SECTION 22 10 00 – plumbing piping

1. GENERAL
	* + 1. RELATED DOCUMENTS
				1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
				2. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.
			2. SUMMARY
				1. Provide materials and installation for complete first class plumbing systems, within and to five feet beyond building perimeter unless noted otherwise on Contract Drawings; Sanitary Waste and Vent Piping, Storm Drain Piping, Domestic Water Piping, Domestic Water Valves, Testing and other normal parts that make the systems operable, code compliant and acceptable to the authorities having jurisdiction.
			3. REFERENCE STANDARDS
				1. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
				2. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
				3. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

2009 Edition of the International Plumbing Code.

NOTE: BJC HEALTHCARE takes various exceptions to the International Plumbing Code and has adopted the more stringent requirements within the Uniform Plumbing Code. These exceptions are included within Project Specifications and/or Project Design Drawings.

ANSI/NSF Standard 61 - Drinking Water System Components - Health Effects.

* + - 1. QUALITY ASSURANCE
				1. Manufacturer’s name and pressure rating shall be permanently marked on valve body.
				2. The Contractor shall notify the manufacturer's representative prior to installing any copper press fittings. The Contractor shall obtain the representative’s guidance in any unfamiliar installation procedures. The manufacturer's representative of copper press fittings shall conduct periodic inspections of the installation and shall report in writing to the Contractor and Owner of any observed deviations from manufacturer’s recommended installation practices.
				3. Manufacturer Qualifications: Company shall have minimum three years documented experience specializing in manufacturing the products specified in this section.
				4. Installer Qualifications:

Company shall have minimum three years documented experience specializing in performing the work of this section.

Installation of plumbing systems shall be performed by individuals licensed by the AHJ as a Journeyman or Master Plumber. Installation may be performed by Apprentice Plumbers provided they are registered with the AHJ examiners and under direct supervision of a licensed plumber. All installation shall be supervised by a licensed Master Plumber.

All installers of copper press fittings shall be trained by the fitting manufacturer's appointed representative. Written notification of training shall be submitted to Owner prior to any installation.

* + - 1. SUBMITTALS
				1. Product Data:

Code and Standards compliance, manufacturer's data for pipe, fittings, valves and all other products included within this specification section.

Manufacturer’s installation instructions.

* + - * 1. Record Documents:

Record actual locations of valves, etc. and prepare valve charts.

Test reports and inspection certification for all systems listed herein.

Provide a certificate of completion detailing the domestic water system chlorination procedure and all laboratory test results.

Submit proposed location of access panels which vary from quantities or locations indicated on Contract Drawings.

Provide full written description of manufacturer’s warranty.

* + - * 1. Operation and Maintenance Data:

Include components of system, servicing requirements, Record Drawings, inspection data, installation instructions, exploded assembly views, replacement part numbers and availability, location and contact numbers of service depot.

* + - 1. DELIVERY, STORAGE and HANDLING
				1. All materials shall be new, undamaged, and free of rust.
				2. Accept valves on Site in shipping containers and maintain in place until installation.
				3. Provide temporary protective coating and end plugs on valves not packaged within containers. Maintain in place until installation.
				4. Provide temporary end caps and closures on pipe and fittings. Maintain in place until installation.
				5. Protect installed piping, valves and associated materials during progression of the construction period to avoid clogging with dirt, and debris and to prevent damage, rust, etc. Remove dirt and debris and repair materials as work progresses and isolate parts of completed system from uncompleted parts.
				6. Protect all materials that are to be installed within this project from exposure to rain, freezing temperatures and direct sunlight. EXCEPTION: Materials manufactured for exterior locations.
			2. EXTRA MATERIALS
				1. Provide the Owner with one differential pressure meter kit for use with domestic hot water return circuit balancing valves installed within this project. Kit shall include meter, hoses, connection accessories, circular slide rule, carrying case and valve manufacturer’s curve charts. **(Remove if project site currently equipped with instrumentation)**
1. PRODUCTS
	* + 1. GENERAL
				1. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
				2. Provide materials as specified herein and indicated on Contract Drawings. All materials and work shall meet or exceed all applicable Federal and State requirements and conform to adopted codes and ordinances of authorities having jurisdiction.
				3. Pressure ratings of pipe, fittings, couplings, valves, and all other appurtenances shall be suitable for the anticipated system pressures in which they are installed.
			2. SANITARY WASTE AND VENT AND STORM DRAINAGE PIPING
				1. Service weight cast iron soil pipe and fittings with hubless connections using clamp type gasketed mechanical fasteners above ground and hub and spigot DWV pipe and fittings with neoprene compression gasket joints for all buried pipe. Cast iron soil pipe, fittings and hub gaskets shall be manufactured by Tyler Pipe or Charlotte Pipe and Foundry. All cast iron pipe and fittings shall be of the same manufacturer.
				2. Secondary (emergency overflow) roof drain piping shall be internally lined with 1/8” thick epoxy for corrosion protection. Lining shall comply with NSF/ANSI Standard 61, ANSI/AWWA Standard C210-97 and International Association of Plumbing and Mechanical Officials. EXCEPTION: Secondary roof drain piping that discharges at grade level does not require internal epoxy lining.
				3. Unburied storm drainage and sanitary waste and vent piping for sizes 4” and smaller may be seamless copper DWV tube with wrought copper or wrought copper alloy solder joint drainage pattern DWV fittings.
				4. Indirect waste piping sizes 1-1/4” through 2” serving fixtures and equipment shall be seamless copper DWV tube with wrought copper or wrought copper alloy solder joint drainage pattern DWV fittings.
				5. Indirect waste piping sizes 1” and smaller serving equipment shall be type "L" hard drawn copper pipe and wrought copper or cast copper alloy solder joint fittings using lead-free solder and non-corrosive flux. Elbows shall be long radius type. Tee fittings shall be combination wye with 45 degree elbow.
				6. Cast iron soil pipe compression gaskets shall be monolithically molded from an elastomer meeting ASTM C 564 and shall be of same manufacturer as pipe and fittings.
				7. Clamps for joining hubless cast iron pipe and fittings sizes 10” and smaller shall meet the performance criteria of FM 1680, have 28 gauge type 304 stainless steel jacket, minimum .094 inch thick ASTM C 564 neoprene gasket and type 305 stainless steel band screws designed to be installed with a pre-set torque wrench calibrated at 80 inch pounds. Couplings shall be manufactured by Clamp-All, Inc. HI-TORQ 80 or Husky, Inc., Orangeshield HD 4000.
				8. Clamps for joining hubless cast iron pipe and fittings sizes 12” and 15” shall meet the performance criteria of FM 1680, have 24 gauge type 304 stainless steel jacket, minimum .100 inch thick ASTM C 564 neoprene gasket and type 305 stainless steel band screws designed to be installed with a pre-set torque wrench calibrated at 125 inch pounds. Couplings shall be manufactured by Clamp-All, Inc. HI-TORQ 125.
				9. Hubless piping systems shall not be used in a directly buried, underground application. EXCEPTION: No-hub type fittings with clamp type coupling joints may be used below ground for pipe sizes up to 10” at connections to existing cast iron sewers provided couplings are cast iron with stainless steel bolts as manufactured by MG Piping Products.
				10. Solder for copper piping shall be lead-free Tin/Copper/Silver/Nickle(optional) solder conforming to ASTM B32, Wolverine Silvabrite 100 Lead-Free Solder or Harris Nick Lead-Free Solder. Use water soluble flux recommended by solder manufacturer and conforming to ASTM B813 and NSF 61, Wolverine Silvabrite 100 Water Soluable Flux or Bridgit Water Soluble Paste Flux.
				11. Lubricant for drainage cleanout plugs shall be Loctite Marine Grade Anti-Seize or approved equal by Bostik Chemical Group, or Dow Corning Corporation.
				12. Double sanitary tee fittings shall not be used as a drainage fitting.
				13. Provide IAPMO figure one, IAPMO figure five or double wye and eighth bend fittings on vertical lines serving back-to-back fixture drains.
				14. Double wye and eighth bend fittings shall not be installed in horizontal drain lines.
				15. All P-traps for floor drains, floor sinks and hub drains shall be deep-seal type.
				16. Provide threaded brass or copper adapters to connect fixture supply stops and waste to service piping within walls. Galvanized nipples shall not be acceptable. Provide DWV copper trap adapters to connect lavatory, sink and drinking fountain trap outlets to sanitary system.
				17. Provide 6” accessible cleanout above all fixtures.
			3. DOMESTIC WATER PIPING (Including Cold, Hot & Softened Water)
				1. All materials within domestic water distribution systems that may come in contact with the potable water delivered shall comply with ANSI/NSF Standard 61.
				2. All brass and bronze piping materials within domestic water distribution systems that may come in contact with the potable water delivered shall have no more than 15% zinc content.
				3. Unburied piping shall be type "L" hard drawn copper pipe and wrought copper or cast copper alloy solder joint fittings using lead-free solder and non-corrosive flux. Piping sizes 2-1/2” and larger may be type “L” hard drawn copper and wrought copper or cast copper alloy roll groove fittings utilizing no-sweat coupling and flange adapter assemblies as manufactured by Victaulic or Anvil.
				4. Unburied piping sizes ½” through 2" installed within occupied buildings for modifying systems having an operating pressure that will not exceed 200 p.s.i.g. may utilize copper press fittings manufactured by NIBCO, Elkhart or Viega conforming to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM. Copper press fittings shall be rated at 200 psi working pressure and 250 degree working temperature. All copper press fittings, couplings and specialties shall be the products of a single manufacturer. Installation tools shall be as recommended by the fittings manufacturer.
				5. Solder for copper piping shall be lead-free Tin/Copper/Silver/Nickle(optional) solder conforming to ASTM B32, Wolverine Silvabrite 100 Lead-Free Solder or Harris Nick Lead-Free Solder. Use water soluble flux recommended by solder manufacturer and conforming to ASTM B813 and NSF 61, Wolverine Silvabrite 100 Water Soluable Flux or Bridgit Water Soluble Paste Flux.
				6. Buried domestic water service entrance piping 4” and larger shall be cement mortar lined Class 53 ductile iron pipe and 350 psi working pressure ductile iron fittings using mechanical joints. All buried ductile iron pipe and fittings shall be encased in polyethylene per ANSI/AWWA Standard C105/A21.5, Method A. Minimum thickness of polyethylene shall be 8 mil.
				7. Buried pressurized piping sizes 1” and smaller shall be type “K” soft copper. No joints shall be allowed below slab. Encase piping within ½” thick un-slit flexible tube type elastomeric thermal insulation up to 1” above slab at both ends. Insulation shall be AP/Armaflex or Rubatex Insul-Tube 180.
				8. Unburied trap primer piping shall be same as specified for domestic water except all elbows shall be long radius type.
				9. Buried trap primer piping shall be type “K” soft copper. No joints shall be allowed below slab except at connection to drain. Encase piping within ½” thick un-slit flexible tube type elastomeric thermal insulation up 1” above slab. Insulation shall be AP/Armaflex or Rubatex Insul-Tube 180.
				10. Dielectric waterway fittings shall have zinc electroplated steel pipe body with high temperature stabilized polyolefin polymer liner; manufactured by Victaulic, Style 47 or PPP, Inc. Series 19000.
				11. Dielectric unions shall be rated at 250 psi, ground-joint type with inert, non-corrosive thermoplastic sleeve. End connection materials shall be compatible with respective piping materials; manufactured by EPCO Sales, Inc or Watts. Provide models to suit applicable transitions.
				12. Dielectric flanges shall be rated at 175 psi, have nylon bolt isolators and dielectric gasket. Materials shall be compatible with respective piping materials; manufactured by EPCO Sales, Inc or Watts. Provide models to suit applicable transitions.
				13. Pipe joint compound shall be lead-free, non-toxic, non-hardening and compliant with ANSI/NSF 61 and Federal Specification TT-S-1732. Temperature service range of -15ºF to +400ºF, manufactured by Hercules “MegaLoc” or approved equal by Rectorseal, La-Co or Oatey.
				14. All exterior water piping sizes 2” and smaller installed above grade shall be provided with electric heat in the form of 120 volt, single phased tape rated at 5 watts per lineal foot at 50°F. Heat tracing shall be manufactured for freeze protection service and be self-regulating to energize at 50°F. Provide an accessible temperature sensing thermostat between electrical power supply and connections to heat tracing to prevent power from activating tracing unless outside ambient temperature is at or below 40°F. This Contractor shall coordinate with the electrical Contractor to provide electrical power supply and connection. Heat tracing shall be by Raychem XL-TRACE or Thermon FLX. Thermostats shall be Raychem AMC-F5 or Thermon N4X-40.
			4. DOMESTIC WATER VALVES: (Including Cold, Hot & Softened Water)
				1. All materials within domestic water distribution systems that may come in contact with the potable water delivered shall comply with ANSI/NSF Standard 61.
				2. All brass and bronze valve materials within domestic water distribution systems that may come in contact with the potable water delivered shall have no more than 15% zinc content.
				3. Similar types of valves shall be the product of one manufacturer; i.e., all butterfly valves shall be of the same manufacturer, all ball valves shall be of the same manufacturer, etc. EXCEPTION: 2-1/2” & 3” ball valves may be by a different manufacturer than 2” and smaller ball valves.
				4. Line Shut-Off Valves up to and including 2” shall be two-piece bronze body of ASTM B584 Alloy 844, ASTM B61, or ASTM B62, full port ball type rated at 600 WOG with threaded connections, blow-out proof stem, plastic coated lockable lever handle, Teflon packing, 316 stainless steel ball and stem. Acceptable valves are NIBCO Model T-585-70-66-LL, or approved equivalent model by Crane, Milwaukee or Apollo.
				5. Line Shut-Off Valves sizes 2-1/2” and 3” shall be full port ball type rated at 400 WOG with threaded connections, two-piece bronze body ASTM B584 with 316 stainless steel ball and stem, plastic coated lockable lever handle, blow out proof stem and reinforced Teflon seats. Acceptable valves are Kitz Model 68PM, or approved equivalent model by Crane, NIBCO, Milwaukee or Apollo.
				6. Line Shut-Off Valves 4” and larger where system operating pressure will not exceed 160 p.s.i.g. shall be 200 WOG threaded lug type ductile iron body butterfly valve with extended neck, lockable lever handle, 416 stainless steel stem, aluminum bronze disc or stainless steel disc, EPDM liner and seal, suitable for bi-directional flow and dead end service with downstream flange removed. Acceptable valves are NIBCO Model LD-2000, or approved equivalent model by Keystone, Jamesbury, Milwaukee, Crane or Apollo.
				7. Line Shut-Off Valves 4” and larger installed within systems having design operating pressures between 160 and 250 p.s.i.g. shall be threaded lug type ductile iron body butterfly valve with extended neck, lockable lever handle, 316 stainless steel stem and disc, EPDM liner and seal, suitable for bi-directional flow and dead end service with downstream flange removed. Acceptable valves are NIBCO Model LD-3022, or approved equivalent model by Keystone, Jamesbury, Dezurik, Milwaukee, Crane or Apollo.
				8. Line Shut-Off Valves 4” and larger installed in roll grooved copper systems may be 300 psi roll grooved end type bronze body butterfly valve with lockable lever handle, bronze trim, EPDM coated disc, suitable for bi-directional flow and dead end service. Manufactured by Victaulic Model V-*size*-3-6-2-2-11.
				9. Provide stem extensions of a non-thermal conducting material for valves in insulated lines to allow unobstructed operation.
				10. Provide memory stops on all ball valves installed in domestic hot water return lines. Memory stops shall be adjustable after pipe insulation is applied.
				11. Provide line shut-off valves that have the same inside diameter of the upstream pipe in which they are installed.
				12. Domestic Hot Water Return Circuit Balancing Valves 1/2" through 2" shall be ‘Y or T’ pattern with threaded inlet and outlet connections, equal percentage globe-style and provide precise flow measurement, precision flow balancing and positive drip-tight shut-off. Valves shall provide multi-turn, 360° adjustment with micrometer type indicators located on the valve handwheel. Valves shall have a minimum of five full 360° handwheel turns. 90° ‘circuit-setter’ style ball valves are not acceptable. Valve handle shall have hidden memory feature to provide a means for locking the valve position after the system is balanced. Valves shall be furnished with precision machined venturi built into the valve body to provide highly accurate flow measurement and flow balancing. The venturi shall have two, 1/4" threaded brass metering ports with check valves and gasketed caps located on the inlet side of the valve. Valves shall be furnished with flow smoothing fins downstream of the valve seat and integral to the forged valve body to make the flow more laminar. The valve body, stem and plug shall be brass. The handwheel shall be high-strength resin. Provide valves as scheduled on Contract Drawings manufactured by Armstrong Model CBV-VT or NIBCO T-1710 and F737-A. Furnish each valve complete with optional pre-formed 25/50 fire/smoke rated insulation.
				13. Swing Check Valves, 2" and smaller - “Y” or “T” pattern bronze, Class 150, with threaded connections and screw‑in cap. Manufactured by NIBCO Model T-433-Y or approved equivalent model by Milwaukee or Crane.
				14. Spring Loaded Check Valves, 2" and smaller - Silent closing, bronze, Class 125, with threaded connections, Buna disc, bronze or stainless steel spring. Manufactured by NIBCO Model T-480 or approved equivalent model by Milwaukee or Crane.
				15. Swing Check Valves, 2-1/2" and larger - 200 pound CWP, Iron body, with bronze or stainless steel trim. Manufactured by NIBCO Model F-918-B or approved equivalent model by Milwaukee or Crane.
				16. Swing Check Valves, 2-1/2" and larger - 285 pound CWP, Iron body, with stainless steel trim. Manufactured by NIBCO Model F-938-33 or approved equivalent model by Milwaukee or Crane.
				17. Spring Loaded Check Valves, 2-1/2" and larger - 200 pound CWP, Iron body, with bronze or stainless steel trim. Manufactured by NIBCO Model F-910 or approved equivalent model by Milwaukee or Crane.
				18. Spring Loaded Check Valves, 2-1/2" and larger - 400 pound CWP, Iron body, with bronze or stainless steel trim. Manufactured by NIBCO Model F-960 or approved equivalent model by Milwaukee or Crane.
			5. DIFFERENTIAL PRESSURE METER: (For Domestic Hot Water Circuit Balancing Valves)
				1. Meter shall be equipped with one 4-1/2” round dial gauge, 0-135” pressure differential, one 4-1/2” round dial gauge, 0-60’ pressure differential, 300 psig maximum working pressure, two five foot hoses with PMP connections and carrying case. Meter and accessories shall be manufactured by Armstrong Model CBDM-135/60 or NIBCO 1022.
2. EXECUTION
	* + 1. Examination
				1. Verify that excavations are to required grade, dry and not over-excavated. Do not install underground piping when bedding is wet or frozen.
				2. Before commencing work, check final grade and pipe invert elevations required for drain terminations and connections to ensure proper slope.
			2. PREPARATION
				1. Ream pipes and tubes. Remove burrs, scale and dirt, inside and outside, before assembly. Remove foreign material from piping.
				2. Prepare piping connections to equipment with flanges or unions.
			3. INSTALLATION
				1. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
				2. All installation shall be in accordance with manufacturer’s published recommendations.
				3. General

Care shall be exercised to avoid all cross connections and to construct the plumbing systems in a manner which eliminates the possibility of water contamination.

Install all materials and products in accordance with manufacturer’s published recommendations. Use tools manufactured for the installation of the specific material or product.

Heat generated by soldering procedures shall not be transmitted to valves, copper alloy roll groove fittings, copper press fittings, no-hub clamps, or any other components installed within the piping system that may be damaged due to high temperatures. Contractor shall take all precautions necessary, including utilizing wet wrapping or allowing heated piping to cool to ambient temperature before attachment.

Pipe joints, no-hub clamps, flanges, unions, etc., shall not directly contact or be encased in concrete, or be located within wall, floor or roof penetrations.

Route piping in direct orderly manner and maintain proper grades. Installation shall conserve headroom and interfere as little as possible with use of spaces. Route exposed piping parallel to walls. Group piping whenever practical at common elevations.

Install piping to allow for expansion and Contraction without stressing pipe, joints or connected equipment.

Furnish all supports required by the piping included in this specification section.

Penetrations through fire rated walls, floors and partitions shall be sealed to provide a U.L. rating equal to or greater than the wall, floor or partition.

Seal all penetrations through floors, exterior building walls and grade beams air and water tight.

Each plumbing pipe projecting through roof shall be installed in accordance with Contract Specifications and Drawings. Penetrations shall be sealed air and water tight and in compliance with any new and/or existing roof warranty requirements. Refer to details on Contract Drawings and coordinate with General Contractor for flashing requirements.

Furnish and install all necessary valves, traps, gauges, strainers, unions, etc. for each piece of equipment (including Owner furnished equipment) having plumbing connections, to facilitate proper functioning, servicing and compliance with code.

Provide code-approved transition adapters when joining dissimilar piping materials. Adaptors installed shall be manufactured specifically for the particular transition.

All piping shall have reducing fittings used for reducing or increasing where any change in the pipe sizes occurs. No bushing of any nature shall be allowed in piping.

Close nipples shall not be installed in plumbing piping systems.

Bury outside water and drainage pipe minimum one foot below recorded frost depth.

Buried piping shall be supported throughout its entire length.

All excavation required for plumbing work is the responsibility of the plumbing Contractor and shall be done in accordance with Contract Documents.

Piping shall be insulated in accordance with Contract Documents.

Provide clearance for installation of insulation and for access to valves, air vents, drains, unions, etc.

Provide dielectric isolation device where non-ferrous components connect to ferrous components. Devices shall be dielectric union, coupling or dielectric flange fitting.

All piping shall be isolated from building structures, including partition studs, to prevent transmission of vibration and noise.

Isolate all bare copper pipe from ferrous building materials. “Tape is not an acceptable isolator.

* + - * 1. Drainage and Vent Systems

Slope drainage lines uniformly at 1/4" per foot, for lines 3" and less, and 1/8" per foot for larger lines, unless noted otherwise on Contract Drawings. Maintain gradients through each joint of pipe and throughout system.

Buried pipe shall be laid on a smoothly graded, prepared subgrade soil foundation true to alignment and uniformly graded. Bell holes shall be hand-excavated so that the bottom of the pipe is in continuous contact with the surface of the prepared subgrade material. Piping invert shall form a true and straight line.

The size of drainage piping shall not be reduced in size in the direction of flow. Drainage and vent piping shall conform to the sizes indicated on the Contract Drawings. Waste lines from water closets shall not be smaller than four inches. Under no circumstances shall any drain or vent line below slab be smaller than two inches.

Unburied horizontal cast iron soil piping shall be supported at least at every other joint except that when the developed length between supports exceeds four feet, they shall be provided at each joint. Supports shall also be provided at each horizontal branch connection and at the base of each vertical rise. Supports shall be placed immediately adjacent to the joint. Suspended lines shall be braced to prevent horizontal movement. Unburied vertical cast iron soil piping rising through more than one floor level shall be supported with riser clamps at each floor level.

Install couplings for hubless pipe and fittings in accordance with manufacturer's published recommendations. Use pre-set torque wrench and tighten band screws to 80 inch pounds minimum or as required by manufacturer’s published instructions.

All unburied change of direction fittings within the roof drainage system shall be braced against thrust loads that might result in joint separation due to dynamic forces caused by sudden, heavy rainfall conditions. Bracing shall incorporate galvanized steel pipe clamps and tie rods.

Provide cleanouts within sanitary waste systems at locations and with clearances as required by the code, at the base of each waste stack and at intervals not exceeding 75 feet in horizontal runs.

Provide cleanouts at the base of each vertical downspout and at intervals not exceeding 75 feet in horizontal building storm drain. Provide clearances as required by code. Horizontal roof drain piping located above building ground floor level will not require cleanouts.

A removable sink or lavatory p-trap with cleanout plug shall be considered as an approved cleanout for 2” diameter pipe.

All interior cleanouts shall be accessible from walls or floors. Provide wall cleanouts in lieu of floor cleanouts wherever possible. A floor cleanout shall be installed only where installation of a wall cleanout is not practical.

Provide a wall cleanout for each water closet or battery of water closets. Locate wall cleanouts above the flood level rim of the highest water closet but no more than twenty four inches above the finished floor.

Coordinate the location of all cleanouts with the architectural features of the building and obtain approval of locations from the Project Architect.

Lubricate cleanout plugs with anti-seize lubricant before installation. Prior to final completion, remove cleanout plugs, re-lubricate and reinstall using only enough force to provide a water and gas tight seal.

Install trap primer supply to floor drains, hub drains and floor sinks that are susceptible to trap seal evaporation and where indicated on Project Drawings. Primer unit installation shall comply with manufacturer's published recommendations. Trap primer lines shall slope to drain at a minimum ¼” per foot.

Capped waste and vent connections for future extensions shall be located accessibly and not extend more than 24” from active main. Waste connections and vent connections shall be located at elevations that will allow future installation of properly sloped piping without the need to dismantle or relocate installed ductwork, piping, conduit, light fixtures, etc.

Unless indicated otherwise within Contract Documents, all sanitary vent pipes passing through the roof shall be provided with lead roof flashings constructed of 2-1/2 pound sheet lead with bases extending no less than ten inches on each side of the pipe. The vertical portion of the flashing shall extend upward the entire length of pipe and be turned tightly inside the pipe at least two inches and shall not reduce the inside diameter of vent pipe more than the thickness of the flashing. Lead flashings shall be furnished by Plumbing Contractor and turned over to Roofing Contractor for installation.

Locate all sanitary vent terminals a minimum of 25 feet horizontally from or 3 feet vertically above all air intakes, operable windows, doors and any other building openings.

Wastewater when discharged into the building drainage system shall be at a temperature not higher than 140°F. When higher temperatures exist, approved cooling methods shall be provided.

* + - * 1. Domestic Water System

On each water supply line serving a plumbing fixture, item of equipment, or other device which has a water supply discharge outlet below the overflow rim, or where cross contamination may occur, provide and install an approved vacuum breaker or backflow preventer. Installation of vacuum breakers shall prevent any possible backflow through them.

Provide thrust blocking and clamps for mechanical joint or gasketed underground water pipe at fittings with 3/4" rods, and properly anchor and support. Restraining rods, clamps and hardware shall be thoroughly coated with bituminous material to prevent corrosion.

Copper piping shall be supported at no greater than six foot intervals for piping 1-1/2" and smaller and ten foot intervals for piping 2" and larger in diameter.

Install all water piping to allow all piping within the system to be drained at low points.

Air chambers, dead-legs, or any other piping arrangement that may allow water to stagnate shall not be installed within domestic water systems. Valves installed for future connections shall not extend more than 24” from an active main.

Provide manufactured water hammer arrestors in water supply lines as indicated on Contract Drawings and in accordance with Standard PDI-WH201.

Pipe insulation shall be applied over installed freeze protection heat tracing tape.

Install union type fitting downstream of isolation valves at equipment connections.

Solder joint fittings shall not be installed within 24" of a copper press fitting.

Threaded adaptors shall be of the same manufacture and type as the system’s copper fittings.

Threaded adaptors on supply stub-outs shall be installed prior to construction of wall and shall not extend more than 1” beyond wall face.

Identify piping utilizing copper press fittings in accordance with project specification section 20 05 53.

* + - * 1. Domestic Water Valves

Domestic water shut-off valves shall be installed where shown on Drawings, at each fixture and piece of equipment, at each branch take-off from mains, at the base of each riser, and at each battery of fixtures.

Install shut-off valves in accessible locations. Provide access panels where valves would otherwise be inaccessible. Coordinate quantity, size and location requirements of access panels with General Contractor.

Install shut-off valves with stems upright or horizontal, not inverted.

Where threaded valves are installed in copper piping systems special care shall be taken to avoid damaging the valve or its parts due to overheating. Install copper or bronze male adapters in each inlet of threaded valves. Sweat solder adapters to pipe prior to connecting to valve body.

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

Provide accessible, external check valves in the individual cold and hot water fixture supply lines serving mixing valve type faucets or assemblies having hose connection outlets that are not equipped with integral check stops.

Install a shutoff valve immediately upstream of each strainer

Install domestic hot water return circuit balancing valves where indicated on Contract Drawings and locate a minimum of five pipe diameters downstream and three pipe diameters upstream of all fittings and/or line shut-off valves. Location of valves shall allow unobstructed access for monitoring and adjustment.

Adjust and set domestic hot water return circuit balancing valves to flows indicated on Contract Drawings and in accordance with valve manufacturer’s published instructions. Use flow meter recommended by valve manufacturer.

Provide a temperature gauge, strainer, union and line shut-off valve upstream of each hot water return circuit balancing valve.

* + - 1. TESTING
				1. General

Equipment, material, power, and labor necessary for the cleaning, flushing, sterilization, inspection and testing of systems covered within this Specification Section shall be furnished by the Plumbing Contractor. All testing and inspection procedures shall be in accordance with Division 1 and Special Condition requirements of this Contract.

All new and parts of existing altered extended, or repaired plumbing system piping shall be tested and inspected for leaks and defects. Piping being tested shall not leak nor show any loss in test pressure for duration specified.

In cases of minor installation and repairs where specified water and/or air test procedures are deemed impractical, Contractor shall obtain written approval from Owner’s Representative to perform alternate testing and inspection procedures. Alternate testing and inspection procedures for minor installation and repairs shall include visual evaluation of installed components by Owner’s Representative during a simulation of use.

The water utilized for tests shall be obtained from a potable source of supply.

Prepare testing reports. If testing is performed in segments, submit separate report for each segment, complete with diagram or clear description of applicable portion of piping. After inspection has been approved or portions thereof, certify in writing the time, date, name and title of the persons reviewing the test. This shall also include the description of what portion of the system has been approved. Obtain approval signature by Owner’s Representative. A complete record shall be maintained of all testing that has been approved, and shall be made available at the job Site. Upon completion of the work, all records and certifications approving testing requirements shall be submitted to the Owner’s Representative before final payment is made.

Verify systems are complete, flushed and clean prior to testing. Isolate all equipment subject to damage from test pressure. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. Leave piping uninsulated, uncovered and unconcealed until it has been tested and approved. Where any portion of piping system must be concealed before completion of entire system, the portion shall be tested separately as specified for the entire system prior to concealment. Contractor shall expose all untested covered or concealed piping.

Gauges used for testing shall have increments as follows:

Tests requiring a pressure of 10 psi or less shall utilize a testing gauge having increments of 0.10 psi or less.

Tests requiring a pressure of greater than 10 psi but less than or equal to 100 psi shall utilize a testing gauge having increments of 1 psi or less.

Tests requiring a pressure of greater than 100 psi shall utilize a testing gauge having increments of 2 psi or less.

Separately test above and below ground piping.

Do not introduce test water into piping systems when exposure to freezing temperatures is possible.

Do not introduce test water into sections of piping located above existing sensitive areas and/or equipment that may be damaged or contaminated by water leakage. Coordinate with Owner’s Representative to determine areas and/or equipment considered as being sensitive.

Defective work or material shall be reworked and replaced, and inspection and test repeated. Repairs shall be made with new materials. Pipe dope, caulking, tape, dresser couplings, etc., shall not be used to correct deficiencies.

The Contractor shall be responsible for cleaning up any leakage during flushing, testing, repairing and disinfecting to the original condition any building parts subjected to spills or leakage.

* + - * 1. Drainage and Vent System

Subject gravity drainage and vent piping and joints to a vertical water column pressure of at least ten feet. If after 12 hours the level of the water has been lowered by leakage, the leaks must be found and stopped and the water level shall again be raised to the level described and the test repeated until, after a 12 hour retention period, there shall be no perceptible lowering of the water level in the system being tested. EXCEPTION: Portions of drainage and vent piping located on uppermost level of building shall be subjected to a water column pressure created by filling the system to point of overflow at roof vent terminals and roof drains. The pipes for the level being tested shall be filled with water to a verifiable and visible level as described above and be allowed to remain so for 12 hours.

Piping located above sensitive areas and/or equipment that may be damaged or become contaminated due to test water leakage shall be tested with air. Isolate the test section from all other sections and slowly fill pipe with oil-free air until there is a uniform gauge pressure of 5 pounds per square inch (34.5 kPa) or sufficient pressure to balance a 10-inch (254 mm) column of mercury. The air pressure shall be regulated to prevent the pressure inside the pipe from exceeding 5.0 PSIG. This pressure shall be held for a test period of at least 15 minutes. Any adjustments to the test pressure required because of changes in ambient temperature or the seating of gaskets shall be made prior to the beginning of the test period.

Test forced (pumped) drainage piping by plugging the end of the piping at the point of connection with the gravity drainage system and applying a pressure of 5psi (34.5 kPa) greater than the pump rating, and maintaining such pressure for 15 minutes.

Should the completion of these tests leave any reasonable question of a doubt relative to the integrity of the installation, additional tests or measures shall be performed to demonstrate the reliability of these systems to the complete satisfaction of the Owner’s Representative.

Test plugs must extend outside the end of pipe to provide a visible indication for removal after the test has been completed.

* + - * 1. Domestic Water System

Subject piping system to a hydrostatic pressure of at least 125 pounds per square inch gauge, but not less than the operating pressure under which it is to be used, for a period of no less than 12 hours. During test period, all pipe, fittings and accessories in the particular piping system that is being tested shall be carefully inspected. If leaks are detected, such leaks shall be stopped and the hydrostatic test shall again be applied. This procedure shall be repeated until no leaks are detected for an entire 12 hour period. EXCEPTION: Piping located above sensitive areas and/or equipment that may be damaged or become contaminated due to test water leakage shall be tested with oil-free air in lieu of water.

After completion of the testing, all new and/or altered water piping systems shall be thoroughly sterilized with a solution containing not less than 50 parts per million of available chlorine. Do not exceed 150 parts per million at any time. Introduce chlorine into the supply stream at a rate sufficient to provide a uniform concentration throughout the system. All outlets shall be opened and closed several times. When the specified level of chlorine is detected at every outlet in the system, close all valves to prevent release of water from the system for 24 hours. At the completion of the 24 hour disinfection period, test every outlet for a minimum chlorine residual of fifty parts per million. This minimum residual must be present to proceed with flushing. Flush the system with clean water at a sufficient velocity until the residual chlorine detected at every outlet is within 0.2 parts per million of the normal water supply’s level.

Sufficient samples must be taken no sooner than 24 hours after sterilization and flushing to represent the extent and complexity of the affected water system, along with a control sample to indicate municipal water quality at the time of testing. Send water samples to an accredited laboratory to perform qualitative and quantitative bacteriological analysis in accordance with AWWA C651. Contractor shall obtain written certification from the independent testing agency stating that the water samples meet Federal and State guidelines for safe drinking water. Upon satisfactory completion of all procedures, and receipt of acceptable laboratory test results, obtain written approval by Owner's representative. Failure to fully comply with the above procedures will result in a requirement to repeat the procedure until acceptable results are achieved, at no additional cost to the Owner.

Isolate or bypass equipment that would be detrimentally affected by disinfecting solution. Isolate all other sections of the domestic water system not being disinfected to prevent migration of chlorine.

Prior to injection of chlorine into the piping system, strategically place signs stating “Heavily Chlorinated Water - Do Not Drink”, and protect all outlets to prevent use during disinfection and flushing procedures.

* + - * 1. A bacteria test is not necessary for small scale work. However, disinfection is required. Examples of small scale work are less than 20 feet of pipe, replacement and/or installation of a sink, drinking fountain, eyewash, backflow preventer, isolation valve, etc. Disinfect individual parts, fixtures, isolation valves, pipes, etc. by swabbing with full strength bleach (5.25%) or soaking for at least 30 minutes in a 500 ppm chlorine solution. The 500 ppm solution can be made by adding one part 5.25% bleach (household bleach) to 100 parts drinking water. For example 3-1/2 ounces of bleach can be added to 2-1/2 gallons drinking water. Materials should then be thoroughly rinsed before putting into service.

END OF SECTION 22 10 00