**SECTION 22 1000**

**PLUMBING PIPING**

**PART 1 GENERAL**

1. DESCRIPTION
   1. All work specified in this Section is governed by the Common Work Results for Plumbing Section 22 0500.
   2. This Section 22 1000 and the accompanying drawings cover the provision of all labor, equipment, appliances, and materials and performing all operations in connection with the construction of the plumbing systems as specified herein and as shown. These systems include, but are not limited to, the following:
      1. Sanitary, waste, and vent systems
      2. Domestic water systems
      3. Storm drainage systems
   3. Provide all final plumbing connections to all equipment furnished by Owner.
   4. Provide isolation valve and reduced pressure backflow preventer or vacuum breaker at the service entrance and at those connections (especially to kitchen equipment) required by local plumbing code.
   5. Note: See specification Section 23 1123 for natural gas piping. Natural gas piping shall be part of this Division’s scope unless otherwise coordinated. Coordinate with all trades.
2. INTENT
   1. It is the intent of this Section of the specifications to provide complete and operable plumbing systems as shown and specified which are free of leaks, properly vented, free of unreasonable noise, vibration and sweating, and fabricated so as to fit the space allotted and to exhibit a minimum resistance to fluid flow.
   2. The word "piping" is defined to mean all piping, fittings, joints, hangers, coatings, valves, cocks, insulation and accessories necessary for the plumbing systems described, shown and specified.
3. GENERAL REQUIREMENTS
   1. Provide all reducing fittings, flanges, couplings and unions of the size and type of material to match the piping connections at each fixture, piece of equipment, valve and accessory.
   2. Union joints, couplings or flanges shall be provided in each pipe connected to each piece of equipment, fixture and elsewhere as indicated and specified. Unions shall match the piping system in which they are installed.
   3. Unions or flanges shall be provided between all copper to steel connections. These unions shall be dielectric, insulating type.
   4. All changes in direction and branches shall be made with manufactured fittings.
   5. The use of offset-type reducers is strictly prohibited in any piping system.
   6. In all water piping systems, changes in horizontal pipe sizes shall be made with eccentric reducers installed flat on top for proper air venting. Reducing tees, reducing elbows and concentric reducers shall only be allowed in water piping systems for changing pipe sizes in vertical risers and for making connections to equipment and accessories from vertical risers.
   7. All pipe joints shall be cut square and all burrs shall be removed.
   8. Open ends of pipes not currently being handled shall be plugged during installation to keep dirt, water, and foreign material out of the system.
   9. Sanitary, waste, vent, and storm drainage piping shall slope down in the direction of flow as shown on the drawings or as prescribed by Code, but not less than 1 percent.
   10. All vents through roof (VTRs) shall be offset just below the roof such that their termination points are at least 15 ft from any outside air intake of any HVAC unit; special attention is called to packaged rooftop and dedicated make-up air units.
   11. Trap primers shall be provided at all floor drains, floor sinks, trench drains, and hub drains except trap primers may be omitted where drain routes to the storm system. Route water piping from nearest cold-water line and as allowed by code. Trap primer shall be tapped off the top of the horizontal line, have an isolation valve, and be at least 1’ in elevation above the connection for every 20’ of downstream piping.
   12. All piping, valves, and fittings shall be provided by a domestic Manufacturer and manufactured in the USA.

**PART 2 PRODUCTS**

1. SANITARY WASTE AND VENT SYSTEMS
   1. All underground sanitary waste and vent piping shall be PVC, DWV Solid Wall Schedule 40 with socket-type, solvent welded joints in sizes up to 12"; \*\*14” and larger piping shall be PVC, DWV Solid Wall Schedule 80 with socket-type, solvent welded joints. All PVC piping shall be installed in accordance to ASTM D2321.
   2. All aboveground sanitary, waste, and vent piping shall be PVC except that sanitary, waste and vent piping located within return air plenums, including throughout future tenant space, shall be hubless cast iron soil pipe. Piping shall be DWV Solid Wall Schedule 40 with socket-type, solvent welded joints in sizes up to 12"; \*\*14” and larger piping shall be PVC, DWV Solid Wall Schedule 80 with socket-type, solvent welded joints.
      1. Above ground installation of PVC piping shall be specifically indicated on the shop drawings or submitted in a confirming RFI, as applicable.
      2. Piping aboveground shall match the requirements for the underground piping as above.
      3. Sanitary, waste, and vent piping less than or equal to 2.5” may be copper DWV. Piping shall meet ASTM B 75, B 88, B 251, and B 306.
      4. \*\*PVC shall not be used in buildings with an occupied floor over 75’ above adjacent grade.
      5. Drain piping from equipment, such as kitchen warewashers, pot sinks, etc. with high temperature discharge shall be Type L hard drawn copper tubing with wrought copper fittings and soldered joints.
      6. Sanitary and waste piping in pressurized piping systems, such as for elevator sump pumps or sanitary sump pumps, shall be copper DWV with wrought copper fittings. All joints shall be brazed.
   3. Joints on hubless cast iron soil pipe shall be made with neoprene couplings and stainless-steel clamps. Gaskets shall conform to ASTM C 564. Couplings and gaskets shall be produced by the same manufacturer and shall be installed in accordance with the manufacturer’s recommendations, including band tightening sequence and torque. All couplings shall be manufactured to the CISPI 310 standard, ASTM C 1277, ASTM C 150, FM Standard 1680 Class I, and certified by NSF International (up to 10”). Coupling shall be as follows:
      1. 1 ½” to 4” - Two (2) stainless steel bands
      2. 4” to 10” - Four (4) stainless steel bands
      3. 12” to 15” - Heavy duty coupling with six (6) stainless steel bands. Heavy duty couplings shall conform to ASTM C 1540.
   4. On piping greater than 4”, all offsets, changes of direction, and sizes changes more than two pipe sizes shall have metal restraining straps by Holdrite or approved equal.
   5. Cleanouts shall be provided at the locations indicated and, as a minimum, where required by Code. Floor cleanouts shall be a minimum of 4" and shall be complete with a flush plug and removable, scoriated bronze floor plate. Provide carpet buttons in carpeted areas. Wall cleanouts shall be threaded cleanout tees and plugs with polished stainless steel coverplate with centerset screw.
   6. Traffic Rated\*\* All cleanouts located in areas that are subject to vehicular traffic shall be heavy duty, traffic rated, JR Smith Model 4253, with bronze cover or equal product by Josam or Zurn.
   7. Check valves:
      1. Valves in waste systems above ground, such as elevator sump pump discharges, shall be non-slam type with iron body, globe-type silent checks with bronze trim, stainless steel spring and flanged end connections. Flow area through the valve shall exceed the cross-sectional area of the pipe in which the valve is installed by not less than 10%. Valves shall be Apollo Valves 910F up to 200 psi or 2” and under, 169T up to 600 psi or equal by Mueller Co., APCO, Metraflex Globe Style Silent Check Valve, Hammond IR 9354, or Milwaukee 1800. In grooved piping systems, valves shall be Victaulic 716, 779, or W715 as appropriate.
      2. All check valves on pump discharges shall be non-slam type.
      3. All check valves shall be installed in an orientation allowed by the manufacturer’s recommendations.
      4. All check valves installed in insulated piping systems shall have the check valve location explicitly labeled on the outside of the insulation.
   8. Floor drains in toilets and finished areas shall be JR Smith 2000 Series with 6" Type B square adjustable strainers finished in satin nickel bronze or equal products by Josam or Zurn. Provide vandalproof secured tops.
   9. Floor drains in mechanical rooms and unfinished concrete floors shall be JR Smith 2131 Series with round 11 3/4" cast iron grate, sediment bucket and deep-seal P-trap; or equal products by Josam or Zurn. Provide vandalproof secured tops.
   10. Hub drains (HD) shall be made with a reducer fitting with opening at least one nominal size larger than the connected piping as scheduled. HDs shall be sized to receive all discharges without splashing.
2. STORM PIPING SYSTEMS
   1. Storm piping systems shall be of the same materials specified above in 2.01 for the sanitary, waste and vent systems; note that all aboveground storm piping located within plenums shall be hubless cast iron soil pipe. All cast iron soil pipe and fittings shall bear the collective trademark of the Cast Iron Soil Pipe Institute or receive prior approval by the \*\*Architect.
   2. Joints on hubless cast iron soil pipe shall be made with neoprene couplings and stainless-steel clamps. All couplings shall be manufactured to the CISPI 310 standard, ASTM C 1277, ASTM C 150, FM Standard 1680 Class I and certified by NSF International. Coupling shall be as follows:
      1. 1 ½” to 3” - Two (2) stainless steel bands
      2. 4” to 8” - Four (4) stainless steel bands
      3. 10” to 15” - Heavy duty coupling with six (6) stainless steel bands
   3. On piping greater than 4”, all offsets, changes of direction, and sizes changes more than two pipe sizes shall have metal restraining straps by Holdrite or approved equal.
   4. Wall cleanouts shall be threaded cleanout tees and plugs with polished stainless steel coverplate with centerset screw.
   5. \*\*See sanitary section for any required check valves.
   6. The roof drains shall be selected for the insulated roof decks indicated. The roof drain bodies and receivers shall be of cast iron construction; domes shall be cast iron or aluminum and the roof drains shall be complete with flashing clamps having integral gravel stops, deck clamps, gaskets and trim. Roof drains shall be JR Smith 1010 or 1015 Series or approved equal products as manufactured by Josam, Zurn.
   7. Emergency overflow roof drains shall be similar to the roof drains except they shall be water dam type. JR Smith 1080 or approved equal.
   8. Emergency overflow piping termination shall be lamb’s tongue-type, JR Smith 1770. Finish shall be chrome-plated bronze, subject to approval by the Architect.
   9. Light Duty\* Area drains (AD-1) shall be JR Smith Series 1400 Promenade Deck Drains with square top, seepage holes, clamps and extensions selected for the \*\*roof/deck/paver construction assembly. The top of the drain shall be flush with the top of the paver/deck system except that it may be installed below the paver/deck system if the system has free flow of water into the drain. Coordinate with the paver/deck system.
   10. Planter drains (PD) shall be JR Smith 2680 with perforated standpipe, standpipe cap, and standpipe stainless steel mesh screen for drain sizes up to 3”, and JR Smith 1910 with perforated standpipe, standpipe cap, standpipe stainless steel mesh screen, 9-3/4” secured bronze dome, and dome stainless steel mesh screen above 3” up to 6”. Finishes shall be subject to approval by the Architect. Standpipe height and installation shall be coordinated with the planter design. Drains for overflow shall be similar with solid standpipe.
3. DOMESTIC WATER SYSTEM
   1. Underground domestic water service entrance piping above 3" in size shall be Class 150 ductile iron pipe with mechanical joints.
   2. All underground copper branch lines (1/2" and 3/4" only) shall be continuous lengths of soft Type K copper tubing with no joints allowed underground.
   3. Aboveground domestic water system piping 3" in size and smaller shall be Type L hard drawn copper tubing with wrought copper fittings and soldered joints.
   4. Alternatively, aboveground domestic water system piping 2-3” in size shall be Type L hard drawn copper tubing with grooved mechanical joints. Fittings shall be ASME B16.18 cast copper alloy, ASME B16.22 wrought copper, ASTM B584 bronze sand castings, with nuts and bolts to secure fittings, Victaulic or approved equal. Couplings shall be ductile-iron housing and Grade P fluoroelastomer gasket rated for 0°F to 180°F where available or EPDM gasket where not available, with nuts and bolts; Victaulic Style 607.
   5. Aboveground domestic water system piping 3” in size and smaller shall be as above or Type L hard drawn copper tubing with press-connect fittings with EPDM sealing elements and un-pressed fitting identification feature. Piping 2.5” and 3” shall have stainless steel grip ring, separator ring, and EPDM sealing element.
      1. Fittings shall be by Viega, Victaulic, or Nibco.
      2. Fittings shall be installed with a tool from the Fitting Manufacturer, or a method approved by the Manufacturer.
      3. Fittings and tubes shall be appropriate for installation in a return air plenum.
      4. Fittings shall be ASME B16.18 cast copper alloy, ASME B16.22 wrought copper, ASTM B584 bronze sand castings, with nuts and bolts to secure fittings.
      5. Fittings and tubes shall be rated in accordance with ASME B31, B16.51, ASTM B88, NSF 61/372, and IAPMO PS 117.
   6. Aboveground domestic water piping 4” and larger shall be Type L hard drawn copper tubing with rolled grooved joints and fittings. Installation ready copper fittings shall meet the same gasket material specifications as couplings. Fittings shall be as follows, or equal, and shall be provided by the Manufacturer with the gasket included in the coupler assembly:
      1. Coupling: Rigid, Victaulic style 607 (8” and smaller)
      2. Gaskets: Grade P fluoroelastomer where available, or EPDM where not available (8” and smaller)
   7. Aboveground domestic water piping within residential units shall be chlorinated polyvinyl chloride (CPVC), manufactured from virgin rigid CPVC vinyl compounds with a cell class of 24448 as identified in ASTM D 1784. Fittings shall be manufactured from virgin rigid CPVC vinyl compounds with a cell class of 23447 as identified in ASTM D 1784. CPVC pipe and fittings shall be copper tube size (CTS) and conform to ASTM D 2846. Pipe and fittings shall be manufactured as a system and be the product of one manufacturer. All pipe and fittings shall be manufactured in the United States. Pipe and fittings shall conform to NSF 14 and 61. CPVC piping and fittings in return air plenums shall be ICC certified. When CPVC materials are used, the Construction Team shall be responsible for the compliance with all compatibility issues. CPVC fittings shall be joined in accordance with the listings of the pipe and fittings. Cure times shall be in accordance with manufacturer’s recommendations but not less than 24 hours. CPVC piping shall only be used in system locations that do not exceed its listed maximum pressure and temperature. \*\*CPVC as an alternate must take into account the difference in pressure loss / flowrate as compared to the basis of design copper. The Construction Team shall analyze the piping system and upsize as required. The Construction Team shall submit specific locations where they will upsize piping.
      1. Any piping or fittings that contacts non-compatible materials shall be replaced with new.
      2. Manufacturer’s material compatibility requirements or recommendations shall be posted on CPVC products in not less than 100’ intervals during construction. In addition, manufacturer’s compatibility requirements shall be permanently posted in the fire service entrance, backflow preventer location, and all mechanical and utility rooms or closets as applicable, and at any transition from metal to CPVC piping. Coordinate postings with Owner.
   8. **Price as alternate:** All aboveground domestic water piping within residential units shall be high-density cross-linked polyethylene (PEX-a). Piping shall conform to ASTM F876, ASTM F877, CSA B137.5, NSF/ANSI 14, and NSF/ANSI 61 and be rated for continuous pressure of 100 psi at 180°F. Piping shall have minimum installed bend radius in accordance with manufacturer’s recommendations. Piping shall be co-extruded with UV resistance, rated for a minimum of 3 months. Piping shall be by Rehau, Uponor, or Viega.
      1. Fittings shall be cold-expansion compression-sleeve type
      2. Fittings shall be from the same manufacturer as the piping
      3. All compression sleeves shall be made from PEX-a
      4. Fitting and tube shall have ASTM F876 standard listing and certification
      5. Fitting certifications shall match piping certifications
      6. Supports shall be in accordance with manufacturer’s recommendations
      7. Systems shall not be installed where subject to UV exposure, including from interior lighting
      8. Installers shall attend the Manufacturer’s installation training class and shall include training certificate(s) with the piping material submittal
   9. All valves in potable water systems shall be “lead-free” type.
   10. All valves ¾” and smaller shall be “full-port” type, and greater than ¾” may be “reduced-port” type.
   11. Gate valves (water entrances only) shall be constructed with a gray iron, non-rising stem, outside screw and yoke (OS&Y), full port. Stem to be adjustable graphite packing, ANSI 372 Lead Free, bronze mounted seat rings, solid wedge, back seat protection, with malleable iron handwheels. Valve shall meet MSS-SP70, Apollo Valves 611F or approved equals by Hammond/ Milwaukee, Nibco, or Stockham.
   12. Ball valves:
       1. Valves 2 inch and smaller shall be two-piece bronze body, full port with solid, smooth bore chrome plated brass ball, meeting MSS-SP110 and rated for no less than 300 psi. Seats shall be reinforced TFE with Teflon packing ring and threaded adjustable packing nut. Valves on insulated lines will be provided with stem extensions to provide clearance for two inches of pipe insulation. Valves to be Apollo Valves 77C, Hammond/Milwaukee UP8301, or Watts B-6080, or Victualic 722L (2” only).
       2. Valves larger than 2 inch and up to 4 inch shall be two piece bronze body, standard port with solid, smooth bore chrome plated brass ball, meeting MSS-SP110, and rated for no less than 300 psi. Seats shall be reinforced TFE (or TFM for 4”) with Teflon packing ring and threaded adjustable packing nut. Valves on insulated lines will be provided with stem extensions, except where not available, to provide clearance for two inches of pipe insulation. Valves to be Apollo Valves 70-100, Hammond/Milwaukee UPBA-480B, or Watts LFB6080/81 with accessory stem extension kit.
   13. Balancing valves:
       1. Valves shall be NSF/ANSI 61/372 certified and suitable for potable water applications. Valve shall be suitable for the greater of 125 psig pressure and 40°F to 250°F temperature or the system’s operating conditions. Valve shall provide positive shut-off and be rated for 300 psig. Each balancing valve shall be equipped with two gauge taps with check valves and drip caps. Balancing valves shall be Bell and Gossett Circuit-Setter Plus or equal by Nexus, FlowDesign, Victaulic, or Watts. Provide preformed insulation to encase valve assembly in insulated piping.
       2. Valves up to 3” shall have lead-free brass body, full-port ball constructed of 304 stainless steel, and shall have calibrated nameplate with memory stop. Balancing valves shall be Bell and Gossett Circuit-Setter Plus or equal by Nexus, FlowDesign, Victaulic, or Watts. After the test and balance is complete, provide to the Owner a differential pressure gauge to match the balancing valves. Autoflow valves are acceptable as a substitution provided the flow cartridge is replaceable and the flowrate is clearly and permanently labeled.
       3. In grooved piping systems, balancing valves may be lead-free brass body, full-port ball constructed of 304 stainless steel, and shall have calibrated nameplate with memory stop; Victaulic 790, 76X, and 78BL. After the test and balance is complete, provide to the Owner a differential pressure gauge to match the balancing valves. Autoflow valves are acceptable as a substitution provided the flow cartridge is replaceable and the flowrate is clearly and permanently labeled.
   14. Check valves:
       1. Valves in water systems shall be NSF/ANSI 61/372 certified and suitable for potable water applications. Valve shall be swing-type, bronze body, brass seat, Apollo Valves 161S-LF up to 200 psi CWP, or equal by Milwaukee UP968 or Hammond.
       2. All check valves on pump discharges shall be non-slam type.
       3. All check valves shall be installed in an orientation allowed by the manufacturer’s recommendations.
       4. All check valves installed in insulated piping systems shall have the check valve location explicitly labeled on the outside of the insulation.
   15. Non-freeze wall hydrants (NFWH) shall be non-freeze, bronze box type with vacuum breaker, loose key and wall clamp. Finish shall be rough bronze subject to approval by the Architect. Wall hydrants shall be JR Smith 5509QT or approved equal by Josam, Watts, or Zurn.
   16. Non-freeze roof hydrants (NFRH) shall be non-freeze, epoxy-coated cast iron or galvanized housing with bronze head, key-operated, integral vacuum breaker or dual-check backflow preventer in water service, and loose key. Vacuum breaker shall not prevent post drainage if used. Post hydrants shall be complete with deck flange and under deck clamp as required by installation location. Post hydrants shall be JR Smith 5906 or approved equal by Josam, Watts, or Zurn. Hydrant drain port shall be indirectly discharged to a drain line or janitor’s sink.
   17. Backflow preventer at water service entrance shall be Watts Series LF009 or LF909 reduced pressure zone (RPZ) principle backflow preventer complete with strainer and shut-off valves. RPZ air gap drain shall be sized for the larger of the manufacturer’s recommendation or the requirements of the AHJ and shall be piped outside of building to a concrete splashblock unless otherwise indicated.
   18. Water connections to appliances shall be made with flexible copper tubing or commercial grade double-reinforced stainless steel braided hose, no less than 3/8” in size, or the connections size of the appliance, whichever is greater.
   19. Water pressure reducing valves (PRV) shall be the self-contained direct operating type with brass or iron body, stainless steel seat, stainless steel spring, and sealed spring cage. The strainer shall have bronze body with 20 mesh stainless steel screen. Strainer shall be attached with a bronze nipple. The unit shall be constructed in accordance with ASSE 1003 and shall bear the seal of approval. The capacities shall be based on maximum reduced pressure fall-off, as defined in ASSE 1003, of 10 psi. Pressure regulators shall be Watts Regulator LF223S or Watts Regulator LF115 (for setpoints indicated outside 25-75 psi), or approved equal. PRV shall be appropriate for the discharge pressure as noted on the plans. Confirm with product pressure ranges.
       1. \*\*Victaulic PRV Station: Factory assembled pressure reducing valve (PRV) station, Style 386 A-E, as selected for the specific project by the Manufacturer. The installed station shall meet all requirements of the installation detail, including if accessories outside the station are required.
   20. Central mixing valves shall be Leonard Model No. TM-186 Series, High-Low Thermostatic Mixing Valve Assembly, or an approved equal, with the piping arranged in accordance with manufacturer’s recommendations based on recirculating flowrate. Mixing valve shall be sized by the Manufacturer for the fixture(s) served. Secure the assembly to the adjacent wall. Mixing valve assemblies in public or employee spaces, such as in kitchens, shall be provided with lockable enclosure.
   21. Water heater mixing valve shall be sized by the Manufacturer for the fixture(s) served but shall be no less capacity than Leonard 210-LF or an approved equal with lead-free construction, vandal resistant adjustment cap, and integral inlet check valves. Special attention is called to minimum fixture hot water flow.
   22. Point of use mixing valves shall be Leonard 170-LF or an approved equal with lead-free construction, vandal resistant adjustment cap, and integral inlet check valves. Mixing valve shall be ASSE 1070 rated. Mixing valve shall be sized by the Manufacturer for the fixture(s) served. Mixing valve shall have no more than 0.25 gpm minimum flowrate required.
   23. All water hammer arresters (WHA) shall be size A, B, C, D, E or F, as required for the fixture units served; Josam, JR Smith, Watts, or Zurn. WHAs shall conform to ASSE 1010. WHAs in potable water applications shall be lead-free.
   24. The hose bibbs (HB) shall be complete with vacuum breaker and **vandal resistant** handle; Watts, Apollo Valves, JR Smith, or Zurn.
   25. Soldered joints shall be made with tin-antimony/silver solder. Solder containing lead shall not be permitted.
   26. Saddle valves and “T” fittings that rely on puncturing the piping main are disallowed.
   27. Thermometers and pressure gauges shall be products of Trerice, Weksler, or Weiss. Select all devices to operate within 20% of the midpoint of their scales under normal operating conditions. Gauges provided on pumps shall be compound type.
   28. Pressure and temperature (P&T) test plugs shall be constructed of brass with two (2) self-closing Nordel cores and be complete with cap and gasket. Plugs shall be as manufactured by Peterson or Lancaster. Provide a complete test kit to the Owner at the time of final inspection. Test kit shall be complete with pressure gauge, thermometer, probes and carrying case.

**PART 3 EXECUTION**

1. ARRANGEMENT
   1. Follow the general piping layout, arrangement, schematics and details. Provide all offsets, vents, drains and connections necessary to accomplish the installation. Fabricate piping accurately to measurements established at the project site to avoid interference with ductwork, other piping, equipment, openings, electrical conduits and light fixtures. Make suitable provision for expansion and contraction with expansion loops and offsets.
   2. Water hammer arresters shall be installed at the top of each riser and on each fixture branch in accordance with Plumbing and Drainage Institute Standard WH201. WHAs shall also be installed at all water service to appliances with quick-closing valves, such as clothes washers, kitchen warewashers, icemakers, water fountains with electronic valves, etc.
   3. Cleanouts shall be provided at the base of all sanitary and storm risers and as required by code.
   4. Fittings, unions, joints, couplings (including no-hub couplings), etc. shall not be within slabs.
   5. All potable domestic water connections to equipment shall be provided with backflow prevention as required by the specification section and code.
   6. Pressure gauges and thermometers called to be permanently installed shall be easily visible from a standing position on the ground.
   7. All proposed material and equipment shall be listed according to Landmark’s Construction Appendix A – Product Selection.
2. UNDERGROUND WATER PIPING
   1. All domestic water piping shall have a minimum cover of 3'-0", or below the frost line, whichever is deeper, except piping at least 20’ from any exterior wall may be installed 3” or more below the bottom of the slab.
   2. For water piping 2” and above, provide concrete thrust blocks at all changes of direction and secure all mechanical joints with restraining rods.
   3. All copper water lines, or other material subject to corrosion, shall be protected from corrosion with a continuous plastic sheathing or coating and wrapping. This sheathing or coating and wrapping shall be extended 6" to 12" above finished floor. The protection shall be installed on the outside of any insulation required.
3. PIPE GROOVING AND INSPECTION
   1. Grooved Pipe Joint Construction: Square cut pipe ends and roll groove ends of pipe in accordance to manufacturer’s specifications. Gaskets shall be verified as suitable for the intended service and shall be coated on the lips with a thin uniform coat of lubricant in accordance with the manufacturer's published instructions. Any coupling requiring a special lubricant to meet the temperatiure or pressure performance requirements will not be accepted. For installation-ready coupling, housing shall engage both grooves, otherwise the housing shall be assembled over the gasket and shall engage both grooves. The nuts shall be uniformly tightened until the housing pads are firmly together, metal to metal allowing visual inspection, or until properly tightened per manufacturer’s specifications and instructions. Any coupling requiring a specic torque requirement for installation must be visually tagged by the installing contractor in the field to ensure proprt torque has been achieved. A factory trained Representative shall provide on-site training for Contractor's field personnel in the use of grooving tools and installation of grooved joint products. The Representative shall periodically visit the jobsite and ensure Contractor is following best recommended practices in grooved product installation including visual inspection of installation. (A Distributor's Representative is not considered qualified to conduct the training or jobsite visit(s).) To assure uniformity and compatibility of piping components in grooved end piping systems, all grooved products and grooving tools utilized shall be supplied by a single Manufacturer with smart tools recommended. Groove depths shall be measured using a Victaulic Go-No-Go tape or 5200i tool to verify compliance with groove specifications.
4. PIPING INSTALLATION ABOVE CEILINGS
   1. All domestic hot and cold-water piping installed above the insulated ceilings shall be installed just above (within 2") of the top of the finished ceiling with the building insulation over the piping to avoid freeze-up.
5. DISINFECTION
   1. All domestic water piping installed under this Division shall be disinfected with chlorine before it is placed into operation. The chlorinating material shall be liquid chlorine conforming to Federal Specification BB-C-120 and shall be introduced to the system by experienced Operators only. The chlorine solution applied to the piping sections or system shall contain at least fifty (50) parts per million of available chlorine and shall remain in the sections or system for a period of not less than twenty-four (24) hours. Alternatively, the system may be disinfected with 200 parts per million of available chlorine and shall remain in the sections or system for a period of not less than three (3) hours. During the disinfection period, all valves shall be opened and closed at least four times. After the disinfection period, the chlorinated water shall be flushed from the system with clear water and the valves operated at least twice until the residual chlorine content is not greater than two-tenths parts per million (0.2 PPM). Submit certification to the Architect that the system was disinfected.

**END OF SECTION**