

PART 1 GENERAL**1.1 RELATED DOCUMENTS**

- A. The requirements of the General Conditions, Supplementary Conditions and the following Specification sections apply to all Work herein:
1. Section 22 00 10 - General Requirements
 2. Section 22 00 20 - Plumbing Scope of Work
 3. Section 22 00 30 - Connections to Utilities
 4. Section 22 05 07 - Design Conditions
 5. Section 22 05 48 - Vibration Isolation
 6. Section 22 05 93 - Testing, Balancing and Adjusting
 7. Section 22 07 00 - Thermal Insulation
 8. Section 22 12 00 - Potable Water Storage Tanks
 9. Section 22 13 00 - Sewage and Drainage System
 10. Section 22 21 23 - Pumps
 11. Section 22 30 00 - Plumbing Equipment
 12. Section 22 40 00 - Clean-outs, Drains, and Plumbing Fixtures

1.2 SUMMARY

- * A. Furnish and install all domestic water pipe, valves, fittings and accessories herein specified and as indicated on the Drawings, complete with all appurtenances required for a complete and operating domestic hot water system.

1.3 REFERENCE STANDARDS

- A. All pipe, valves, fittings and accessories shall be designed, manufactured and tested in accordance with the latest applicable industry standards including the following:
1. ASTM
 2. ASSE - American Society of Sanitary Engineers
 3. ANSI B16.22 and B16.3
 4. ANSI A 112-26-1M
 5. AWWA
 6. MSS SP-69, 1996, "Pipe Hangers and Supports: Selection and Application"
 7. MSS SP-58, 1993, "Pipe Hangers and Supports: Materials, Design and Manufacture"
 8. MSS SP-89, 1998, "Pipe Hangers and Supports: Fabrication and Installation Practices"
 9. MSS SP-80, 1997, Bronze Gate, Globe, Angle and Check Valves
 10. MSS SP-110, 1996, Ball Valves Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends
 11. NSF/ANSI Standard 61 - Drinking Water System Components
 12. NSF/ANSI Standard 61, Annex F and Annex G
 13. NSF/ANSI Standard 372 Drinking water system components - Lead Content
 14. California's Health & Safety Code (Section 116875) - AB1953
- B. All equipment and material to be furnished and installed on this Project shall be in accordance with the requirements of the authorities having jurisdiction and suitable for its intended use on this Project.

1.4 SUBMITTALS

- A. The following submittal data shall be furnished according to the General Conditions and Section 22 00 10 and shall include, but not be limited to:
1. Schedule of Pipe and Fitting Materials, complete with typical mill reports.
 2. Pipe Cleaning Certification*.
 3. Gate Valves, Globe Valves, Ball Valves, Butterfly Valves, Check Valves, pressure reducing valves, dielectric fittings and Strainers.
 4. Thermometers and Gauges.
 5. Galvanized Pipe.
 6. Copper Pipe.
 7. Cut Grooved Couplings and Fittings for galvanized pipe.

8. Roll Grooved Couplings and Fittings for copper and stainless steel pipe.
 9. Subcontractor's Roll and Cut Groove Machine Certifications*.
 10. Factory Test Reports
 - a. Viega NSF International Test Report
 11. Proposed test procedures, recording forms, test equipment, and list of personnel and qualifications for all tests proposed. Refer to Section 22 05 93 titled "Testing, Balancing and Adjusting" for additional requirements.
 12. Field Test Schedule.
 13. Field Test Reports.
 - a. Hydrostatic Test Reports.
- B. All items or equipment listed above with asterisks (*) shall be certified by the manufacturer using Manufacturer Certification "MCA" as set forth in Section 22 00 10. See Section 22 00 10 for certification requirements.

1.5 WARRANTY

- A. Comply with the requirements of the General Conditions and Section 22 00 10.

PART 2 PRODUCTS

2.1 DOMESTIC HOT AND COLD WATER PIPING

- A. This building will utilize various pressure classes for the domestic cold and hot water piping systems. Pipe, valves, fittings and materials shall conform to the working pressure requirements indicated in Section 22 05 07 titled "Design Conditions" and as indicated on the Drawings.
- B. Pipe material shall be as follows:
1. Copper Pipe (6" pipe size and smaller):
 - a. Pipe above ground inside the building for Class 150 psig working pressure pipe, ASTM B88-72, H23.1-59 Type "L" and Type "K" for class 300 psig working pressure hard drawn seamless copper water tube shall be used for sizes 6" and smaller. Copper tube shall be manufactured in the United States by Cerro, Halstead, Mueller, Wolverine or approved equal. Connections between steel pipe and copper tubing shall be made with dielectric-insulating fittings.
 2. Stainless Steel Pipe (6" pipe size and smaller):
 - a. Pipe above ground inside the building (express riser) may be Schedule 40 A312/316L for class 150, 250, 300 and 750 psig working pressure systems in lieu of Type "K" and Type "L" copper for sizes 6" and smaller.
- C. Fitting material shall be as follows:
1. Mechanical Couplings for Joining Stainless Steel Pipe:
 - a. All grooved joint couplings, fittings, valves and specialties shall be products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
 - b. Stainless Steel Mechanical Couplings: Manufactured in two or more segments of cast stainless steel, conforming to ASTM A-351, A-743, and A-744. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. (Gaskets used on potable water systems shall be UL classified in accordance with ANSI/NSF-61 for potable water service.) Mechanical coupling bolts shall be stainless steel, type 316, meeting the physical properties of ASTM A-193, grade B8M, Class2.
 - 1) Rigid Type: Cast with key designed to clamp the bottom of the groove to provide an essentially rigid joint. Victaulic Series 489.
 - 2) Flexible Type: Use in locations where vibration attenuation and stress relief are required. Victaulic Series 77S.
 - c. Ductile Iron Mechanical Couplings: Manufactured in two segments of cast ductile iron, conforming to ASTM A-536. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. Mechanical coupling bolts shall be zinc plated (ASTM B-633) heat treated carbon steel track head conforming to ASTM A-449 and A-183, minimum tensile strength 110,000 psi (758450 kPa).
 - 1) Sizes to 12", rigid type, designed to clamp the bottom of the groove to provide an essentially rigid joint. Victaulic Series 89.

- 2) 14" through 24": Victaulic AGS series with lead-in chamfer on housing key and wide width gasket. Rigid type, housing key shall fill the wedge shaped AGS groove and provide rigidity. Victaulic Style W89.
 - 3) 2" through 4" sizes may be Installation-Ready, for direct stab installation without field disassembly, with grade EHP gasket rated to +250 deg F / 120 deg C. Victaulic Style 107H (rigid) or Style 177 (flexible).
 - d. At the Subcontractor's option, pipe fittings for sizes 8" and larger may be painted ductile iron Victaulic Style 07 "Zero Flex", 75, 77, 07 or Gruvlok 7000, 7001 or 7401 couplings up to and including 400 psig working pressure on risers and mains and galvanized ductile iron full flow fittings. The cut grooving tool shall be manufactured by the grooved piping system manufacturer and furnished with a calibrated gauge to check the groove depth. If they comply with these Specifications, couplings and full flow fittings manufactured by Grinnell Corporation (Gruvlok) or Victaulic Company of America will be acceptable.
 - e. Screwed Fittings and Flanges: Screw threads shall be in accordance with American Pipe Thread Standards. LACO, Rector-Seal or WKM "Key Tite" pipe joint compound shall be used in making the joints.
 - f. Flanged Fittings: At each flanged joint, flanges shall have matching raised or flat faces. Gaskets shall be minimum 1/16" thick J. M. Clipper Style 960 or 961 compressed non-asbestos with nonstick clean surface factory applied parting agent. Gasket material shall be suitable for the service intended and shall be installed as recommended by the Manufacturer. Gaskets manufactured by Dallas Gasket, Garlock or J. M. Clipper will be acceptable if they comply with these Specifications.
 - g. Grooved End Fittings for Stainless Steel Pipes: Fittings shall be manufactured of stainless steel conforming to ASTM A-403, WPW, WPW/S9, or CR/S9, or shall be fabricated from stainless steel pipe conforming to ASTM A312, with factory grooved ends. Fittings shall be type 304/304L or 316/316L stainless steel.
 - h. Grooved End Mechanical Joint Fittings and Couplings: Fittings and couplings shall be suitable for the system design working pressure and temperature as specified in Section 23 05 07 titled "Design Conditions". Full flow galvanized fittings and couplings shall be made of ASTM A 47 Grade 32510 malleable iron or ASTM A 536 Grade 65-45-12 ductile iron with grooved ends. Gaskets for water service below 230°F shall be a "Triple Seal" Grade "EPDM" synthetic gasket.
2. Copper Pipe:
- a. Copper pipe fittings shall be Arco, Elkhart, Grinnell, Mueller, Nibco or approved equal, wrought copper joint fittings conforming to the latest edition of ANSI B16.22.
 - b. Copper fittings shall be soldered with ASTM B 32-76 Grade 95TA tin antimony solder or brazed with AWS classification BCuP-2 brazing alloy as required by the system temperature and working pressure.
SOLDER OR BRAZING ALLOYS THAT CONTAIN LEAD WILL NOT BE ACCEPTABLE.
 - c. The Subcontractor may use a "T-Drill" joining system with brazed joints at the "T-Drill" connections in lieu of copper fittings for copper branch piping 2" and smaller for working pressures 150 psig and lower. Provide manufacturer's written instructions and Subcontractor's pro-posed installation details for the Engineer and Owner review. The "T-Drill" installation shall be performed in strict accordance with the manufacturer's written instructions.
 - d. At the Subcontractor's option, copper pipe in sizes 2-1/2", 3", 4" and 6" for 150 psig systems may be assembled with Victaulic Style 606 or Grinnell Gruvlok 7400 couplings. All fittings shall be full flow fittings. If they comply with these Specifications, couplings, fittings and gaskets manufactured by Grinnell Corporation (Gruvlok), Tyler Pipe Industries (Gustin Bacon) or Victaulic will be acceptable. Grooved fitting manufacturer shall be ISO 9001 approved.
 - e. At the Subcontractor's option, copper pipe in sizes 4" and smaller for 150 and 300 psig working pressure systems may be assembled using crimp type copper or bronze fittings with EPDM seals manufactured by Viega and installed with a RIDGID ProPress crimping tool. Viega shall submit a NSF International test report to the Owner confirming compliance with the requirements of ANSI/ASME B16.22, ASTM B88 and ANSI/NSF61 and the requirements of IAPMO PS 117-2001. The test report shall indicate that the Viega ProPress test copper fitting assembly was successfully hydrostatically tested at a pressure of 600 psig and a water temperature of 210°F for a period of 48 hours and no leakage occurred. A quality control procedure shall be submitted to the Engineer to verify the integrity of each joint. The hydrostatic test specified in paragraph 3.02 hereinafter shall be maintained continuously for at least two (2) hours during which each joint, connection, etc., shall be visually examined to verify there is no evidence of weeping or leakage. The Subcontractor shall maintain a hydrostatic test log listing the system tested, portion tested, date of test, start time and pressure, finish time, pressure and test supervisor for each hydrostatic test. The hydrostatic test

log shall be submitted to the Engineer and Owner for record prior to substantial completion of the Project.

3. Stainless Steel Pipe:
 - a. Grooved End Mechanical Joint Fittings and Couplings: Fittings and couplings shall be suitable for the system design working pressure and temperature as specified in Section 23 05 07 titled "Design Conditions". Full flow galvanized fittings and couplings shall be made of ASTM A 47 Grade 32510 malleable iron or ASTM A 536 Grade 65-45-12 ductile iron with grooved ends. Gaskets for water service below 230°F shall be a "Triple Seal" Grade "EPDM" synthetic gasket.
- D. Provide piping of proper size as indicated on the Drawings and as required for hot and/or cold water to all sinks, lavatories, toilets, urinals, etc. Each fixture shall be provided with a shutoff valve for each supply line. All exposed pipe Work in public areas, tenant areas and similar locations shall be metallic and chromium-plated. Provide vacuum breakers and backflow preventers as required by local code and regulations of the authorities having jurisdiction.
- E. All domestic water pipe in concrete slabs or under concrete slabs in contact with the earth shall be Cerro, Chase, Mueller, Phelps-Dodge, Wolverine or approved equal, ASTM B 88 Type "M" annealed (soft temper) seamless copper water tube without fittings. Connections between steel pipe and copper tubing shall be made with dielectric insulating fittings or Gruvlok Di-Lok nipples.

2.2 UNDERGROUND DOMESTIC COLD WATER SERVICE PIPING

- A. All piping below ground shall be ductile iron bell and spigot push-on joint pressure water pipe designed and manufactured in accordance with the latest revisions of ANSI A21.50 (AWWA C150) and ANSI A21.51 (AWWA C151) standards. Four (4) inch ductile iron pipe shall be thickness Class 51 and six (6) inch and larger ductile iron pipe shall be thickness Class 50.
- B. Push-on joints shall be of the "Tyton" or approved equal, type employing a molded rubber gasket retained in a ring recessed into the inside of the bell. Restraints shall be provided at all changes in direction. Joints shall be in accordance with the requirements of the latest revision of ANSI Standard A21.11 (AWWA C111). Where indicated on the Drawings provide ductile iron restrained (internally locked) push on type, "Tyton" or approved equal, joint pipe and fittings in lieu of thrust blocking or tie rods.
- C. Fittings shall be gray iron or ductile iron conforming to all applicable requirements of the latest revision of ANSI Standard A21.10 (AWWA C110).
- D. Pipe and fittings shall be cement mortar lined. Coat pipe and fittings inside and outside with the manufacturer's standard asphaltic sealcoat in accordance with the latest revision of ANSI Standard A21.4 (AWWA C104) suitable for domestic water service.
- E. Unless otherwise noted on the Drawings, all ductile iron pipe, fittings, etc., shall be encased in eight (8) mils thick polyethylene tubing in accordance with the latest revision of ANSI Standard A21.5 (AWWA C105).
- F. Ductile iron piping, fittings and joints shall be suitable for a minimum working pressure of 150 psig in the sizes indicated on the Drawings and in Type 4 laying conditions with 2 to 15' of cover and as required for freeze protection, unless otherwise indicated on the Drawings.
- G. Before backfilling, all underground piping, fittings, joints and valves shall be checked by the manufacturer's representative for location of possible tears and holes in the protective coating. Repair any breaks in the protective coating as recommended by the manufacturer. Refer to Section 22 00 30 titled "Connections to Utilities" for excavation, backfilling, compaction, etc., requirements.
- H. Pipe and joints shall be as manufactured in the United States by Clow Corporation, Tyler Pipe and Foundry Company, U.S. Pipe and Foundry Company or approved equal.
- I. At the Subcontractor's option, subject to the authorities having jurisdiction, PVC AWWA C900 Class 100 bell and spigot pipe may be used for underground domestic water service and Class 150 and 200 underground fireline service. The joint gasket material shall be an ASTM F-477 compliant flexible elastomeric ring, which provides a tight water seal and protects the piping from shock and vibration and provides for expansion and

contraction. The pipe shall be installed in strict accordance with the pipe manufacturer's written instructions: J-M Publication TR-704B "Blue Brute PVC Class Water Pipe Installation Guide". AWWA C900 Piping shall conform to the requirements of the working pressures as indicated in Section 22 05 07 titled "Design Conditions". If it complies with these specifications AWWA C900 pipe and joints shall be as manufactured by J-M "Blue Brute" or approved equal.

2.3 CONTROLLING VALVES

- A. Furnish and install all valves that are shown on the Drawings and/or specified herein. Packing and gaskets shall contain no asbestos and shall be so certified. See Section 22 00 10 for certification requirements. Prior to purchase of any valve manufactured outside the United States the Subcontractor shall submit complete construction details, material list of all components, pressure test data and certified compliance with the reference standards listed herein.
- B. Above Ground Domestic Hot and Cold Water Valves:
1. All above ground domestic hot and cold water valves for 150 psig working pressure systems shall be in accordance with the following schedule:
 - a. Copper Pipe:
 - 1) Gate Valves (Lead Free): Copper piping up to and including 3" size – Crane No. LF1320, Milwaukee UP149 or Nibco S-113-LF, 200# WOG, bronze body with screwed bonnet, solder joints and classified in accordance with NSF/ANSI 372.
 - 2) Globe Valves (Lead Free): Copper piping up to and including 3" – Milwaukee UP1502 or approved equal, 200# WOG, bronze body, bronze rising stem, union bonnet, renewable seat, solder joints and classified in accordance with NSF/ANSI 372.
 - 3) Ball Valves:
 - a) Ball valves shall be constructed to permit repacking without removal of the valve body from the line and stem shall not blow out under pressure. Valves used for insulated domestic cold and hot water service shall be insulated and vapor sealed to the protective sleeve for cold water as detailed on the Drawings. Extended, non-thermal conductive handle ball valves similar or approved equal to Nibco "Nib-Seal" shall be utilized. The ball valve stem shall be extended so that the operating handle is above the pipe insulation surface.
 - b) Ball valves (Lead Free) for 150 psig working pressure up to and including 2" for insulated domestic water piping system shall be similar and approved equal to Nibco Nib-Seal. Ball valves for non-insulated domestic water piping shall be similar and approved equal to Nibco T-585-80-LF ball valves, red brass, cast bronze or yellow forged bronze with brass, stainless steel or bronze ball and stem, 400 psig non-shock WOG at 200°F and and classified in accordance with NSF/ANSI 372. Valve shall have a stem extension of sufficient length to position the operating handle, mechanical memory and position lock devices above the insulation. If it complies with these Specifications, valves manufactured by one of the following manufacturers will be acceptable: Apollo, Flow Design, Hills-McCanna, Jamesbury, Milwaukee, Nibco, Inc., or Watts.
 - 4) At the Subcontractor's option, if copper domestic water piping 2-1/2" to 6" is assembled with roll grooving couplings and fittings, butterfly valves similar and approved equal to Victaulic Series 608-300 with Grade E, EPDM trim, UL classified in accordance with ANSI/NSF 61, Annex G for potable water and dead end service (both directions), may be used.
 2. All above ground domestic hot and cold water valves for 300 psig working pressure systems shall be in accordance with the following schedule:
 - a. Copper Pipe:
 - 1) Gate Valves (Lead Free): Copper piping up to and including 3" size – Milwaukee UP149 or approved equal, bronze body with screwed bonnet, solder joints and classified in accordance with NSF/ANSI 372.
 - 2) Globe Valves (Lead Free): Copper piping up to and including 3" – Milwaukee UP1502 or approved equal, 300# WOG, bronze body, bronze rising stem, union bonnet, renewable seat, solder joints and classified in accordance with NSF/ANSI 372.
 - 3) Ball Valves:
 - a) Ball valves shall be constructed to permit repacking without removal of the valve body from the line and stem shall not blow out under pressure. Valves used for insulated domestic cold and hot water service shall be insulated and vapor sealed to the protective sleeve for cold water as detailed on the Drawings. Extended, non-thermal conductive handle ball valves similar or approved equal to Nibco "Nib-Seal" shall be utilized. The ball

valve stem shall be extended so that the operating handle is above the pipe insulation surface.

- * b) Ball valves (Lead Free) for 300 psig working pressure up to and including 2" for insulated domestic water piping system shall be similar and approved equal to Nibco Nib-Seal. Ball valves for non-insulated domestic water piping shall be similar and approved equal to Nibco T-585-80-LF ball valves, red brass, cast bronze or yellow forged bronze with brass, stainless steel or bronze ball and stem, 400 psig non-shock WOG at 200°F and and classified in accordance with NSF/ANSI 372. Valve shall have a stem extension of sufficient length to position the operating handle, mechanical memory and position lock devices above the insulation. A protective sleeve integral to the valve around the stem shall be provided to maintain the integrity of the domestic hot water piping insulation. If it complies with these Specifications, valves manufactured by one of the following manufacturers will be acceptable: Apollo, Flow Design, Hills-McCanna, Jamesbury, Milwaukee, Nibco, Inc., or Watts.
 - 4) At the Subcontractor's option, if copper domestic water piping 2-1/2" to 6" is assembled with roll grooving couplings and fittings, butterfly valves similar and approved equal to Victaulic Series 608-300 with Grade E, EPDM trim, UL classified in accordance with ANSI/NSF 61, Annex G for potable water and dead end service (both directions), may be used.
- C. Underground Domestic Cold Water Valves:
1. All underground water service valves for 150 psig working pressure systems shall be in accordance with the following schedule:
 - a. Ductile Iron Gate Valves: Underground ductile iron piping 4" through 12" U.S. Pipe/Smith Class 150 "Tyton" gate valve with "Tyton" joint or approved equal. Provide valve stem extensions as required and/or as indicated on the Drawings.
 2. If it complies with these Specifications, gate valves manufactured by one of the following manufacturers will be acceptable: Clow, Crane, Grinnell, Nibco/Scott, Red and White/Toyo, Stockham, Walworth or Tyler.
 3. Check valves, strainers, etc., shall be as specified herein under the Subsection titled "Miscellaneous Piping Accessories".

2.4 MAKE-UP WATER AND QUICK FILL CONNECTIONS

- A. Domestic water shall be connected to equipment as shown on the Drawings. Each of the systems requiring domestic water shall be provided with a manual quick fill, makeup water connection, in addition to the automatic feed connections. Makeup water piping shall be copper as specified herein for domestic hot and cold water piping up to the tap into the main system line.
- B. Clayton "RP", Hersey, Watts No. 909 or Zurn reduced pressure backflow preventer assembly shall be lead-free and installed in make-up water line to each of the systems subject to approval by the local authorities having jurisdiction. Assembly shall be complete with strainer and inlet and outlet shutoff valves. Drain connection on the reduced pressure backflow preventer shall be piped through a Josam Series 1801 or Watts Series AG air gap, to the nearest floor drain. Equipment manufactured by Hersey will be acceptable if it complies with these Specifications. See Section 22 30 00 titled "Plumbing Equipment" for additional requirements. Install reduced pressure backflow preventer assembly in accordance with the American Society of Sanitary Engineers Standard 1013, latest edition.

2.5 WATER HAMMER ARRESTERS

- A. The Subcontractor shall furnish and install sufficient engineered piston type water hammer arresters throughout the domestic water systems in accordance with the American Society of Sanitary Engineers (ASSE) standard for sizing and placement of water hammer arresters under ASSE 1010 certification. The water hammer arresters shall have sufficient volume of compressed gas within the system at flow pressure to absorb the shock energy and dissipate the kinetic energy generated within the domestic water systems. All water hammer arresters shall be installed in the vertical position. Engineered water hammer arresters shall be manufactured by Sioux Chief Mfg. Co. (Peculiar, MO), Josam, J. R. Smith or Zurn and shall be lead-free..

2.6 PIPE HANGERS AND SUPPORTS

- A. All domestic water piping throughout the building shall be thoroughly and substantially supported with listed hangers and supports. Furnish and install any special hangers or supports that may be required by the building construction. The design, selection, spacing and application of horizontal pipe hangers, supports, restraints, anchors and guides shall be in accordance with the latest editions of the Manufacturers' Standardization Society Standards: MSS SP-69, 1996, "Pipe Hangers and Supports: Selection and Application"; MSS SP-58, 1993, "Pipe Hangers and Supports: Materials, Design and Manufacture" and MSS SP-89, 1998, "Pipe Hangers and Supports: Fabrication and Installation Practices".
- B. All horizontal galvanized steel water pipe shall be supported on Anvil Figure 260 or approved equal, adjustable wrought clevis hangers with the following exceptions. Piping subject to movement shall be mounted on Anvil Figure 177 or approved equal pipe roller supports, or on Anvil Figure 257 or approved equal pipe sliding supports. Roller guides are not acceptable to support horizontal water piping subject to both longitudinal and transverse movement.
- C. Horizontal copper pipe shall be supported on Anvil Figure CT-65 or approved equal, plastic coated clevis hangers. Steel hangers similar to Anvil Figure 65, CT-65, or approved equal, may be used if taped at each horizontal and vertical support point with Scotchrap No. 43 or approved equal pipe protection dielectric tape. Dielectric tape shall be spiral wrapped to at least 1/2" on either side of the support device.
- D. All vertical pipes not specified to be supported on vibration isolation shall be supported as follows:
1. Vertical pipes 12" in diameter and smaller shall be supported at least at every other floor with a minimum of two (2) bolt riser clamps, designed for the load and manufactured by Anvil or approved equal riser clamps. Any welding, extensions or modifications of the riser clamps shall be reviewed by the Project Structural Engineer.
 2. Vertical copper pipes shall be supported on Anvil Figure 261C or approved equal, minimum two (2) bolt plastic coated riser clamps at least at every other floor.
- E. All vertical pipes requiring vibration isolation shall have spring isolators as specified in Section 22 05 48 titled "Vibration Isolation". Riser clamps and steel channels supports shall be as specified herein and indicated on the Drawings with provisions for attachment to the vibration isolators. Welded extensions to riser clamps to accommodate vibration isolators are unacceptable.
- F. Concrete inserts for hanger rods shall be Anvil Figure 282, Figure 152 or approved equal, for pipe sizes up to 8" IPS. For over 8" IPS pipe, an insert reinforced with steel anchor bars or suitable steel plate embedded in the concrete may be used.
- G. Metal deck concrete insert shall be Carpenter & Patterson, Inc. Figure 143, galvanized fabricated steel metal deck ceiling bolt, Rawl Double FF-S-325 or approved equal.
- H. Hanger rods, inserts, etc., shall be sized and installed as recommended by the hanger manufacturer for the service intended. Hanger rods shall be galvanized.
- I. The Subcontractor shall submit pipe hanger and support details and other details as required by the Architect or Mechanical Engineer, to the Project Structural Engineer for review and approval prior to submission to the Engineer.
- J. Non-insulated copper piping subject to sweating shall be taped at each horizontal and vertical support point with Scotchrap No. 43 or approved equal pipe protection tape. Tape shall be spiral wrapped to at least 1/2" on either side of the support device.
- K. Hangers on domestic water piping exposed to weather or in the cooling tower enclosure shall be hot dipped galvanized after fabrication.
- L. Refer to Section 22 05 48 titled "Vibration Isolation" for additional requirements. The location and type of supports, load imposed on the structure at the support, anchor points and forces shall be indicated on the "Coordination Drawings" and submitted to the Project Structural Engineer. Refer to Section 22 00 10 for additional requirements.

- M. If it complies with these Specifications, equipment manufactured by one of the following manufacturers will be acceptable: B-Line, Anvil International, Inc. (formally Grinnell), Michigan Hanger, National, PHD or Tolco.

2.7 PIPE COVERING PROTECTION SADDLES AND SHIELDS

- A. Furnish and install pipe covering protection shields or saddles as required by MSS SP-69 for all insulated piping at the locations of all supports. The insulation may be applied directly over a clevis type pipe hanger without the use of pipe shields for domestic water systems only.
- B. Protection shield length and gauge thickness for use with clevis type hangers and any type of cold water (33°F to 59°F) support shall be as specified for Type 40 protection shields in the current edition of MSS SP-69, 1996. Protection shields shall be galvanized and shall be arranged to cover one-half of the circumference of the insulation and shall be mounted on the outside of the insulation with insulation blocking between the pipe and shield to prevent crushing of insulation. Blocking on piping shall be furnished and installed as specified in Section 22 07 00 titled "Thermal Insulation". The Subcontractor shall provide gauge thickness and length of shields appropriate for point loading or use with roller supports.
- C. Pipe covering protection saddles equal to Anvil Figure 160 Series shall be provided at all supports, other than the steel band or sliding types, as required by the current edition of MSS SP-69 for hot water systems (120°F and above). Protection saddles shall be welded to the piping and shall be of sufficient length to maintain contact at supports at all conditions of the pipe movement. After welding, fill void between saddle and pipe with sectional insulation or approved insulating cement as specified in Section 22 07 00 titled "Thermal Insulation".

2.8 THERMOMETERS

- A. Thermometers shall be filled with blue or green colored spirit (organic) fluid having scale length of not less than 9" and scale divisions of 2°F, or less similar and approved equal to Moeller Instrument Company, Inc., Style A.J. Range shall be as specified or as required for the duty.
- B. Thermometers shall be installed as shown on the Drawings. Thermometer wells only shall be installed in like manner. All thermometer wells shall be constructed of brass or stainless steel and where installed in insulated piping shall have at least 2-1/2" lagging extension. Pressure temperature ratings of each well shall be suitable for the system in which it is installed in accordance with Section 22 05 07 titled "Design Conditions" and as indicated on the Drawings. All wells shall be filled with silicon and be complete with caps and chains.
- C. Thermometers and thermometer wells shall have the following insertion lengths:
1. Located in Horizontal Piping and Vertical Piping Below 6'-0":
 - a. 4" and 5" Pipe - 2-1/2"
 - b. 6" and 8" Pipe - 2-1/2"
 - c. 10" and Larger Pipe - 5"
 2. Located in Vertical Piping Above 6'-0":
 - a. 3", 4" and 6" Pipe - 2-1/2"
 - b. 8" and 10" Pipe - 5"
 - c. 12" and Larger Pipe - 5"
- D. Thermometers shall have the temperature ranges listed herein and shall be installed where indicated on the Drawings or specified elsewhere.
1. Domestic Cold Water: 0-100°F
 2. Domestic Hot Water: 30-240°F
- E. Thermometers and wells must be of at least the quality and design specified. If it complies with these Specifications, equipment manufactured by one of the following manufacturers will be acceptable: Moeller, Terice or Weksler. Submit a list detailing design and construction of thermometers for review by the Engineer.

2.9 GAUGES AND GAUGE STOP VALVES

- A. Gauges shall be bourdon tube with minimum 4-1/2" dial and die cast aluminum case with black enamel finish. The movement shall be all stainless steel with Grade A phosphor bronze bourdon tube brazed at socket and tip. The accuracy of the gauge shall be within 1/2 percent of the scale range. The pointer shall be the micrometer adjustment type recalibrated from the front. Pressure, compound and differential pressure gauges shall have suitable scale ranges, shall be submitted and are subject to the review of the Engineer. Graduations shall be one pound or less on all gauges where this is standard for the required range.
- B. Gauges shall have 1/4" IPS connections and shall be Moeller "Vantage" gauges with Case Style No. 2 or approved equal.
- C. Gauges shall be installed on the suction and discharge piping for each pump and at locations as indicated on the Drawings. Gauges shall be furnished complete with stop valves as specified herein suitable for the pressure and temperature ratings of the system in which they are installed in accordance with Section 22 05 07 titled "Design Conditions".
- D. If it complies with these Specifications, equipment manufactured by one of the following manufacturers will be acceptable: Ashcroft, Marsh, Midwest, Moeller, Taylor, Trerice, Weiss or Weksler.

2.10 MISCELLANEOUS PIPING ACCESSORIES

- A. Furnish and install all necessary miscellaneous piping accessories that are shown on the Drawings and/or specified herein:
 - 1. Check valves 2" and smaller shall be for 150 psig working pressure systems for 300 psig systems. Valves of equality and construction manufactured by Grinnell, Hammond, Nibco or Walworth will be acceptable.
 - 2. Check valves larger than 2" located in domestic water pipes shall be spring loaded quiet type as manufactured by APCO, CPV, Mission, Muessco, Nibco, Techno Corporation, Williams-Hager or Zurn. Check valve non-shock pressure temperature rating shall be same as specified for piping in which it is installed. Check valve shall have full circle threaded lug body, flanged or grooved body. Wafer valve type installed between companion flanges will not be acceptable. Check valves on pump discharges shall be installed with the valve shaft perpendicular to the pump shaft.
- B. Strainers shall be similar and approved equal to the following:
 - 1. All water strainers shall be similar and approved equal to the following Mueller Steam Specialty Company Model numbers listed. If it complies with these Specifications, equipment manufactured by one of the following manufacturers will be acceptable: Crane, Flow Design Inc., Grinnell, Keckley, McAlear, Muessco or Zurn.
 - a. 150 psig system working pressure - up to 2". Muessco No. 11, 400# WOG, iron body with perforated 20 mesh monel or stainless steel screen with clean-out and screwed ends.
 - b. 150 psig system working pressure - 2-1/2" through 24". Muessco No. 758, 150# WOG, iron body with perforated monel or stainless steel screen with 1/8" perforations for sizes through 4" and 5/32" perforations for 5" and above, with clean-out and Class 125 ANSI B16.1 flanged ends.
 - c. 300 psig working pressure - up to 2". Muessco No. 11, 400# WOG, iron body with perforated 20 mesh monel or stainless steel screen with clean-out and screwed ends.
 - d. 300 psig working pressure--2-1/2" to 24". Muessco No. 752, 300# WOG, iron body with perforated metal monel or stainless steel screen with 1/8" perforations in sizes through 4" and 5/32" perforations for 5" and above, with clean-out and Class 250 ANSI B16.5 flanges.
- C. Branch Pressure Reducing Valves (Low Rise):
 - 1. Branch pressure reducing valves shall maintain a constant downstream pressure (plus or minus 3 psig) regardless of changing inlet pressures and/or flow rates. All flow conditions from zero (0) to full flow are to be handled in a stable manner. The valve shall close drop tight when the downstream pressure rises to the setting of the spring. No pressure "creep" or leak can be tolerated. Valve body and cover shall be of a bronze or ductile iron construction. The trim shall be 316 stainless steel. The valve shall contain an integral chrome nickel stainless steel (X46A) strainer and low flow by-pass (990). All repairs shall be possible without removing the valve body from the line. The valve body shall be constructed of NPT union tailpieces at the inlet and outlet of the valve. The valve shall be similar in all respects to

“Cla-Val Co. 90-48 with a 990 low flow bypass pressure reducing valve as manufactured by Cla-Val Co. or “JRG Gunzenhauser” PRV valve of same configuration is an approved alternate. No other substitutions will be accepted.

- D. Domestic Cold Water Pressure Reducing valve Assemblies:
1. Domestic water pressure reducing assemblies shall be provided where indicated on the Drawings. The pressure reducing assemblies shall have the capacities indicated in the “Schedule of Capacities” on the Contract Documents and shall maintain a constant downstream pressure with the varying inlet pressure indicated over the minimum to maximum flow range listed in the Schedule. The pressure reducing valves shall be selected to provide stable flow conditions without cavitation or valve chatter over the entire flow range specified. PRV piping, valves and strainers shall be full size of incoming line. Valve shall be sized as listed in the “Schedule of Capacities” on the Contract Documents or as noted on the Drawings.
 2. The high flow pressure reducing valve with integral strainer shall be a hydraulically operated, pilot controlled diaphragm type cast iron body, globe valve with stainless steel trim Cla-Val X46A strainer and suitable for a working pressure as indicated on the Drawings. The pressure reducing valve shall have an adjustable outlet pressure range suitable for the scheduled valve outlet pressure and shall have an adjustable opening speed control device (Cla-Val Options). The valve shall be stem guided at both ends and have a single removable seat and resilient disc. The pilot control shall be a direct-acting, adjustable, spring loaded, normally open diaphragm valve designed to permit flow when controlled pressure is less than the spring setting. The control system shall include a fixed orifice and opening speed control. Furnish the pilot control system completely factory piped with shut off cocks to isolate the pilot system on valves 4” and larger. The pressure reducing valve shall be Cla-Val 90G-01AS, or approved equal.
 3. The low flow pressure reducing valve shall be selected to operate at flow rate below the minimum flow rate of the high flow valve and the minimum flow rate indicated in the “Schedule of Capacities” on the Contract Documents. The low flow pressure reducing valve shall be a spring loaded direct acting globe valve suitable for a working pressure as indicated on the Drawings. The pressure reducing valve shall be Cla-Val Watts #223, or approved equal.
 4. Furnish and install relief valves suitable for a working pressure where required and as indicated on the Drawings. Relief valve size shall be as required by the applicable code and as indicated on the Drawings. Domestic cold water pressure reducing assembly relief valve shall have an adjustable range of 20 to 200 psig and shall be Cla-Val Series 50.
 5. Provide and install pilot operated solenoid valves as detailed on the Drawings in the inlet to each pressure reducing valve station. This valve shall be closed by the BMCS upon a signal from the BMCS that an over pressure condition exist downstream of the pressure reducing valve station. Valve shall be Cla-Val Model 136-01, 24V, 60 hertz. Wiring shall be furnished by Division 26.
- E. Trap Primer Valve:
1. Trap primer valves where specified or indicated on the Drawings shall be Precision Plumbing Products, Inc. Model PR 500 - ASSE 1018 and UPC approved. Provide Model PR-500 P-1 or P-2 with (DU) distribution unit when supplying 2 to 8 floor drains requiring trap priming. Piping below floor or encased in concrete shall be Type “K” copper and installed as specified herein.
- F. Local Backflow Preventers:
1. Coffee makers - Watts 3/8 7C check assembly polished chrome-plated ASSE approved.
 2. HVAC humidification water supply - Watts 008 QT for interior use.. ASSE approved. Install tight to underside of slab. Install and adjust as per manufacturer’s written instructions.
 3. RPZ where required by local codes or as indicated on the Drawings - Watts 909 FDA approved with strainer, ball valves and AG-909 air gap. Provide an additional rubber seated check valve on outlet side of backflow preventer, if required by local code.
 4. Install in accordance with the American Society of Sanitary Engineers Standard 1013 latest edition for backflow preventers.

2.11 UNDERGROUND PIPE TRENCH EXCAVATION, INSTALLATION AND BACKFILL

- A. See Section 22 00 30 titled “Connections to Utilities” for requirements.

PART 3 EXECUTION**3.1 GENERAL**

- A. All pipe materials shall be as specified herein and shall be installed in accordance with the latest industry standards, per the manufacturer's recommendations, and as indicated on the Drawings. All piping shall be made up and installed in a manner that permits expansion and contraction caused by changes in temperature and pressure. This shall be accomplished by the use of expansion loops as required and as shown on the Drawings and by installation of supports that will permit the movement of the pipe without undue stress and by any other precautions that might be deemed necessary by the Engineer. Refer to Section 22 05 48 titled "Vibration Isolation".
- B. Piping exposed in all rooms shall be installed as nearly as possible parallel with or at right angles to the building walls. Install all pipes straight and true. Springing or forcing piping into place will not be permitted unless specifically called for. Install piping in such a manner as to prevent strain on equipment connections. Install piping in such a manner as to eliminate all static and dynamic conditions of loading on equipment connections.
- C. Piping in finished portions of the building, except in mechanical equipment rooms or where otherwise indicated on the Drawings, shall be concealed.
- D. All piping shall be carefully graded so as to eliminate traps and pockets. Provide means for drainage by valved connections with pipe plugs for water traps.
- E. A gate or ball valve type stop valve shall be installed on each domestic hot and/or cold water riser.
- F. Make all joints smooth and unobstructed inside. Ream all pipe ends to remove burrs. Remove all obstructions and debris inside the piping systems prior to installation.
- G. Install unions or flanges at all equipment connections and elsewhere as indicated on the Drawings. Unions shall be of the same pressure rating as the respective piping system and shall be of the ground joint type.
- H. Connections between dissimilar metal piping shall be made with dielectric insulating flanges or unions to prevent any electrolytic action between dissimilar metals.
- I. All piping shall be of the sizes indicated and shall be routed as indicated on the Drawings or as required, to serve all equipment and systems.
- J. When the street utility main pressure exceeds 80 psig approved pressure reducing valves and relief devices shall be furnished by the Division 22 Contractor to limit the pressure at any fixture to a maximum of 80 psig under all system operating conditions.

3.2 PIPE CLEANING AND STERILIZATION

- A. The Subcontractor shall furnish all required pipe cleaning chemicals, chemical feed equipment, materials and labor necessary to sterilize the domestic water piping as herein specified. In addition, the Subcontractor shall permanently install necessary chemical injection fittings complete with stop valves, etc.
- B. Hydrostatic Testing: Hydrostatic testing shall be conducted in accordance with local code requirements or in accordance with the National Standard Plumbing Code. After each hydrostatic leak testing procedure is complete, drain the system until empty. Liquid for hydrostatic testing of domestic water systems shall be clean domestic water. Refer to Section 22 05 93 titled "Testing, Balancing and Adjusting".
- C. All domestic water piping and tanks shall be thoroughly flushed and then treated and sterilized with a liquid chlorine gas and water solution, powdered chlorine and water solution or a direct chlorine gas placed in the upstream side in amounts to give a dosage of 50 PPM chlorine calculated on the volume of water the piping will contain. All chlorine products used shall be EPA registered for use in domestic water systems. A minimum residual of 5 PPM chlorine shall remain in all parts of the system for a minimum of eight (8) hours. After sterilizing, flush all lines thoroughly. The foregoing shall be considered minimum requirements. The

sterilization shall be in strict accordance with the local water department requirements and regulations of the authorities having jurisdiction.

- D. Under no circumstances shall the Subcontractor permit the use of any portion of the domestic water system until it has been properly sterilized and certified same by the local water department or the authorities having jurisdiction. A minimum of twenty-four (24) hours notice shall be given to the Engineer and Owner prior to testing and sterilization.

3.3 FACTORY TESTING

- A. All pipe, valves, fittings and accessories shall be tested in accordance with the latest applicable industry standards.

3.4 QUALIFICATIONS

- A. The Subcontractor utilizing a grooved piping system shall provide a letter of certification to the Engineer and Architect stating that a Project Site training session of at least two (2) hours duration was conducted for this Project by the grooved fitting manufacturer for the Subcontractor's supervisory and installing personnel.

3.5 FIELD TESTING

- A. Refer to Section 22 05 93 for additional testing requirements for domestic water systems.

END OF SECTION