SECTION 22 00 00 - PLUMBING PIPING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The Conditions of the Contract and applicable requirements of Division 1, "General Requirements", and Section 23 01 00, "Mechanical General Provisions", govern this Section.

1.2 APPLICABLE PUBLICATIONS

NSF/ANSI 61 --Drinking Water System Components – Health Effects
NSF/ANSI 372 -- Drinking Water System Components – Lead Content

1.3 DESCRIPTION OF WORK:

A. Work Included: Provide complete operating plumbing piping systems including pipe, tube, fittings, and appurtenances as indicated and in compliance with these Specifications. The Work of this Section shall include, but not be limited to:

1. Securing and installing plumbing services for the building.
2. A complete domestic hot and cold water distribution system. In laboratory facilities, the domestic hot and cold water distribution system shall be distinct from the industrial water distribution system.
3. **[A complete laboratory air and vacuum distribution system.]**
4. **[A complete natural gas distribution system.]**
5. A complete sanitary soil waste and vent system.
6. A complete storm water piping system.
7. Testing of piping and disinfection of potable water systems
8. Miscellaneous plumbing equipment and specialties required for a complete plumbing system as specified.

B. Plumbing Services: Secure all plumbing services necessary for the project as required or shown on the Contract Drawings, including paying all required fees and charges. Work related to plumbing services maybe shown on Plumbing, Civil, Architectural or other drawings in the Contract Documents. Plumbing services include, but are not limited to:

1. Securing water connection permit from the authority having jurisdiction.
2. Tapping or arranging for tapping of the city main in accordance with the authority having jurisdiction.
3. Extending water service to meter box.
4. Installation of water meter and meter box in accordance with authority having jurisdiction.
5. Extending water service from meter box to building entry.
6. Securing sanitary sewer connection permit from the authority having jurisdiction.
7. Connecting or arranging for the connection of the sanitary lines(s) into the sanitary sewer in accordance with the authority having jurisdiction.
8. Securing storm sewer connection permit from the authority having jurisdiction.
9. Connecting of or arranging for the connection of the storm drain(s) into the storm sewer system in accordance with the authority having jurisdiction.
10. Installing all drainage systems with the proper slope as required by code.

11. Boring and jacking existing streets, sidewalks, etc., in city right-of-ways as is necessary. (Where this stipulation cannot be met, it shall be the responsibility of the plumbing contractor to secure all necessary permits at his cost to do whatever is required to secure the service from the city or local authority, and make whatever repairs necessary after the service is secured.)
12. Arranging with the gas company to have the necessary gas service and properly sized gas meter station located where shown on drawings.
13. Extending gas service from the gas meter station to the building entry.

C. Coordination: The Division 23 Contractor shall be responsible for coordinating plumbing services and site utility work as shown on the Contract Drawings with the General Contractor to determine what work is included in the scope of the Division 23 Contractor.

D. Applications: Applications of piping systems include, but are not limited to, the systems as listed below:

SYSTEM	WORKING PRESSURE	OPERATING TEMPERATURES
Domestic Cold Water		
High	350 psig	55°F to 80°F
Medium	300 psig	55°F to 80°F
Low	150 psig	55°F to 80°F
Domestic Hot Water		
High	350 psig	105°F to 110°F
Medium	300 psig	105°F to 110°F
Low	150 psig	105°F to 110°F
Make-Up Water		
High	350 psig	55°F to 80°F
Medium	300 psig	55°F to 80°F
Low	150 psig	55°F to 80°F
Condensate Drainage	--	40°F to 60°F
Sanitary Drainage	--	--
Storm Drainage	--	--
Natural Gas	--	--
[Laboratory Air]	**[100 psig]**	**[--]**
[Laboratory Vacuum]	**[-25" HG]**	**[--]**
Fuel Oil (Emergency Generator)	125 psig	55°F to 95°F

Pressures
High ..... Floors **[**_____**]** through **[**_____**]**
Medium..... Floors **[**_____**]** through **[**_____**]**
Low ..... Floors **[**_____**]** through **[**_____**]**

E. Basic Materials and Methods: Refer to Section 23 03 00 for additional plumbing piping system requirements.

F. Valves and Accessories: Refer to Section 22 10 00 for additional plumbing piping system components.

G. Vibration Isolation: Refer to Section 23 05 48, "Vibration Isolation", for piping system isolation.

H. Insulation: Refer to Section 23 07 00, "System Insulation", for piping system insulation.

1.4 QUALITY ASSURANCE:

A. Welding: Qualify welding procedures, welders, and operators in accordance with ANSI B31.1, Paragraph 127.5, for shop and job site welding of piping work. Make welded joints on the piping system with continuous welds, without backing rings and with pipe ends beveled before welding. Gas cuts shall be true and free from burned metal. Before welding, surfaces shall be thoroughly cleaned. The piping shall be carefully aligned and no weld metal shall project inside the pipe. Refer to Section 23 03 00 for additional requirements.

B. [UPC Listing: All materials, fixtures or devices used or entering into the construction of the plumbing system shall be listed for UPC or shall conform to Alternate Standards recognized as "equal" by the City Officials having jurisdiction.]

C. Cast Iron Pipe Testing: All cast iron waste and vent pipe shall be 100% factory water pressure tested at 50 psig minimum pressure prior to application of the exterior coating. A certified factory test report shall be furnished to the Engineer with the pipe submittal.

D. Cast Iron Pipe Manufacturers: Cast iron pipe shall be as manufactured by Tyler Pipe or Charlotte Pipe or AB & I and shall bear the CI mark indicating compliance with the CISPI quality assurance and inspection program.

E. Grooved Systems: To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be supplied by Victaulic. Grooving tools shall be of the same manufacturer as the grooved components.

1.5 SUBMITTALS:

A. Shop drawing submittals shall include, but not be limited to, the following:

1. Cut sheets marked to clearly indicate all plumbing piping system materials.
2. Piping fabrication drawings for all main piping runs **[including connections to existing piping]**. Fabrication drawings shall include plan views and suitable elevations and shall include all accessories and equipment.
3. Additional items as required in Section 23 01 00.
4. Grooved joint couplings and fittings shall be shown on drawings and product materials, and be specifically identified with the applicable Victaulic style or series number.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver components in factory-fabricated water resistant packaging, as applicable.

B. Handle components carefully to avoid damages to components, enclosures, and finish.

C. Store components in a clean, dry space, and protect from weather.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS:

A. General: Provide pipe and tube of type, joint, grade, size, and weight (wall thickness, schedule or class) indicated for each service. Comply with applicable governing regulations and industry standards.

1. Lead Content: Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for Human consumption, and shall be certified in accordance with NSF/ANSI 61 or NSF 372. Endpoint devices used to dispense water for drinking must meet the requirements of NSF/ANSI 61, Section 9.

2. Steel Pipe: ASTM A53 or ASTM A106 black or hot-dipped galvanized as specified. [Piping shall be domestically manufactured by one of the manufacturers listed in the latest edition of the American Petroleum Institute (API) approved manufacturers listing.]

3. Copper Tube: ASTM B88, Types "K", Type "L", or Type "M" copper water tube as defined by the Copper and Brass Research Association.

4. Ductile Iron Pipe: ANSI A21.51, Class 350 with bell and spigot ends for push-on joints.

5. Cast Iron Soil Pipe: ASTM A74, most current edition.

6. Hubless Cast Iron Soil Pipe: CISPI 301, most current edition.

7. **[Polyvinyl Chloride (PVC) Storm Pipe: Sewer main SDR 41 or SDR 26, ASTM D3034 with bell ends and pre-inserted gasket joints.]**

8. **[Polyvinyl Chloride (PVC) Water Pipe: Class 150, thickwall, AWWA C900 mechanical joint.]**

2.2 PIPE/TUBE FITTINGS:

A. General: Provide factory-fabricated fittings of type, materials, grade, class, and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve, and equipment connections. Where not otherwise indicated, comply with governing regulations, industry standards, and where applicable, with pipe manufacturer's instructions for selections.

1. Cast Iron Flanged Fittings: ANSI B16.1, Class 125 or Class 250, black or galvanized as specified, including bolting and gasketing.

2. Cast Iron Threaded Fittings: ANSI B16.4 or ASTM A126, Class 125 or Class 250, black or galvanized as specified.

3. Malleable Iron Threaded Fittings: ANSI B16.3, Class 150 or Class 300, black or galvanized as specified.

4. Malleable Iron Threaded Unions: ANSI B16.39, select for proper piping fabrication and service requirements including style, end connections, and metal-to-metal seats (iron, bronze, or brass), plain or galvanized as specified.

5. Threaded Pipe Plugs: ANSI B16.14.

6. Steel Flanges/Fittings: ANSI B16.5, including bolting, gasketing, and butt weld end connections.

7. Forged Steel Socket-welding and Threaded Fittings: ANSI B16.11, rated to match schedule of connected pipe.

8. Wrought Steel Butt-welding Fittings: ANSI B16.9, except ANSI B16.28 for short radius elbows and returns; rated to match connected pipe.

9. Cast Iron Drainage Fittings: ANSI B16.22 galvanized, recessed fittings with pitched threaded ends.

10. Pipe Nipples: Fabricated from same pipe as used for connected pipe, except do not use less than Schedule 80 pipe where length remaining unthreaded is less than 1/2". Do not thread nipples full length (no all-thread nipples).

11. Wrought Copper/Bronze Solder-joint Fittings: ANSI B16.22 suitable for working pressure up to 250 psig.

12. Hubless Cast Iron Pipe Fittings: CISPI 301, most current edition, and comply with governing regulations.

13. Cast Iron Soil Pipe Fittings: ASTM A74, most current edition.

14. Compression Gaskets: ASTM C1563 for gasket testing and ASTM C564 for elastomeric compound.
15. Lead/Oakum Joint Materials: Sealite white oakum and pure pig caulking lead.
16. Standard Grooved End Fittings: ASTM A234 forged steel or ASTM A53 fabricated carbon steel, or ASTM A536 ductile iron fittings joined with Victaulic Style 77 or Style 07 couplings and Grade "E" gaskets on steel systems. **[On copper systems, ASTM B-75 alloy C12200 or sand casting B-584-87 alloy CDA 844 (81-3-7-9) with Style 606 coupling.]**
17. Flanged Fittings: Comply with ANSI B16.15 for bolt-hole dimensioning, materials, and flange-thickness.
18. Flange Bolts: Bolts shall be carbon steel ASTM A307 Grade A hexagon head bolts and hexagonal nuts. Where one or both flanges are cast iron, furnish Grade B bolts. Cap screws utilized with flanged butterfly valves shall be ASTM A307 Grade B with hexagon heads.
19. Flange Bolt Thread Lubricant: Lubricant shall be an antiseize compound designed for temperatures up to 1000°F and shall be Crane Anti-Seize Thread Compound or approved equal.
20. Mechanical Joints for Cast Iron and Ductile Iron Pipe: AWWA/ANSI 21.11 with appropriate gaskets, nuts and bolts.
21. **[Polyvinyl Chloride (PVC) Fittings: ASTM D2665, Carlon, Vylon "Z" high strength sewer fittings.]**

B. Miscellaneous Piping Materials/Products:

1. Welding Materials: Comply with ASME Boiler and Pressure Vessels Code, Section II, Part C, for welding materials.
2. Brazing Materials: American Welding Society, AWS A5.B, Classification BCup-5.
3. Gaskets for Flanged Joints: 1/16" thick for all pipe size 10" and smaller and 1/8" thick for all pipe size 12" and larger. Ring-type shall be used between raised face flanges and full face-type between flat face flanges with punched bolt holes and pipe opening. Gaskets shall be Garlock Style 3400 compressed nonasbestos or equal.
4. Insulating (Dielectric) Unions: Provide dielectric unions at all pipe connections between ferrous and nonferrous piping. Unions shall be "Clearflow" waterway as made by Victaulic, "Delvin" as made by Pipeline Seal and Insulator Company or "EPCO" as made by Epco Sales, Inc. and shall have nylon insulation.
5. Gaskets for Cast Iron Soil Pipe: ASTM C564, neoprene, compression-type.
6. Push-on-joints: ANSI A21.11, rubber compression-type, "Tyton Joint" as manufactured by U.S. Pipe or equal.
7. Hubless Cast Iron Joints: Heavy duty couplings: Clamp all 125, Husky SD4000 or MG.
8. Solder: All solder used for sweating of water **[and laboratory air and vacuum]** piping joints shall be 95/5 tin-antimony or tin-silver. All solder used for sweating of natural gas piping joints shall be phosphorous-free, non-lead bearing silver brazing solder with a melting point in excess of 1000°F.
9. Threadsealing Tape: Threadsealing tape used for plumbing piping applications shall be stretched or nonstretched teflon tape. Threadsealing tape used for natural gas piping applications shall be nonstretched 0.004" thick teflon tape and shall be yellow in color for identification.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION:

A. General:

1. Industry Practices: Install pipe, tube, and fittings in accordance with recognized industry practices which will achieve permanently leakproof piping systems, capable of performing each indicated service without failure or degradation of service. Install each run with a minimum of joints and couplings, but with adequate and accessible unions or flanged connections to permit disassembly for maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align accurately at connections, within 1/16" misalignment tolerance. Coordinate piping locations with other trades to avoid conflict. Give ductwork preference unless directed otherwise by the Engineer.

2. Systems: Install piping parallel or perpendicular to lines of building, true to line and grade, and with sufficient hangers to prevent sags between hangers. Provide fittings at changes in direction. Piping in finished areas shall be concealed, except in mechanical rooms. Where pipes of different sizes join, provide reducing elbows, tees, or couplings. Bushings will not be acceptable.

3. Expansion and Contraction: Install loops, offsets, sizing joints, and expansion joints, as necessary, to avoid strain resulting from expansion and contraction of piping systems on fixtures and equipment.

a. Expansion Loops and Offsets: Provide expansion loops and offsets in piping systems for not less than one inch (1") expansion or contraction per 100'of pipe. Use Victaulic style 75 or 77 flexible type couplings on expansion loops in accordance with the latest Victauliv recommendations for expansion compensation.

b. [Mechanical Grooved Couplings: Provide mechanical grooved connections equal to Victaulic style 75 or 77 where indicated on the Drawings and Specifications to reduce vibration at equipment connections. Provide expansion joints in piping systems by mechanical grooved connections where specifically indicated on the Drawings.] Expansion joints shall be of one of the following types:

- Packless, gasketed slip-type expansion joint grooved end telescoping body for installation with Victaulic style 07 rigid type couplings, providing axial end movement up to 3”. Victaulic style 150 Mover.
- combination of Victaulic style 77 or 75 flexible type couplings and short nipples joined in tandem for increased expansion. Joined movement and expansion capabilities determined by the number and style of couplings/nipples used in the joint. Victaulic series 155.

4. Pipe Grading: Install domestic water piping to pitch down in the direction of flow for drainage. Grade storm, soil, and waste piping at 1/4" per foot whenever possible, and not in any case less than 1/8" per foot for pipe sizes 4" and larger, unless shown otherwise on the Drawings. Grade vent piping at 1/4" per foot whenever possible, and not in any case less than 1/8" per foot toward vents. Grade gas piping at a minimum of 1/8" per foot toward condensation traps at connected equipment.

B. Steel Pipe: Ream steel pipe after cutting and before threading. Thread with clean-cut taper threads of length to engage all threads in fittings and leave no full-cut threads exposed after make-up. Use John Crane or approved equal teflon thread tape applied only to male threads to make-up joints.

C. Copper Pipe: Cut copper pipe square and ream to remove burrs. Clean fitting socket and pipe ends with sand cloth, No. 00 cleaning pads or wire brush. No acids shall be used to clean either pipe or fittings or as a flux in sweating joints. The use of drilled T connections is not permitted.

D. [PVC Pipe: Cut PVC pipe square and remove all burrs. Clean fitting and pipe butt prior to installation. Install all PVC piping in accordance with the manufacturer's

recommendations.]Underground installation of PVC piping shall be in compliance with ASTM D2321.

E. Final Connections to Equipment Furnished by Owner or Under Other Divisions of These Specifications: Where Drawings show equipment to be furnished under other Divisions of these Specifications or by the Owner, such equipment will be delivered to the site, uncrated, assembled, and set in-place under those other Divisions of these Specifications or under the separate contracts. Any required automatic control valves shall also be provided under those other Divisions of these Specifications or other separate contracts. Make all final connections of chilled water, hot water, condenser water, gas, domestic water, waste, and vent as shown. Provide valves, unions, strainers, check valves, and traps as required for proper operation of systems and equipment. Equipment not shown or noted on the piping drawings shall not be included in the scope of this requirement.

F. Excavation, Installation, and Backfill for Underground Pipe:

1. Layout: Pipes shall be laid and pipe joints made in presence of the Owner's Representative and field measurements, layouts, batter board alignment, grade establishments, and similar locations shall be performed by a Professional Engineer in the employ of the Contractor. The Contractor's engineer shall be on the job during all underground work. A "Bench-Mark" reference for use by the Contractor shall be provided by the Owner.

2. Pipe Grading: Lay and maintain all pipes at required lines and grades during the course of the Work to comply with the Drawings.

3. Trench: Excavate the trench to the depth required. Properly brace and dewater the trench and keep it free of water during installation, testing pipe, and backfilling. No water shall be discharged onto a street or freeway without approval by the Architect. Refer to Section 15100 for additional requirements.

4. Excavation: The trench shall be at least 18" wider than the maximum diameter of the pipe or largest bell and the pipe shall be laid in the center of the trench. The trench shall be excavated to a depth sufficient to provide for pipe cushions or supports as specified with a minimum backfill cover of 30". Trench width may be increased as required and piling left in place until sufficient compacted backfill is in place. Properly sheet and brace all open trenches to render them secure and remove all such sheeting and bracing before completing the backfill. Comply with local regulations or, in the absence thereof, with the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc. The quantity of excavation required to install sheeting and the installation and removal of sheetings and bracings will not be regarded as Extra Work. All costs incurred for this excavation and the installation of sheeting shall be included in the Contract Price. Refer to Section 23 03 00 for additional requirements.

5. Grading: Upon completion of excavation and prior to the laying of the pipe, the trench bottom shall be brought up to the required elevation with a pipe cushion, except where the cushion has been eliminated by the Engineer. Pipe cushions shall be select material deposited in the trench and shall be compacted, leveled off, and shaped to obtain a smooth compacted bed along the laying length of the pipe. Pipe cushion shall be as follows:

   a. *Stable, Firm Semidry Trench: Piping shall be laid on undisturbed earth, in a constant uniformly sloped trench. Laying space for hubs or mechanical joints shall be hand cut to 6" either side of the joint and stabilized sand poured and wet in to even with the natural earth trench bottom. The leakproof integrity test of the piping system shall be inspected by the Owner's Representative prior to covering the piping. Failure to notify the Owner's Representative for inspection prior to covering the piping will result in the piping being uncovered and the test being performed again. Where the slope of the trench is found to belly down along the line of piping, before joining, the pipe shall be removed from the trench and the belly converted to uniform slope by adding stabilized bank sand, wet down and slightly mounded to the center of the trench. The section of*

piping will then be "rolled" into place so with support uniform along its entire length. Where the slope of the trench is found to arch up along the line of piping, before joining, the pipe shall be removed from the trench and the arch converted to uniform slope by cutting the arch out. The section of piping will then be reset into place with support uniform along its entire length.

b. *Wet Clay - Black Gumbo: Piping shall be laid in a constant, uniformly sloped trench. After shaping, the trench shall receive 3" minimum clean bedding sand, which shall be uniformly distributed on the trench bottom. Laying space for the hubs or mechanical joints shall then be hand removed and the piping placed on the setting bed with the weight of the piping distributed evenly on the setting bed over its entire length. The leakproof integrity test of the piping system shall be inspected by the Owner's Representative prior to covering the piping by the Engineer's agent. Failure to notify the Owner's Representative for inspection prior to covering the piping will result in the piping being uncovered and the test performed again.*

c. *Rock: Where rock is encountered, the trench shall be excavated to a minimum of 6" below the pipe elevation and then backfilled with bedding sand to provide a uniform layer for pipe support. Backfill shall be as indicated for Wet Clay - Black Gumbo.*

d. *Special Considerations: Where there are expansive soil conditions on the site, special precautions shall be taken to prevent pushing and breakage of underground piping. Precautions shall be in accordance with local installation techniques and may include carton forms or special pipe bedding.*

6. Anchors: Cast iron pipes shall have concrete anchors at each change in direction and/or as directed. Any change in direction exceeding 15 degrees shall be anchored. Concrete anchors shall rest against **solid (virgin) ground** with the required area of bearing on pipe and ground to provide suitable anchoring.

7. Backfill: Backfill trenches only after piping has been inspected, tested, and approved by the Architect. Place backfill material in the trench either by hand or approved mechanical methods. The compaction of backfill material shall be accompanied by tamping with hand tools or approved pneumatic tampers, by using vibratory compactors, by puddling, or by any combination of the three. The method of compaction shall be approved and all compaction shall be done to the satisfaction of the Architect. Backfill completely around pipe, including 18" above the pipe, with suitable bank sand, tamped in 4" layers under, around, and over pipe. Water down backfill as required. The remainder of the backfill for pipes shall be select backfill material tamped at intervals of no more than 12" depths, to attain a 95% Proctor Compaction Density. All materials to be used as select material backfill shall be approved by the Architect. If, in the opinion of the Architect, the excavated material does not meet the requirements of select material, the Contractor shall be required to screen the material prior to its use as select material backfill. Material used in the upper portion of the backfill or subgrade shall not contain stone, rock, or other material larger than 6" in its longest dimension. No wood, vegetable matter, or other material, which in the opinion of the Architect is unsuitable, shall be included in the backfill. The upper 24" of backfill may be water jetted, if desired. Bring backfill up to finish grade identified on the Architectural Drawings, including additional backfill required to offset settlement during consolidation. When removal of unsuitable, excavated material creates a shortage of backfill material, the Contractor shall, at no change in Contract amount, furnish material as specified in this Section in the amount required to complete the backfill.

8. Existing Surfaces: Restore existing streets, driveways, and sidewalks damaged during the excavation work to acceptable condition, subject to approval by the Architect.

9. Safety: Provide street and sidewalk excavations with approved barricades, warning lights, and cover plates as required by the City. Refer to Section 23 03 00 and Division 1 for additional requirements.

G. Pipe Fabrication Drawings:

1. Pipe fabrication drawings shall be submitted for all piping in the Central Plant, **[Utility Tunnel,]** Mechanical Rooms, Penthouse and for Equipment connections and all other areas requiring coordination with other trades.
2. Pipe fabrication drawings shall be double line drawings to scale on 1/4" scale building floor plans and shall indicate pipe size, fittings, valves, accessories, connections, system type, insulation, support requirements, pipe elevations and other information required for coordination with other trades and fabrication of pipings.
3. Pipe fabrication drawings shall be coordinated with other trades and building construction prior to submittal for approval. Refer to Section 23 01 00 for additional shop drawing requirements.

H. Basic Materials and Methods: Refer to Section 23 03 00 for additional requirements related to plumbing piping.

3.2 PLUMBING SERVICES:

A. General: Install the various piping systems as described and as required by the local plumbing inspection department.

1. Slope domestic hot and cold water **[and laboratory air and vacuum]** piping to drain and provide with hose valves (drain valves) at low points. **[Branch taps for laboratory air and vacuum piping shall be made from the top of the piping main.]**
2. Install soil, waste, and vent piping with horizontal lines pitched in accordance with local codes, but in no case less than 1/4" per foot for pipe 3" and smaller and 1/8" per foot for pipe 4" and larger. Install soil, waste, and vent piping with hubs of each length of piping in the upstream position.
3. Make-up lead and oakum joints with molten lead run into hubs in one continuous pour, to a minimum depth of one inch (1").
4. Make-up "Ty-Seal" or "Dual-Tite" gasketed joints using lubrication and joining tools as instructed by the manufacturers. Base of stacks, horizontal runs under pressure, and gasketed pipe 5" and larger shall be made up using "Tyler Lubrifast" joining material. Horizontal joints, 5” and larger, shall be restrained.
5. Torque "No-Hub" joints in accordance with manufacturer's instructions. Do not install "No-Hub" joints below ground.
6. Provide chrome-plated piping at each fixture installed in a finished space. Install with proper strap wrenches to avoid marking or defacing.
7. Provide proper restraints on riser and stack offsets.
8. **[Kitchen equipment shall be furnished under another Division of the Specifications. This Contractor shall install all faucets, drains, hose outlets, and similar items supplied by kitchen equipment Contractor. This Contractor shall furnish and install traps, trim, stops, and similar connections as required to make piping system complete in every way. All exposed piping to sinks, disposals, hose reels, and similar items shall be chrome-plated. Gas piping to kitchen equipment shall be black steel pipe.]**

B. Plumbing Connections to Mechanical Equipment:

[VERIFY THE FOLLOWING]

1. General: Provide necessary pipe and fittings. Make final connections to provide cold water make-up and natural gas supply to mechanical equipment. Locate cold water make-up and gas supply where shown and connect with suitable stop valves, check valves and bypass valves as applicable.

2. Gas Supply: Provide gas supply to boilers and kitchen equipment as indicated on Drawings.

3.3 MAKE-UP WATER PIPING SYSTEMS:

A. Connections: Connect domestic water to automatic fill and manual quick-fill connections on each HVAC piping system and as shown on Drawings. Provide reduced pressure backflow preventers at each system.

B. Compatibility: Use piping and fittings of same material type as materials of the domestic water supply.

3.4 DOMESTIC HOT AND COLD WATER PIPING SYSTEMS:

A. Interior Hot and Cold Water Piping:

1. Piping 3" and smaller, Type "L" copper tubing hard drawn joined using non-lead bearing solder, such as 95-5 silver or antimony solder (95% tin and 5% silver or antimony). **[or grooved ends with Victaulic Style 606/607 couplings {flaring of tube and fitting ends to IPS dimensions is not permitted}]**.

2. Piping 4" and larger, Schedule 40, galvanized steel pipe, ASTM A53 with galvanized malleable iron fittings, or galvanized cast iron flanged fittings.

3. Provide isolation fitting whenever dissimilar materials are used.

4. **[Option: At the Contractor's option, for galvanized steel piping 4" and larger, a grooved piping connection system with "cut-grooves" may be used. Grooved couplings shall be Victaulic Style 75 or 77 flexible type with Grade "E" synthetic rubber gaskets. Rigid couplings shall be used at valves and in other areas where piping system rigidity is required and shall be Victaulic Style 07 Zero-Flex couplings with Grade "E" gaskets syntahetic rubber gaskets. Taps to mains shall be made using Victaulic Style 72 or Style 920/920N hot dip galvanized outlet couplings or fittings or Gruvlok Fig. 7045/7046 hot dip galvanized outlet couplings or fittings. Mechanical "T" couplings with U-bolts shall not be permitted. Flange connections shall be made using Victaulic Style 741 or 743 flanges with Grade "E" synthetic rubber gaskets. Fittings for elbows, tees, reducers, etc. shall be Victaulic or Gruvlok hot dip galvanized full flow fittings. All grooved piping connection materials shall be utilized with the manufacturer's recommended groove cutting tool. All grooved piping couplings and fittings used in association with an individual coupling or fitting shall be by the same manufacturer. The use of boltless couplings, reducing couplings and Mechanical "T" fittings with U-bolts is prohibited. All wetted surfaces in the piping system shall be hot dip galvanized and all proposed grooved piping connection materials shall be suitable for domestic water use at the temperatures and pressures at the point of application. Painted couplings may be used where they meet the above requirements. Grooved reducing couplings shall not be installed.]**

B. Piping Runouts to Fixtures: Provide piping runouts to fixtures sized to comply with governing regulations. Where not otherwise indicated, provide runouts sized to comply with the following: lavatories - 1/2" hot, 1/2" cold; water closet flush valves - one and one half inch (1-1/2") cold; urinal flush valves - one inch (1") cold; drinking fountains - 1/2" cold. Provide each fixture with a shut-off valve for each supply line. All exposed lines shall be chromium-plated.

C. Air Chambers:

1. Riser Air Chambers: At the top of each main hot and cold water riser, provide [a properly sized Wade Shoktrol or approved equal sealed air chamber] [an air chamber two pipe sizes larger than riser pipe and 24" high].

2. Fixture Air Chambers: At each hot and cold water supply pipe at each fixture, provide [a properly sized Wade Shoktrol or approved equal sealed air chamber] [an air chamber the same size as the fixture branch and not less than 18" high].

3.5 UNDERGROUND DOMESTIC WATER AND FIRE PROTECTION PIPING:

A. Service Piping Two Inches and Smaller: Type "K", copper tubing with wrought copper brazed end fittings.

B. Service Piping Three Inches and Larger: Class A, 150 AWWA ductile iron bell and spigot, push-on joint, pressure water pipe. Joints shall be of the push-on-type employing a molded rubber "O" ring gasket retained in a ring recessed into the inside of the bell **[per ANSI A21.1] [Class 150 cast iron domestic water pipe with mechanical joints.] [Class 150 mechanical joint PVC]. [All underground cast iron or ductile iron pipe shall be encased in black 8-mil thick, polyethylene plastic sheet, per ANSI/ AWWA, C105/A21.5-82, Method C.] [Pipe and joints shall be manufactured by Tyler Pipe and Foundry Company or equal. Coat pipe and fittings inside and outside with the manufacturer's standard coal tar enamel suitable for domestic water service.]**

C. Underslab Piping: Piping under the building slab for hose bibbs and equipment stubs shall be no larger than one inch (1") and shall be Type "K" soft drawn copper tubing. Piping shall be run continuous from slab penetration to penetration and there shall not be any fittings or connections below the slab. Piping shall have minimum 12" cover in nonpaved areas. Underground piping up to 3" above slab penetrations shall be protected as described herein below.

D. Underground Pipe Protection: Underground metallic water piping which is not coated with coal tar enamel shall be coated with 3M Scotchwrap Pipe Wrap Insulation No. 50, applied in strict accordance with the manufacturer's recommendations. Machine wrapping of piping is acceptable. Concrete thrust blocks shall be poured at all turns and offsets of mechanical joint piping.

E. [Water service piping shall not be installed under concrete slabs on grade.]

3.6 STORM AND SANITARY DRAINAGE SYSTEM:

A. Waste and Vent Piping Underground: All underground waste and vent piping, including turns to the vertical to 12" above the grade floor slab, shall be constructed of service weight (SV) hub and spigot cast iron soil pipe and fittings with **positive sealing elastomeric gasket joints.] Elastomeric gaskets shall be installed using an approved gasket lubricant.]** Pour concrete thrust blocks at all below grade turns and offsets for waste piping 6" and larger.

B. **[Vertical]** Waste **[and Vent] [Stacks] [and Waste] [Piping]** Above Grade: Service weight (SV) cast iron pipe and fittings with positive sealing neoprene elastomeric compression type gasket joints. Elastomeric gaskets shall be installed using gasket lubricant. All horizontal stack offsets **[and elbows]** (4" and larger) shall be joint-strapped and supported using riser clamps and threaded rod.

C. **[Horizontal Fixture, Waste and]** Vent **[Manifolds] [Piping] Above Grade**: Connect to the vertical stack with "No-Hub" cast iron soil pipe and fittings assembled with Stainless Steel No-Hub Coupling Assemblies.

D. Building Storm Drainage Piping Underground: All underground horizontal Storm Water piping including turns to the vertical to 12" above the grade floor slab, shall be constructed of service weight (SV) hub and spigot cast iron soil pipe and fittings with **[[positive sealing neoprene gasket]** joints. **[Elastomeric gaskets shall be installed using an approved gasket lubricant.]** Pour concrete thrust blocks at all below grade turns and offsets. The Building Storm Water System shall extend **[5'-0"]** outside the Building **[to a catch basin as shown on the Drawings]**.

E. Building Storm Piping Above Grade: All Storm Drainage piping within the Building shall be service weight (SV) cast iron pipe and fittings with positive sealing neoprene elastomeric gasket joints. Elastomeric gaskets shall be installed using an approved gasket lubricant. All horizontal stack offsets **[and all elbows]** shall be joint-strapped and supported using riser clamps and threaded rod.

F. Insulation: All **[kitchen grease waste,]** condensate drains and related piping, roof drain**[,]** and overflow roof drain bodies and horizontal runs of storm drainage piping within the occupied spaces of the building, shall be insulated as specified in Section 23 07 00.

G. Parking Garage Storm Drain Piping Underground: All underground Storm Water piping including turns to the vertical to 12" above the grade floor slab shall be constructed of **[service weight (SV) hub and spigot cast iron soil pipe and fittings with positive sealing neoprene elastomeric gasket joints.] [PVC SDR-41 pipe and solvent welded fittings.] [Elastomeric gaskets shall be installed using an approved gasket lubricant.] Pour concrete thrust blocks as all below grade turns and offsets. The Garage Storm Water System shall extend [5'-0"] outside the Garage [to a catch basin as shown on the Drawings]. [All parking garage drainage shall route through an oil interceptor prior to discharge.]**

H. Parking Garage Storm Drain Piping Above Grade: All Storm Drainage piping within the Parking Garage shall be **[service weight (SV) cast iron pipe and fittings with elastomeric neoprene gasketed joints.] [PVC SDR-35 (ASTM D2241) pipe and solvent welded fittings (ASTM D2466, D2564). All PVC shall be supported at each floor level.] [Elastomeric gaskets shall be installed using an approved gasket lubricant.]** All horizontal stack offsets **[and all elbows]** shall be joint-strapped and supported by riser clamps and threaded rod.

I. Pump Discharge Piping: Discharge from pumps to the horizontal gravity main shall be Schedule 40 galvanized steel with galvanized cast iron drainage fittings. Each pump discharge shall be carried separately to the horizontal gravity main and shall discharge into the top of the horizontal gravity main with a wye fitting.

J. Cleanouts:

1. Locations:
   a. *At base of every drainage stack.*
   b. *Upper terminal of each horizontal drainage pipe.*
   c. *Each 90'length of horizontal straight run of drainage piping on the exterior, each 50' length of horizontal straight run of drainage piping in the interior.*
   d. *Where shown on Drawings.*
   e. *As required by local code.*
2. Size: Cleanouts shall be line size for piping up to 4" and 4" size for piping larger than 4".
3. Access: Provide access doors for access to cleanouts installed in concealed locations.

K. Fixture Connections:

1. Water Closets: Galvanized castable nipples.
2. Urinals: Copper or cast iron nipples with suitable adapters.
3. Lavatories: Copper or cast iron nipples with suitable adapters.
4. Service Sinks: Brass or cast iron nipples with suitable adapters.
5. Drinking Fountains: Copper or cast iron nipples with suitable adapters.

L. Grease Traps and Sampling Wells: Furnish and install grease traps and sampling wells as shown on the drawings and required by local authorities. Grease traps and sampling wells may be precast or cast-in-place concrete. Coordinate forming and pouring or purchase and setting of grease traps with the General Contractor.

3.7 NATURAL GAS PIPING SYSTEM:

A. Code Compliance Products: Comply with local utility company and AGA regulations which require the products used for gas piping work to be selected from lists in certain published standards or coded as indicated.

B. Gas Piping: Gas piping intended for operation at pressures of 5 psig or greater shall be ASTM A53, Schedule 40, black steel joined by Schedule 40, black welding fittings. Gas piping, 2-1/2" and smaller, intended for operation at pressures less than 5 psig shall be ASTM A53, Schedule 40, black steel joined by Class 150 socket weld fittings except that Class 150, banded, black malleable iron, threaded fittings maybe used at valves and equipment connection **[and downstream of room isolation valves]**. Gas piping, 3" pipe size and larger, intended for operation at pressures less than 5 psig shall be ASTM A53, Schedule 40, black steel joined by Schedule 40, black welding fittings. Provide condensation traps with removable caps at all equipment connections.

C. Concealed Piping and Protection: Gas piping run concealed in walls, chases, or above ceilings shall be installed in a Schedule 20 welded steel sleeve vented to the outside atmosphere. Suitable internal spacers shall be provided. Inaccessible piping shall be all-welded connections. Socket type weld fittings may be used for sleeved gas piping.

D. Underground Piping: Gas piping installed below grade shall be coated with Republic Steel Corporation (US) "X-Tru-Coat" high density polyethylene extruded coating, factory-applied with a fluid mastic to a minimum thickness of 0.040". Field welds, joints, and fittings shall be protected with mastic undercoat and by wrapping at least two layers of "X-Tru-Tape" installed as instructed by manufacturer.

E. Gas Distribution System Drip Pipes: Drip pipes shall be provided throughout the gas piping systems for the purpose of accumulating moisture and condensate. They shall be sized no smaller than the gas main which they drain in each instance.

F. Gas Distribution System Fabrication Methods:

1. All interior gas piping shall, wherever possible, be installed so as to grade back toward the gas entry. In all cases where such grading is impracticable and it is necessary to grade the house piping away from the inlet, drip pipes of adequate capacity must be installed where traps are formed by such changes in grade. Drip pipes shall terminate a screwed pattern, malleable iron black cap. No drip pipes shall be used as outlets for the attachment of any fixture or gas appliance. Drip pipes must, moreover, be placed at the bottom of all vertical pipes which rise from and connect to the end of any horizontal pipe.

2. All branch outlet pipes shall be taken from the top or sides of running horizontal lines and not from the bottom. No crosses shall be installed in any horizontal gas line. No unions, gas cocks, or valves shall be used in any concealed location. Every gas cock and valve shall be accessible for inspection and repair.

3. The general arrangement of all gas piping shall be such that the number of threaded joints involved is reduced to an absolute minimum. If obstructions are encountered, pipe shall not be bent to circumvent such obstructions. Welding fittings shall be used for this purpose in the case of welded lines, and if threaded lines are involved, screwed fittings shall be used. Wherever gas pipes run through outside brick, stone, or other walls, the opening around the pipe shall be securely and rigidly sealed. Gas pipe sizes shall be at least one pipe size larger than the inlet of the gas appliance which they supply. No bushings shall be used in conjunction with any gas piping.

G. Gas Distribution System Protective Coating: Gas piping systems installed underground shall utilize pipe which has been factory coated with Scotchkote protective resin No. 212. All materials, surface preparation, application and testing shall conform to Federal Specification L-C-530 B-Type 2. This coating shall be applied by A&A Coating Company, Lone Star, Texas. Underground welded joints and fittings shall be coated with Scotchkote No. 306 epoxy resin and taped with vinyl Scotchwrap-50 brand tape. Flanged joints shall be given two coats of Koppers Company No. 300M Catalyzed Coal Tar Epoxy. Under no circumstances shall any backfilling operations be begun until these pipe protection operations have been completed.

3.8 **[LABORATORY AIR AND VACUUM PIPING SYSTEM**:

A. Pipe and Fittings: Piping 4" and smaller shall be Type "L" copper tubing hard drawn with wrought copper brazed end fittings.

a. Victaulic grooved end copper fittings shall be wrought copper conforming to ASME B16.22, or bronze sand castings conforming to ASME B16.18, manufactured to copper tubing dimensions with grooves designed to accept Victaulic Style 606/6-7 couplings. Grade "E" EPDM synthetic rubber gasket for oil-free air, or grade "T" Nitrile for air with oil vapors, FlushSeal design. (Flaring of tube and fittings ends to IPS dimensions is not permitted).

B. Cleaning: All piping and fitting shall be washed and sealed prior to installation and shall be blown out with compressed air before service fittings are installed.]

3.9 CONDENSATE DRAINAGE:

A. General: Provide a condensate drain pipe to connect each cooling unit drain pan and secondary drain pan to extend to and discharge into an open-type drain in the plumbing system.

B. Assembly: Use Schedule 40, galvanized steel pipe made up with Class 125, galvanized, threaded fittings. Assemble fittings to form a trap with depth equal to or greater than operating pressure of the unit served. Drains shall be of the sizes indicated, but not less than the full size of the drain pan connection. Air handling unit drains shall have deep seal traps to permit unit pan drainage. Install a deep seal trap for each blow-through or draw-through air handling unit to maintain the water seal.

3.10 CHASE AND WALL PIPING SUPPORTS:

A. All piping whether sanitary or water shall be rigidly installed in all chases or walls. Test for rigidity shall be that the piping is virtually immovable by hand short of deforming the piping. Valve, stop and fixture penetrations thru chase or fixture mounting walls shall be firmly supported from just inside the wall or chase prior to penetration to the room-side of the chase or wall.

B. Support inside the chase or wall for Sanitary Waste and Vent Piping shall be accomplished by utilizing fixture carrier bolt-downs, "Uni-Strut" or similar structural bracing system, "U-bolts", nuts and lock-washers, all bolted to the floor and to the piping system.

C. Support for Water Piping or other similar service piping shall be accomplished by using a "system" designed for that purpose. An approved system shall consist of preformed steel supports which shall be installed between studs or joists and preformed nonmetallic pipe holder inserts which are designed to rigidly support or hold the piping to the steel supports.

D. In no case shall Sanitary Sewer Waste or Vent Piping depend on blocks, brick, stone or wood sleepers for its final support. In no case shall Water Piping or similar service piping depend on its final support on "tie-wires", soldering or brazing to metal studs or joists, copper tube soldered to risers and tied to joists or any other method which does not have the written approval of the Engineer. Piping improperly supported shall have improper supports promptly removed and replaced with specified supports at the direction of the Engineer at no additional cost to the Owner and/or Architect/Engineer.

E. Support system shall be as manufactured by "Holdrite" or an approved equal.

3.11 CLEANING, FLUSHING, TESTING AND INSPECTING:

A. Cleaning: Clean exterior surfaces of installed piping systems and prepare surface for application of any required coatings.

B. Piping Tests:

1. General: Blank off equipment during tests. Perform tests before piping is enclosed in walls, floors, partitions or in any other way concealed from view. Tests may be performed in sections. Tests shall be witnessed by the Engineer or Owner's Representative and local inspectors and results presented to the Engineer for acceptance and approval prior to

concealing piping from view. Provide all necessary equipment for testing, including pumps and gauges. Refer to Section 15020 for additional requirements.

2. Domestic Water Systems: Test hot and cold water systems hydrostatically to a pressure of 150 psig or 1-1/2 times working pressure, whichever is greater, for a period of 24 hours. Repair all leaks, replacing materials as necessary, and repeat tests until systems are proven tight.

3. Soil, Waste and Vent Piping System: Test soil, waste, and vent piping by plugging all openings and filling system to height required by UH Plumbing Inspector, but not less than 10'above the level of the pipe being tested, for a minimum of 3 hours. Inspect all joints for leaks, repair all leaks found, and retest until piping is demonstrated to be free from leaks as evidenced by no perceptible lowering of the water level after 3 hours. In addition to water test, apply peppermint or smoke tests, if required by local code.

4. Storm Drainage Piping System: Test storm drainage piping same as specified for Soil, Waste, and Vent Piping System.

5. Sump Pump and Sewage Ejector Discharge Piping: Test sump pump and sewage ejector piping same as specified for domestic water systems.

6. Natural Gas Piping System: Test natural gas piping with compressed air or nitrogen to a pressure of five times the expected service pressure, but not less than 100 psig, for a period of 24 hours. Repair all leaks, replacing materials as necessary, and repeat test until systems are proven absolutely tight. After all pneumatic testing of the entire gas piping system has been completed and all leaks have been repaired and at a time deemed suitable by the Owner's duly authorized representative, the Contractor shall have the gas supply turned on and the gas odorant chemical added by a representative of the gas company, as applicable. The Contractor shall then bleed gas from every riser and every runout until the odor of gas is present at every gas connection.

7. Flushing: Flush water piping systems with clean water following successful testing. Refer to Section 15100 for additional pipe cleaning and flushing requirements.

8. **[Laboratory Air and Vacuum Piping Systems: Test laboratory air vacuum piping with compressed air or nitrogen at a pressure of 150 psi for a period of 24 hours. Repair all leaks, replacing materials as necessary, and repeat tests until systems have been proven tight.]**

C. Disinfection of Potable Water Systems: Disinfect all underground and above ground potable water lines for new construction projects and major renovation projects to ensure compliance with the methods and procedures outlined in ANSI/AWWA Standard C651 and meet the bacteriological standards. Underground potable water lines shall be considered those potable water lines downstream from the water meter; above ground water lines shall be considered those potable water lines upstream from the water meter.

Contractor is responsible for demonstrating a thorough laboratory testing and analysis of the potable water system to meet compliance standards listed below. A CO or TCO will not be issued until satisfactory final testing results are received. Recommended timing for receipt of test results is at least three weeks prior to scheduled Substantial Completion or Occupancy.

1. Reference Standards and External Information:

   a. ANSI/AWWA Standard C651 - The Water Main Disinfection Standard

   b. A Compilation of Water Quality Goals, 17th Edition, January 2016: http://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/docs/wq_goals_text.pdf (California)

   c. EPA National Primary Drinking Water Regulations (NPDWRs) and Secondary Drinking Water Standards.

2. Responsibilities
    a. The plumbing contractor will provide the personnel, equipment and materials necessary to perform the actual disinfection of the underground lines in compliance with ANSI/AWWA Standard C651.
    b. When a sub-contractor performs the disinfection procedure, it is the joint responsibility of both the general contractor and designated sub-contractor to comply with this procedure.
    c. Environmental Health and Safety (EHLS), with the assistance of Owner's 3rd-party sampler/testing lab, is responsible for witnessing all analytical tests and verifying that the building's plumbing system meets the minimum bacteriological standards as set forth by the Texas Department of Health and Safety Code and the EPA NPDWRS. This will be accomplished by the test results received from the testing laboratory.
    d. EHLS inspector/s will verify the chlorine residual at the end of the retention time and issue a flush order.
    e. Facilities Planning and Construction (FPC) is responsible for overseeing the entire disinfection procedure including verification of the chlorine residual.
3. Standard Disinfection Procedure for all Underground Potable Water Lines
    a. EHLS and Owner's 3rd-party sampler/testing lab must be present at flushing and sampling procedures. Plumbing contractor must provide 48 hours notification to EHLS inspectors prior to the flushing and sampling procedures taking place.
    b. EHLS strongly prefers the use of the slug method (calcium hypochlorite tablets placed in each section of water lines as the lines are installed) in disinfecting potable water systems. EHLS also requires that the initial Chlorine Residual shall be at least 100 ppm (100 mg/L).
    c. Tablet or Continuous feed methods require prior approval by EHLS prior to the installation of the underground piping.
    d. Alternative forms of chlorine that may be used in the disinfection operations (with EHLS approval prior to lines being installed) include liquid chlorine, sodium hypochlorite solution or granules or tablets.
    e. EHLS inspector/s will verify the chlorine residual at the end of the retention time and issue a flush order.
    f. The entire system shall be continuously flushed with clear potable water. The flush water shall be directed into a sanitary sewer system in accordance with the municipal separate storm water sewer system (MS4) adopted by the University of Houston (http://www.uh.edu/ehls/environmental/water). Alternative methods of collection of the flush water can be utilized with prior approval from EHLS.
    g. The chlorine residual in the effluent shall be monitored on a periodic basis. When the chlorine residual is equal to the chlorine residual in the distribution system, the system has been properly flushed. The FPC inspector will then contact EHLS to arrange for bacteriological testing.
4. Emergency Slug Method:
    a. In cases of emergency when the system must be returned to service as soon as possible, a chlorine residual of 325 ppm with a contact time of only 15 minutes may be used with prior approval from EHLS (Sec. 10.4 of Std. C651-92). The affected section can be flushed and returned to service if the chlorine residual is not less than 300 ppm when the emergency methods were employed.

b. EHLS, with the assistance of Owner's 3rd-party sampler/testing lab, will sample the system to ensure the water meets minimum bacteriological standards after the system has been placed back into service.

5. Bacteriological Analysis of the Underground Potable Water Lines

   a. Upon completion of flushing and receipt of "passing" testing results , EHLS with the assistance of Owner's 3rd-party sampler/testing lab, will re-sample the water system effluent from the sample cock (the end of the distribution line used for water sampling). The Total Coliform Count Method, as summarized in "Standard Methods for the Examination of Water and Wastewater" A.P.H.A. American Public Health Association, will be used to verify the bacteriological water quality.

   b. When all samples demonstrate that the water system meets the minimum APHA and EPA NPDWRs) standards, EHLS will sign off on the disinfection procedure.

   c. The minimum standards are:

      - Total Coliform Count (CFU/ml -- Coliform Forming Units per milliliter of water) = Zero.
      - Heterotrophic Plate Count = 500 CFU/ml or less.

6. Chlorination Procedure for the Above Ground Potable Water Lines:

   a. The EHLS inspector will verify ALL underground distribution lines (upstream from the meter) have been properly disinfected.

   b. The entire building distribution system shall be continuously flushed with clear potable water. When complete, the contractor will then notify the EHLS inspector.

   c. The FP&C Project Manager will contact EHLS to arrange for bacteriological testing of the new system.

7. Bacteriological and Taste/Color/Odor Analysis for the Above Ground Potable Water Lines:

   a. Upon completion of flushing and receipt of "passing" testing results, EHLS with the assistance of Owner's 3rd-party sampler/testing lab will re-sample the water system effluent from the sample cock. The Samples taken will be sent to the laboratory for a EPA Primary and secondary analysis.

   b. FPC/EHLS will also conduct a Heterotrophic Plate Count of water samples from the safety showers and eyewash stations. Ensure the drinking fountains, safety shower and eyewash stations have been thoroughly flushed.

   c. When all samples demonstrate that the water system meets the minimum APHA, EPA NPDWRs and Secondary Drinking Water standards, EHLS will sign off on the disinfection procedure.

   d. The minimum standards are

      - Total Coliform Count (CFU/ml -- Coliform Forming Units per milliliter of water) =Zero.
      - Heterotrophic Plate Count = 500 CFU/ml or less.
      - EPA National Primary Drinking Water Regulations (NPDWRs) and Secondary Drinking Water Standards.

8. Reporting Requirements:

   a. The general contractor will notify EHLS of all scheduled building chlorination procedures at least <u>two days</u> prior to disinfecting the potable water system. The general contractor will notify EHLS of all scheduled building chlorination procedures at least <u>two days</u> prior to disinfecting the potable water system. In situations where the building is partially occupied, the slug procedure requires notification to anyone in the building

performing operations involving eye wash or safety showers that operations must stop during this period: water would not be considered safe for these uses unless the chlorination operation can be isolated.

9. Competency Assessment and Training Requirements:

   Sampler must have extensive knowledge in taking water samples for a registered water Laboratory.

D. Cleaning and Adjusting: Thoroughly clean and disinfect all plumbing fixtures, including all exposed trim. Adjust all flush valves for proper flushing, but without excess use of water. Demonstrate to the Engineer that the entire plumbing system and all its components are functioning properly.

E. Inspecting: Visually inspect each run of each system for completion of joints, adequate hangers, supports, and inclusion of accessories and appurtenances.

F. Grooved Piping Installation: Grooved joint piping systems shall be installed in accordance with the manufacturer's (Victaulic) guidelines and recommendations. All grooved couplings, fittings, valves and specialties shall be supplied by a single manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be supplied by Victaulic. Grooved end shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove. A Victaulic factory trained field representative shall provide on-site training to contractor's field personnel in the installation of grooved piping products. Factory trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

3.12 IDENTIFICATION:

A. Refer to Section 23 03 00 for applicable painting, nameplates, and labeling requirements.

END OF SECTION 22 00 00