than 0.7 feet, 110V/120V, 60 cycle; “2 inch Figure 7100-D Globe”; Golden Anderson of Mars, Pennsylvania, or approved equivalent.
2. ¾ inch pipe size, 2-way pilot operated, brass body, normally closed, Teflon main disk seating, minimum 0 psi operating pressure differential and up to maximum 150 psi operating pressure differential, rated for maximum 180 degrees F fluid operating temperature, 120 volt, AC, 17.1 watts, molded epoxy solenoid enclosure with combination water-tight, dust-tight and corrosion-resistant enclosure classification meeting Type 4X NEMA standards; “Red Hat II Series 8210G095” by Automatic Switch Company (ASCO), or approved equivalent.
3. 1 inch pipe size, 2-way pilot operated, water service, brass body, normally closed, BUNA “N” seating, minimum 0 psi operating pressure differential and up to maximum 225 psi operating pressure differential, rated for maximum 200 degrees F fluid operating temperature, 120 volt, AC, 20.1 watts, molded epoxy solenoid enclosure with combination water-tight, dust-tight and corrosion-resistant enclosure classification meeting Type 4X NEMA standards; “Red Hat II Series 8210G027” by Automatic Switch Company (ASCO), or approved equivalent.
4. 1¼ inch pipe size, 2-way pilot operated, brass body, normally closed, Teflon main disk seating, minimum 0 psi operating pressure differential and up to maximum

125 psi operating pressure differential, rated for maximum 180 degrees F fluid operating temperature, 120 volt, AC, 16.1 watts, molded epoxy solenoid enclosure with combination water-tight, dust-tight and corrosion-resistant enclosure classification meeting Type 4X NEMA standards; “Red Hat II Series 8210G055” by Automatic Switch Company (ASCO), or approved equivalent.

5. 1½ inch pipe size, 2-way pilot operated, brass body, normally closed, Teflon main disk seating, minimum 0 psi operating pressure differential and up to maximum 125 psi operating pressure differential, rated for maximum 180 degrees F fluid operating temperature, 120 volt, AC, 15.4 watts, molded epoxy solenoid enclosure with combination water-tight, dust-tight and corrosion-resistant enclosure classification meeting Type 4X NEMA standards; “Red Hat II Series 8210G056” by Automatic Switch Company (ASCO), or approved equivalent.

K. Relief Valves:

1. Pressure and Temperature Relief Valve: Bronze body and spring and diaphragm combination pressure and temperature type relief valves with test lever and automatically reseating type thermostatic element. Tested under ANSI Z21.22 with ratings as certified and listed by AGA and rated relief capacities greater than water heater’s BTU/hour input rating; Zurn Wilkins, or approved equivalent.
2. Vacuum Relief Valve: Conformance with ANSI Z21.22, CSA certified, brass body; “Model VR-10” by Zurn Wilkins, or approved equivalent.

2.04 DOMESTIC WATER SYSTEM MISCELLANEOUS COMPONENTS

A. Water Hammer Arrestors:

1. Pre-charged sealed air chamber, piston type arrester, with EPDM O-rings in seamless copper tube chamber lubricated by FDA-approved silicone compound, meeting or exceeding PDI Standard WH 201, ASSE Standard 1010, and ANSI A112.26.1M. Precision Plumbing Products, Sioux Chief, or Zurn Wilkins.
2. Properly sized and selected per PDI Standard WH 201 and having sufficient displacement volume to dissipate the calculated kinetic energy generated by the piping system in accordance with PDI sizing guidelines.

B. Trap Primer:

1. General: Tested and certified to the ASSE Standard 1018, non-flow though type trap primer body consisting of brass body and fittings and O-ring seals with no springs or diaphragms; not requiring adjustments and operating on line pressure drop, complete four view holes, removable filter screen, distribution unit, air gap, distribution unit for multiple drain applications.
2. Style and Application:

a. Single drain up to 3 drains: Pressure-drop activated brass trap seal primer, with inlet opening of male ½-inch NPT and outlet opening of female ½-inch NPT complete with four view holes and removable filter screen. Serves up to 3 floors drain traps and requires no adjustments and no air pre-charge; Precision Plumbing Products (PPP) model P2-500, or approved equivalent.
b. Serves up to 6 drains: Pressure-drop activated brass trap seal primer, with inlet opening of male ½-inch NPT and outlet opening of female ½-inch NPT complete with four view holes and removable filter screen and

requires no adjustments and no air pre-charge; Precision Plumbing Products (PPP) model PR-500, or approved equivalent.

c. Serves up to 10 drains: Pressure drop activated brass trap seal primer, with inlet opening of male ½-inch NPT and outlet opening of female ½-inch NPT complete with four view holes and removable filter screen; Precision Plumbing Products (PPP) model P1-500, or approved equivalent.

d. Precision Plumbing Products (PPP) Prime-Time Electronic Trap Primer, surface mount 115 Volt, ¾" inlet &½" or ⅝" compression outlet NEMA 1 cabinet. PT trap primer to be used where length of water line run will not see pressure drop in the line.

3. Accessories: Air gap copper air gap fitting complete with a male ½-inch NPT fitting at the inlet supply incorporating a stream directing nozzle, a female ½-inch NPT outlet, and a 1-inch vertical air gap, conforming to ASME A112.1.2 Air Gaps in Plumbing Systems Standard; "AG-500" by Precision Plumbing Products (PPP), or approved equivalent.

C. Strainers:

1. "Y" Type Strainer: Sized to match line size, bronze "Y" type strainer, Type 304 stainless steel perforated screen 0.045-inch for domestic water service; "Model YB Series" by Zurn Wilkins, or approved equivalent.
2. Plate Strainer: Sized to match line size, dual elliptical or flange, cast bronze housing, stainless steel plate screen, housing bolts, flange bolts and nuts, and rubber gasket; "Recordall Plate Strainer" by Badger, or approved equivalent.

D. Water Meter:

1. Bronze body, disc type water meter with 1-inch NPT test plug including remote readout ROM system, certified to comply with AWWA Standard C700 and acceptable to water utility authority; "4-In. Compound Meter" by Hersey Meters, or approved equivalent.
2. 1½-inch bronze body, disc type water meter with 1-inch NPT test plug with remote readout ROM system, certified to comply with AWWA Standard C700 and NSF/ANSI 61 and acceptable to water utility authority; "Model M120LL" by Badger Meter, Inc., or approved equivalent.
3. Class II turbine principle measurement type water meter, with external strainer, with register providing contact closures to open or close an electrical circuit at pre-determined intervals proportional to the volume measured by the water meter, certified to comply with AWWA Standard C700, line size as indicated on the Drawing(s); "W Turbo Meter, Impulse Contactor Register Unit" by Invensys Sensus Metering Systems.

a. Connecting Cable Requirement: Belden #8760 or equivalent 2-conductor shielded cable is required. Maximum outside diameter of the cable should be 0.156 inches to effect a water-tight seal at the register.

b. Contact Type: Single pole, double throw (Form C) dry contact switch operated by rotating cam.
Switch Output: One (1) contact operation per ten (10) cubic feet.
Contact Rating(s): 24 volts DC: 2 amps resistance. 125 volts AC: 2 amps resistance.

c. Contact Actuation Time: 100 milliseconds minimum at meter's maximum flow rate (i.e., N.O. Circuit: contacts closed 100 milliseconds minimum).

d. Contact Protection: On inductive load applications, suitable electrical suppression should be provided for contact protection.

4. ⅝ inch by ¾ inch size, bronze body, disc type water meter with digital output encoder register compatible with automatic meter reading system, cubic foot unit measure operating temperature up to 80 degrees F; “Model 25 Disc Meter – Recordall Transmitter Register (RTR) with Model 40 Integral or Remote ITRON – Encoder/Receiver/Transmitter (ERT)” by Badger-Meter, Inc., or approved equivalent.
5. ¾ inch size, bronze body, disc type water meter with digital output encoder register compatible with automatic meter reading system, cubic foot unit measure, temperature up to 80 degrees F; “Model 35 Disc Meter – Recordall Transmitter Register (RTR) with Model 40 Integral or Remote ITRON – Encoder/Receiver/Transmitter (ERT)” by Badger-Meter, Inc., or approved equivalent.
6. Automatic Meter Readout System: Radio read type for automatic meter reading systems; “ITRON” radio frequency system by Badger-Meter, Inc., or approved equivalent.

2.05 BACKFLOW PREVENTERS

A. Reduced Pressure Zone Backflow Preventer 2½ inch and larger line size: Device meeting requirements of USC’s FCCC & HR Manual, Sec. 10, ASSE 1013 and CSA B64 Series 7, B64.4; sized to accommodate line size indicated on the Drawings; with stainless steel body, epoxy coated cast/ductile iron strainer, Noryl™ soft seated check valves with OS&Y gate valves, pressure differential relief valve, air gap drain, and 4 bronze body ball type test cocks factory-installed on assembly; “Model 375AST-FSC-OSY” by Zurn Wilkinsor approved equivalent.

B. Reduced Pressure Zone Backflow Preventer 2 inch line size or smaller: Device meeting requirements of USC’s FCCC & HR Manual, Sec. 10, ASSE 1013 and CSA B64 Series 7, B64.4; sized to accommodate line size indicated on the Drawings; with bronze body, strainer, soft seated bronze check valves with full port ball valve shut-off valves or non-rising gate valves, pressure differential relief valve, air gap drain, and 4 bronze body ball type test cocks factory-installed on assembly; the seat ring and all internal polymers shall be NSF® Listed Noryl™ and the seat disc elastomers shall be silicone; “Model 975XL-AG“ by Zurn Wilkins, or approved equivalent.

C. Double Check Detector Assembly: 304 stainless steel body, 100 percent lead free, two independently operating, spring-loaded check valves, two UL-Listed and FM-approved, OS&Y resilient wedge gate valve with pre-grooved stem for tamper switch, and bypass assembly with test cocks. Bypass assembly consists of water meter and double check valve assembly with test cocks. Meeting requirements of USC’s FCCC & HR Manual, Sec. 10, ASSE 1013 and CSA B64 Series 07, B64.4; “350ASTDA” by Zurn Wilkins, or approved equivalent.

D. Vacuum Breakers:

1. Atmospheric Type: Interior hose threads; “Series 8B” by Watts, “Series BFP-8” by Zurn Wilkins, or approved equivalent.
2. Pressure Type: Sized to match line size, internally loaded check valve and loaded air inlet valve opening to atmosphere on discharge side of check valve with ball valves, bronze body construction, tight seating rubber discs, and ball type test

cocks factory-installed on vacuum breaker, meeting requirements of USC's FCCC & HR Manual, Sec. 10, ASSE 1020 and CSA B64 Series 07, B64.1.2; "Model Series 40-500" by Conbraco, "Model Series 720A" by Zurn Wilkins, or approved equivalent.

E. Vented Backflow Preventer

1. For potable water supplies to beverage dispensers, carbonated beverage dispensers and coffee machines to be provided with vented backflow preventer conforming to ASSE 1022 standards; "Series 3D" by Watts or approved equivalent
2. Or provide air gap connection in lieu of a backflow preventer

2.06 PIPING SEISMIC JOINT

A. Piping seismic joints shall consist of flexible loops of stainless steel braided flexible connectors similar to Flexible Expansion Loops as specified in specification Section 22 05 16 –Expansion Compensation for Plumbing.

B. Required seismic movement to be compensated for by the piping seismic joint shall be as identified on the Structural Drawings or on the Seismic Joint Schedule on the Drawings.

C. Provided pipe anchors located on each side of the building seismic joint and piping seismic joint, anchored to the structure. Anchors shall be as specified in specification Section 22 05 16 - Expansion Compensation for Plumbing.

PART 3 – EXECUTION

3.01 APPLICATIONS

A. Piping:

1. Provide unions at connections to each piece of equipment for easy dismantling and at such other points to facilitate installation. Unions shall be of same strength and manufacturer as used in the respective piping systems, and shall be of the ground joint type as specified in specification Section 22 11 10 - Plumbing Piping and Accessories.

B. Shut-off Valves:

1. Provide shut-off valves for all water supplied, equipment and fixtures, and devices which do not have supply stop or integral isolation valves provided with equipment or fixtures.
2. Provide shut-off valves and capped outlets in water piping, as required and where indicated for future extension to equipment and fixtures provided under other Sections of the work.
3. Provide shut-off valves at connections in water piping for the work of other trades, within two feet of their related equipment.
4. Coordinate and include as part of this work final connections with applicable trade.
5. Provide shut-off valves on each water riser.
6. Provide shut-off valves for each water hammer arrestor and trap primer installation.

C. Backflow Preventers:

1. Provide vacuum breakers and/or backflow preventers in all water supplies to fixtures and equipment requiring inlet connections wherein a minimum air break cannot be attained, or where chance of contamination may exist.
2. Provide full size indirect waste from reduced-pressure backflow preventer's relief port's funnel drain connection to floor sink or floor receptor with air break at drain.
3. Comply with manufacturer's specific instructions for installation of backflow preventer, and install and test in accordance with requirements of local jurisdictional authority.
4. When required by the local Authorities Having Jurisdiction, reduced-pressure backflow preventers shall be installed in strict accordance with the regulations and requirements of that department.
5. At carbonated beverage dispensers, downstream piping shall not be affected by carbon dioxide gas.
6. Provide full size indirect waste from vented backflow preventer to discharge indirectly to floor sink or floor receptor with air break at drain.

D. Water Hammer Arrestors:

1. Provide water hammer arrestors in the piping systems and adjacent to all pieces of equipment wherein quick-closing valves are installed and where indicated by PDI.
2. Water hammer arrestors shall be properly sized and selected per PDI Standard WH 201 and having sufficient displacement volume to dissipate the calculated kinetic energy generated by the piping system. Install all units in a vertical position unless otherwise indicated by manufacturer.
3. Provide access panels with Allen wrench key lock for each arrester.
4. Install water hammer arrestors as close as possible to inlet side of quick closure valves and devices.
5. Install water hammer arrestors in upright position on inlet side of solenoid valve.
6. Do not install water hammer arrestor at greater than 90-degree angle from vertical position.

E. Gauges: Provide pressure gauges in locations shown on the Drawings and as specified in Section 22 05 19 - Meters, Gauges and Thermometers for Plumbing. Shut-off cock shall be provided between gauge and piping to permit gauge removal while system is under pressure.

F. Thermometers: Provide thermometers with wells on inlet and outlet of water heaters and on hot water circulation lines, as specified in specification Section 22 05 19 - Meters, Gauges and Thermometers for Plumbing, and where indicated.

G. Strainer:

1. Provide ball valve or hose bib on strainer blow-off port on strainers 2 inches and larger in line size.
2. Provide strainer on inlet side of hot water circulation pump.
3. Provide strainer upstream of solenoid valves.
4. Provide strainer upstream of pressure-reducing valves supplied without integral strainers.
5. Provide strainers in inlet line to all temperature-regulating mixing valves and automatic modulating control valves.

6. Flush strainer and supply piping after hydrostatic pressure test and prior to operation of solenoid valves and pressure-regulating valves.
7. Flush strainer prior to pump operation and at least once after pump has been placed into operation for period of no greater than 8 hours. Flush strainer as needed to assure piping is free of piping assembly sediment and debris.

H. Trap Primers:

1. Provide trap primer units with trap primer discharge piping, and connection to tailpiece or drain body for each floor drain.

2. Provide trap primer units with trap primer discharge piping, and connection to tailpiece or drain body for each floor sink, except floor sinks in serving food preparation sinks/equipment and dishwashing equipment.
3. Provide access panel for trap primers installed behind walls or above hard ceilings as specified in Section 22 05 50 – Access Doors in General Construction for Plumbing.
4. Trap primer discharge piping shall be same as specified for domestic water piping.
5. Provide field wrap of 20-mil PVC tape or factory-applied PVC coating around exterior of copper tubing that is buried in concrete floors.
6. Provide a line shut-off valve and union connection upstream of the trap seal primer in order to shut off the water supply when performing maintenance on the trap seal primer.

I. Relief Valves:

1. Provide adjustable bronze spring and diaphragm combination pressure and temperature type relief valves with test lever and automatically reseating type thermostatic element.
2. Drain to terminate over floor drain or to other safe location.
3. Locate on water heaters.

3.02 INSTALLATION

A. Piping:

1. Minimum cover on underground water piping shall be 3 feet, 0 inches below final grade.
2. Carry headers for groups of fixtures full size throughout their length.
3. All domestic water piping shall be arranged to drain to low points and to provide for air elimination at high points.

4. Mains, risers and branch connections to mains shall be arranged to permit expansion and contraction and seismic movement without strain by means of elbow swings and/or expansion joints and seismic movement.
5. All cut and threaded pipe shall have the cutting burrs and sharp edges reamed out. In erecting pipe, friction wrenches and risers shall be used exclusively, and any pipe cut, dented or otherwise damaged shall be replaced.
6. All ferrous to non-ferrous pipe connections shall be made with accepted dielectric pipe or flange union isolating joints to prevent any electrolytic action between dissimilar metals.
7. All copper tubing shall be cut and reamed to remove all burrs. Outside and inside of the fittings and outside of the tubing at each end shall be well cleaned with steel

wool before soldering to remove all traces of oxidation regardless of how clean the surfaces of the pipe and fittings may appear.

8. Nipples: Any piece of pipe 8 inches in length and less shall be considered a nipple. All nipples with unthreaded portion 1½ inches and less shall be extra heavy. All other nipples to be of weight corresponding to fitting connected. Only shoulder nipples shall be used; closed nipples will not be acceptable.
9. All fitting unions and connections at pumps, tanks or other major equipment 3 inches and over in size shall be assembled with flanged joints and approved gaskets.
10. Supports for vertical piping shall be double bolt riser clamps (consistent with pipe material, i.e., copper for copper pipe) with each end having equal bearing on the building structure. Vertical piping to be supported at every level. Refer to Section 22 05 29 - Supports, Hangers, Anchors and Sleeves for Plumbing.
11. Support piping for copper piping in accordance with Section 22 05 29 - Supports, Hangers, Anchors and Sleeves for Plumbing.
12. Install piping for copper piping in accordance with Section 22 11 00 - Plumbing Piping and Accessories.
13. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
14. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
15. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate with silcon and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
16. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
17. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. [**Square cut**] [**Roll**] groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
18. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
19. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

20. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

B. Valves:

1. Arrange and orient valves, check valves, pressure-reducing valves, water hammer arrestors, trap primer valves, etc., in manner accessible for maintenance and/or removal.
2. Provide shut-off valves for cold water and hot water branches serving more than two fixtures.

3. Install standard weight or extra-heavy weight valves in conformity with the requirements for water piping fittings as specified.
4. Provide valves with soldered, threaded or flanged ends as required by the piping system in which they are installed and as specified.
5. Provide shut-off valves for all plumbing equipment, fixtures, and fixture trim, which do not have supply stop or integral isolation valves included.

C. Solenoid Valve:

1. Install valve with pipe connection opening horizontal to floor and position coil and solenoid in upright and vertical position.
2. Verify power wiring provided by Division 26. Contractor matches voltage and current required to operate valve in accordance with solenoid valve UL listing and manufacturer's guidelines prior to energizing solenoid valve.
3. Install unions on inlet and outlet side of solenoid valves.
4. Remove solenoid valve from piping during hydrostatic pressure tests.

D. Strainer:

1. Flush strainer and supply piping after hydrostatic pressure test and prior to operation of solenoid valves and pressure-regulating valves.
2. Flush strainer prior to pump operation and at least once after pump has been placed into operation for period of no greater than 8 hours. Flush strainer as needed to assure piping is free of piping assembly sediment and debris.

E. Thermometers: Install oversize pipe tee and nipple for wells of thermometer installations.

F. Trap Primer:

1. Flush water line before installing trap primer. Ensure that all flux and other debris is removed.
2. Use only Teflon tape around threads. Do not use pipe dope. Do not solder fittings directly onto the inlet or outlet of the primer.
3. Cycle trap primer at least six (6) times to ensure optimum performance and view water discharge from the orifice.
4. Disassemble and clean trap primer in event of excess water discharge or lack of water discharge.
5. Do not install the trap seal primers closer than forty (40) feet apart when using the same potable water supply line.
6. Mount trap primer outlet one foot above the finished floor for every twenty (20) feet of floor drain trap make-up water line.

3.03 THRUST BLOCKS AND RODDING

A. Provide thrust blocking at each change in direction of buried water main piping 4 inches and larger.

B. Provide rodding or retaining glands and thrust blocking on ductile iron mechanical joints at each change in direction of piping.

3.04 WATER METER

A. Contact water utility company to obtain size and type of water meter and obtain copy of

"Standard Specifications for Interior Meter Setting Piping" along with all pertinent drawings, details, regulations, applications, etc.

B. Water Connection: Make arrangements with local Water Authority for tapping of public water main. The Contractor shall pay all fees and costs to the water authority as required for tapping sleeve valve, wet tapping and inspections.

C. Water Service: Provide all products, materials and services required for the complete installation, testing, disinfection and activation of this water service except for those products, materials and services which are provided by utility company.

3.05 TESTING AND ADJUSTMENTS

A. Provide, in written format, testing information including date of testing, starting pressure, pressure after test and length of test, pressure loss after test and witnesses present.

B. During the progress of the work, test the domestic water systems including fixture roughing-in sections as directed to permit general construction and building-in of rough work to proceed. Test entire piping systems or in sections after rough piping systems are installed where deemed advisable to meet construction schedule and sequencing of other work. Such tests shall be made in the presence of the Owner's Representative, Building Department Inspectors and any other Authorities Having Jurisdiction. A minimum of 48-hours' notice shall be given to the Architect prior to any testing.

C. The Contractor shall provide all apparatus, temporary work or any other requirements necessary for such tests and shall take all due precautions to prevent damage to the Building or its contents. If damage occurs, the Contractor shall repair and remedy all damages made without cost to the Owner.

D. Any defects or deficiencies discovered as a result of tests shall be immediately repaired and tests repeated until the test requirements are fully complied with. Retest piping section which fails testing until successful test results are obtained. No caulking of pipe joints to remedy leaks shall be permitted.

E. Backfill trench between joints before testing to prevent movement of pipe during tests. Expose joints to detect visible leaks. Sufficiently harden thrust blocks prior to tests. Fill pipe with water for minimum 24 hours prior to applying test pressure to stabilize system.

F. The domestic water supply system shall be tested to a hydraulic pressure equal to 1½ times the normal operating pressure, but no less than 125 pounds per square inch before being enclosed and before non-conducting covering is applied. Do not connect fixtures, equipment and solenoid valves into system during this test. All leaks or defects indicated by tests shall be repaired or replaced with new material, as directed by the Architect, and test repeated until all defects are removed. Disconnect apparatus for developing required pressures during stated periods. After fixtures are connected, test system for 2 hours at 75 psig or prevailing water pressure, whichever is higher.

G. Do not cover or conceal plumbing system or portion of plumbing system until after testing and approval by jurisdictional authority. Expose systems that has been covered or concealed before testing or inspection and retest.

H. ADJUSTING

a. Perform the following adjustments before operation:

6) Close drain valves, hydrants, and hose bibbs.
7) Open shutoff valves to fully open position.
8) Open throttling valves to proper setting.
9) Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a) Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
b) Adjust calibrated balancing valves to flows indicated.

10) Remove plugs used during testing of piping and for temporary sealing of piping during installation.
11) Remove and clean strainer screens. Close drain valves and replace drain plugs.
12) Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
13) Check plumbing specialties and verify proper settings, adjustments, and operation.

3.06 DISINFECTION/CLEANING

A. Do not open valves separating new piping and existing water systems until piping tightness tests, flushing and disinfection has been completed. Provide temporary test valves piping and drain components to accomplish disinfection and cleaning.

B. Record flushing information including date of flushing, volume of flushing, length of time and witnesses present. Flush piping systems in accordance with the following:

1. Domestic Water – 3 inch and smaller pipe size:

a. Prior to testing, flush piping with clean water until clean water free of silt or grit is observed for at least one minute, for specific pipe size.
b. Flow rates per pipe size shall be as follows:

gpm	**for pipe size (in inches)**
220	3
150	2½
100	2
55	1½
40	1¼
25	1
16	¾
8	½

2. Buried Domestic Water Piping Systems – 4 inch and larger pipe size:

a. Prior to testing, flush piping with clean water until clean water free of silt or grit is observed for at least one minute, for specific pipe size.

b. Flow rates per pipe size shall be as follows:

gpm	for pipe size (in inches)
390	4
880	6
1560	8
2240	10

C. Disinfection of Potable Water Systems: Comply with local requirements, where local code requirements are more stringent. Provide necessary labor, equipment, material and test kits for chlorine application and tests. Make all arrangements with jurisdictional water authority for witnessing chlorination and tests of proper disinfection. The Contractor shall pay all fees and costs including water sample testing.

1. Exterior Water Service Line: Perform disinfection of water main piping in conformance of applicable local jurisdictional authorities' standards and requirements of AWWA Standard C651, "Disinfecting Water Mains" with exception of Item 7.3.

   a. Following flushing of main, provide for collection of samples of water by Local Water Authority or Local Department of Health.
   b. Do not place main in service until water has been approved and notification received from Local Water Authority or Local Department of Health.

D. Interior Water Piping: Sterilize all parts of building water services system with water solution containing 50 parts per million of available chlorine for at least a 24-hour contact period. After contact period, flush all parts of system with clear water until system tests at no more than 0.2 ppm residual chlorine.

END OF SECTION 22 11 00