

DIVISION 22 – PLUMBING

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22 00 00. PLUMBING

22 00 03. GENERAL PROVISIONS

- .1 ALTERNATES OR ALTERNATIVES: Refer to Division 01 for instructions regarding use of the word "Alternate".
- .2 ALTERNATE MATERIALS FOR ACID WASTE SYSTEMS: Refer to 22 10 00 (15411) for pipe and pipe fittings. One of the acceptable materials shall be specified as the base bid and one or more of the others shall be specified as an alternate. Acid dilution tanks, which are a part of acid waste systems, should be located in such a way that they are easily accessible for servicing.
- .3 CODES: All materials and installations shall be compliant with the current Ohio Building Code, and the current Ohio Plumbing Code.
- .4 SEWER AND WATER TAPS: City of Columbus Sanitary Sewer Tap Fees and System Capacity Charges shall be paid by the contractor doing the work. Costs of and arrangements for sewer and water taps, including capacity charges, must be resolved with the University Architect before preparation of final documents. Also see Division 33 – Utilities (02600.3, Site Utilities).

22 00 05. SUBMITTALS:

- .1 STATE INSPECTION CERTIFICATE: Soil, waste, and vent piping shall be approved by the State of Ohio Department of Health. Work shall be inspected by the State Plumbing Inspector and a copy of the final inspection certificate shall be delivered to the University Architect.
 - .1.1 Fees: Specify that inspection fees shall be a part of the contractor's job cost.
- .2 TEST REPORTS: Submit reports of all tests required by 22 00 07.

22 00 07. TESTING

- .1 Underground Water Service Piping: Test with water at 150 psig pressure, in accordance with AWWA procedures.
- .2 Interior Water Piping: Test with water, at 125 psig pressure, for a period of not less than 6 consecutive hours.
- .3 Domestic Water Supply Piping: Flush and sterilize under the supervision of a qualified consultant. Provide the University Architect with written certification of sterility and confirm that the piping system is clean and safe to transmit water for human consumption. The sterilization method to be followed shall be that prescribed by the health authority having jurisdiction or water purveyor having jurisdiction, or in the absence of a prescribed method, the procedure described in either AWWA C651 or AWWA C652, or as described in the Ohio Building Code, Ohio Plumbing Code Section 610.1, whichever is the more stringent.
- .4 Gas Service Piping and Interior Gas Piping: Test with nitrogen for a period of 24 consecutive hours in conformance with the rules and regulations of the local gas supplier. Submit test report.

22 00 00. PLUMBING (Cont'd)

22 00 07. TESTING (Cont'd)

- .4.1 A minimum of 48 hours notice shall be given in writing to the University Architect prior to the purging of lines. Purging shall be performed in conformance with recommendations of and under supervision of the local gas supplier. Venting during purging operations shall be to the outside of buildings at a safe location.
- .5 Exterior Storm and Sanitary Sewers: Test according to the requirements of the City of Columbus Section 901.10 of the Construction and Material Specifications, or to the Ohio Building Code, Ohio Plumbing Code, or to the Authority Having Jurisdiction, whichever is the most stringent.
- .6 Compressed Air Piping: Test to 125 psig for 6 hours.
- .7 LP Gas Systems: Should be purged and tested in accordance with the latest edition of NFPA 58. Submit test report.
- .8 Oxygen and/or Surgical or Miscellaneous Gas Lines: Test as recommended by National Cylinder Gas and NFPA. Consult the University Architect for any special testing or purging requirements.
- .9 Recording Line Charts shall be specified for all gaseous pressure testing.

22 00 09. RELATED WORK IN GENERAL CONSTRUCTION:

.1 WATER SUPPLY PIPING INSTALLATION:

- .1.1 Provide a minimum of 42 inches cover over pipe to prevent freezing.
- .1.2 Provide concrete anchors and steel yokes on all fittings with over 1/16 bend. Details shall be shown on drawings.
- .1.3 A 2 feet wide by 1 foot thick reinforced concrete bridge beam shall be keyed into the foundation wall immediately under any water service line to the building. This beam will be carried out from the building wall to firm support beyond the excavation for the building wall.

.2 GAS PIPING BACKFILL: Specify that no backfill operations be performed until piping installation has been tested and approved.

- .2.1 Sand: Use only clean sand, free of rubble and rocks of 1- 1/2 inch diameter or greater.
- .2.2 Backfilling: Deposit sand to a depth of 3 inches above and below piping. Caution the contractor to exercise care to prevent breaking of wires and displacement of anodes. Remainder of backfill shall be made with clean excavated material free of rubble, rocks, bricks, wood or debris placed and compacted in accordance with requirements stated in Division 2 of these guides. Grits are prohibited.

.3 CLEANING AND PAINTING: Cleaning of fixtures and equipment shall be included in the Plumbing Contract. Painting may be a divided responsibility of the General Contractor and the Plumbing Contractor. The Associate shall coordinate the specifications to clearly indicate each contractor's responsibilities in order to avoid double costs for identical work or total omission of the work. See Section 09 90 00 (09900).

22 05 05. PLUMBING MATERIALS AND METHODS

22 05 07. SLEEVES: Sleeves shall be provided for piping through all walls and floors. See Facility Services-3.12 through 3.12.3.4.

22 05 09. SUPPORTING DEVICES: Refer to PART FOUR, Facility Services-3.15 and 3.19.2 for general requirements.

22 05 20. METERS, GAUGES AND THERMOMETERS

.1 METERS:

.1.1 Temporary services are usually metered. Refer to Division One, 01 51 00.2 (01511.2) for possible metering requirements.

.1.2 Permanent utility services to each building require permanent metering.

.1.3 Water supply metering shall: Conform to requirements of the utility system providing the water, read in cubic feet, permit connection of a remote readout register, and be flanged and valved to permit convenient replacement of metering.

.1.4 Gas supply metering shall: Conform to requirements of the utility system providing the gas, be located in a boiler room or outside of the building, and be valved to permit convenient replacement of metering. Venting pipes shall be vented to outside of the building.

.1.5 Sewer auxiliary meters: Locate deductive water meters on cooling towers, water-cooled devices which discharge directly to storm sewers and lawn irrigation systems. Comply with all installation policies and requirements of the Division of Sewerage and Drainage having jurisdiction. Deduct meters shall read in cubic feet consistent with City of Columbus requirements or as required by the authority having jurisdiction. See Appendix H for City of Columbus requirements.

.2 GAUGES:

.2.1 Gauges shall be 4-1/2 inches in diameter single spring type with recalibration adjustment in the dial face and with gate valve shut-off. Tailor the range to the application. Gauges shall not be positioned over 6 feet above the floor; install remote sensing gauges as required to conform with this restriction.

.2.2 Water supply: Locate a pressure gauge at the water service entrance and elsewhere as needed to properly identify pressure within the piping system.

.2.3 Domestic hot water: Locate pressure gauges on suction and discharge sides of pumps and elsewhere as needed to properly identify pressure within the piping system. When hot water is supplied by the power plant, provide gauges on both supply and return.

.2.4 Gas service: Locate pressure gauges at the service entrance and upstream and downstream of pressure reducing valves.

.2.5 Other piped systems: Locate vacuum or pressure gauges as required to properly identify pressure within each system. Provide pressure gauges at entrance and exit locations for steam supply, condensate return, hot water supply and hot water return.

22 05 05. PLUMBING MATERIALS AND METHODS (Cont'd)

22 05 20. METERS, GAUGES AND THERMOMETERS (Cont'd)

.3 THERMOMETERS:

- .3.1 Thermometers shall be mercury-free, red-reading-in-glass type with 9-inch magnified column, Fahrenheit scale, recalibration feature, and adjustable head. Tailor the range to the application. Installation shall be in brass or stainless steel pressure tight separable well with heat transfer paste. Thermometers shall not be positioned over 6-feet above the floor; install remote head type of thermometers as required to conform with this restriction.
- .3.2 Piped systems and storage tanks: Locate thermometers as required on all systems or tanks where temperature should be identifiable for operation and maintenance. Provide at building entrance and exit locations for steam supply, condensate return, hot water supply and hot water return.

22 05 25. VALVES

.1 GENERAL REQUIREMENTS

- .1.1 Proprietary specifications: All valve-types (e.g. flush valves, ball valves, balance valves, etc.) provided for a single project shall be products of a single manufacturer. Specify three (3) proven equal manufacturers for the contractor to select from.
- .1.2 Valve tags: Specify that each valve in each piping system be tagged with a brass or aluminum tag numbered consecutively for each system and attached to the valve with a brass or aluminum chain. Valve tags shall have stamped abbreviations of the system in addition to the valve number.
- .1.3 Valve chart: The Associate shall determine the location for installation of a valve chart and shall specify that a typewritten directory of all valve numbers (by system, describing location) be furnished, framed under glass, and installed in the equipment room where indicated. A copy of the valve directory shall be bound in a hard fiber binder and delivered to the Associate for forwarding to the University Architect's Office.
- .1.4 Design requirements:
 - .1.4.1 Shut-off valves shall be provided on all branches off main water lines and ahead of dielectric unions. Branches shall be provided with drain valves to facilitate drainage of branches.
 - .1.4.2 Fixture Stops: Each fixture and piece of equipment shall be provided with a fixture stop. Groups of fixtures shall be valved separately. Stops for flush valves shall be screwdriver stops with protective caps; all other shall be handwheel stops.
 - .1.4.3 Unions and Fittings: A union or bolted flange fitting shall be provided downstream of, and within approximately 12 in. of each valve, and adjacent to both inlet and outlet of pumps and other equipment.
 - .1.4.4 Flush Valves: Expose for easier maintenance.

22 05 05. PLUMBING MATERIALS AND METHODS (Cont'd)

22 05 25. VALVES (Cont'd)

.2 GATE VALVES:

- .2.1 2-1/2 inches and smaller, brass or bronze body, trim and stem, solid wedge, rising stem, union bonnet, 125 pounds screwed ends.
- .2.2 3 inches and larger, iron body, bronze trimmed, O.S. & Y. 125 pounds flanged, (conforming to the City of Columbus Item 802).

.3 VALVE BOXES: Valve boxes shall be furnished on all valves of water service piping. Boxes shall be extended to final grade or pavement. The word "WATER" shall be cast in the cover. A 3 inches galvanized steel pipe shall be installed in each valve box to prevent misalignment. Liners shall be removed as the last item of work at the installation.

.4 GAS COCKS:

- .4.1 1-1/2 inches and smaller, screwed, all brass 150 lb. WOG.
- .4.2 2 inches and larger, lubricated types, 175 pounds WOG.
- .4.3 Valves shall be labeled as required to be compliant with all requirements of the International Fuel Gas Code (IFGC), as referenced within the Ohio Building Code.

.5 GLOBE AND ANGLE VALVES:

- .5.1 2-1/2 inches and smaller, brass or bronze body, trim and stem, union bonnet, 125 pounds screwed ends.
- .5.2 3 inches and larger, iron body, bronze trimmed, 125 pounds flanged.

.6 CHECK VALVES:

- .6.1 2-1/2 inches and smaller, swing check type, brass or bronze, renewable, disc, 125 pounds screwed ends.
- .6.2 3 inches and larger, swing check type, iron body, bronze trimmed, bolted cap, 125 pounds flanged ends.
- .6.3 Spring loaded check valves, flanged silent center guide, 250 lb. semi-steel body, bronze stem, 1/16 inch raised face.

.7 BALL VALVES:

- .7.1 3 inch and smaller, two or three piece bronze body, screwed ends, chrome plated brass or stainless steel ball, steel stem, reinforced TFE packing and seat ring with appropriate pressure and temperature rating for specific application.

.8 BUTTERFLY VALVES:

- .8.1 2 inch and larger, ductile iron disc and body, extended neck, geometric drive, molded-in seat liner, stainless steel stem, EPDM rubber liner, 125 pounds. Lug or wafer style.

22 05 05. PLUMBING MATERIALS AND METHODS (Cont'd)

22 05 25. VALVES (Cont'd)

.9 **BACKFLOW PREVENTION DEVICES:** As required and specified per Ohio Building Code, Ohio Plumbing Code and all referenced ASSE standards. Provide 3/4-inch minimum size drain line to floor drain. Units must be removable and accessible for maintenance. The Ohio Environmental Protection Agency specifies those situations in which backflow prevention devices and arrangements shall be used. Code-approved air gaps are recommended and pumping units with code-approved air gaps are also recommended. Where air gaps and vacuum breakers are not acceptable, products of the following manufacturers of backflow prevention devices are approved:

Size in Inches	Model	Manufacturer
4; 6; 8; 10	BEECO #6 or 6U	Hershey Products, Inc. Dedham, Mass. 02026
1; 1-1/2; 2; 2- 1/2, 3; 4; 6; 8; 10	BEECO #6C	Hershey Products
1; 1-1/2	BEECO #10	Hershey Products
3/4	BEECO #12	Hershey Products
3/4; 1; 1-1/2, 2; 3	BEECO #14	Hershey Products
3/4	#80-0059	The Toro Co. San Marcos, CA 92069
1	#9- 2770	The Toro Co.
3/4; 1; 1-1/4, 1-1/2; 2; 3	#900	Watts Regulator Co. Lawrence, Mass. 01842
3/4	BF-075	Richwell Valve Co. Santa Anna, CA 92707
1	BF-100	Richwell Valve Co.

22 05 50. VIBRATION AND SEISMIC CONTROLS

.1 **DESIGN REQUIREMENTS:** Refer to PART ONE. Specify sound emission and transmission controls as required to meet standards indicated in the Table entitled, "Ranges of Design Limits for Sound Control" in the Appendix, or when applicable, to meet Federal standards.

.2 **WATER SUPPLY PIPING:** Shock absorbers shall be provided in accordance with the Plumbing and Drainage Institute Standard PDI-WH201. Shock absorbers shall have stainless steel air chamber and brass, bronze, or stainless steel body.

.3 **COMPRESSED AIR SYSTEMS:** Vibration isolators or inertia pads shall be provided under air compressors. Flexible connectors shall be provided on discharge line of compressor.

.4 **DOMESTIC HOT WATER SYSTEMS:** Branch connections to hot water risers shall be designed with adequate provision for movement.

.5 **VACUUM PUMPS:** Shock absorbers shall be provided similar to those for Water Supply Piping.

22 07 00. PLUMBING INSULATION

22 07 16. PLUMBING EQUIPMENT INSULATION

.1 **STORAGE TANK INSULATION:** Insulation for hot water and cold water storage tanks shall comply with Federal Specifications HH-I-530A.

22 07 00. PLUMBING INSULATION (Cont'd)

22 07 16. PLUMBING EQUIPMENT INSULATION (Cont'd)

- .1.1 For domestic hot water storage tanks: Recommended thickness 2 inch, density 6 pounds/cubic foot, compressive strength 300 psi at 10% deformation, thermal conductivity .32 Btu/(hour) (square foot) (F degrees/inch) at 175 degrees mean temperature.
- .1.2 For cold water tanks: Recommended thickness 2 inch, density 9 pound/cubic foot, compressive strength 530 psi at 10 percent deformation.

.2 FLUE INSULATION: Domestic hot water heater flues shall be insulated when required for safety or for reducing heat transfer.

22 07 19. PLUMBING PIPING INSULATION

.1 PIPING INSULATION: Fibrous glass, or equal mineral fiber, molded sectional type covering. Asbestos is expressly prohibited and water-soluble treatment of insulation jacket to impede or retard flame or smoke is also prohibited. Insulation thickness and R-value shall be as required by the Ohio Building Code, Ohio Plumbing Code, whichever is more energy efficient.

- .1.1 Concealed locations: Insulation for cold water piping shall be provided with a factory-applied fire retardant vapor barrier jacket with self-sealing lap; insulation for domestic hot water piping shall be provided without vapor barrier.
- .1.2 Exposed locations: Insulation for both cold and hot water piping in exposed locations shall be of 7 pound density and jacket shall have pre-sized glass cloth.
- .1.3 Insulation for interior downspout piping, roof drain sumps, water cooler wastes, and chilled water wastes shall be of 7 pound density, with or without jacket as required for the location.
- .1.4 Thicknesses:
 - .1.4.1 Insulation on cold water piping, interior downspout piping, roof drain sumps, water cooler wastes, and chilled water wastes shall be at least 1/2 inch thick. Insulation on piping 3 inch and larger shall be at least 3/4 inch thick.
 - .1.4.2 Insulation on domestic hot water lines 2 inch and smaller shall be 1 inch thick. Insulation on piping 2-1/2 inch and larger shall be 1-1/2 inch thick.
- .1.5 Installations: Insulation shall be installed over hangers and supports and shall be carried continuous through all sleeves. In addition to the following requirements, specify any other insulation required. All of the following piping shall be insulated:
 - .1.5.1 Cold Water Lines.
 - .1.5.2 Domestic hot water lines, including recirculating lines and storage lines.
 - .1.5.3 Horizontal runs from roof drains and horizontal downspouts, inside buildings.
 - .1.5.4 Roof drain sumps, inside buildings.

22 07 00. PLUMBING INSULATION (Cont'd)

22 07 19. PLUMBING PIPING INSULATION (Cont'd)

.1 PIPING INSULATION: (Cont'd)

.1.5.5 Exposed horizontal waste lines from water coolers and lines carrying chilled water waste.

22 10 00. PLUMBING PIPING AND PUMPS

22 10 05. PIPE AND PIPE FITTINGS

.1 PROHIBITED INSTALLATIONS:

.1.1 Water, sewer, drain, steam, condensate and gas lines shall not be designed for installation over electrical switchgear and transformers, or in elevator or electrical equipment rooms and shafts. This is not intended to prohibit sprinklers in electrical equipment rooms.

.1.2 Bullhead connections in any piping service are expressly prohibited except air, gas or cold water lines.

.1.3 Mass waste piping under slabs or underground is prohibited.

.2 STEEL PIPE: A120/A53 is acceptable in lieu of either A120 or A53 Type F, provided that all of the other restrictions governing the use of either grade are followed. If the dual graded pipe is to be used in place of A53, Type F, the vendor will provide mill certification signed by the manufacturer's chief metallurgist. Said certification shall conform to the ASTM A-53 requirements for chemistry, tensile, bending/flattening, and hydrostatic testing. It is strongly recommended that, if dual graded pipe is specified, that it be specified as domestically produced so that the University has recourse in event of non-specification compliance.

.3 UNDERGROUND WATER PIPE

.3.1 Underground Water Pipe (Exterior) underground water distribution system shall be designed to the City of Columbus Construction and Material Specifications, most current version, Section 800, except as noted in the following paragraphs 22 10 05.3.2 and 22 10 05.3.3.

.3.2 Sizes 4 inch and under -- hard drawn type K copper tubing with minimum number of cast bronze or wrought copper class 150 lb. socket solder fittings.

.3.3 Sizes 5 inch through 20 inch (4 inch optional) ductile iron, manufactured and labeled as AWWA C151; AWWA C115 from the factory and labeled with the words, "DUCTILE IRON". Pipe shall be furnished with a thin bituminous-coated cement lining and with an outside coating of bitumastic enamel, or approved equal. Physical properties and wall thicknesses shall be:

Tensile strength	50,000 psi minimum
Yield strength	42,000 psi minimum
Elongation in 2 inch	10% minimum
Hardness Rockwell	B-90 maximum

22 10 00. PLUMBING PIPING AND PUMPS (Cont'd)

22 10 05. PIPE AND PIPE FITTINGS (Cont'd)

.3 UNDERGROUND WATER PIPE (Cont'd)

Nominal Size	Class	Wall Thickness
4 inch	53	0.32 inch
8 inch	53	0.36 inch
12 inch	54	0.43 inch
20 inch	54	0.48 inch

Pipe shall have slip ring joints and fittings shall be Class 250 grey cast iron with mechanical joints.

.4 INTERIOR COLD WATER AND DOMESTIC HOT WATER PIPING: Connections to valves or equipment shall be flanged. Branch off with valves to isolate areas of the building so that the entire water supply does not have to be shut off during repairs.

.4.1 4 inch and smaller, hard drawn type L copper tubing, with cast bronze or wrought copper class 150 lb., socket solder fittings.

.4.2 5 inch and larger, (optional 4 inch) galvanized steel pipe, Schedule 40, conforming to ASTM-A53, Type E, Grade B Fittings shall be Class 150 lb. malleable iron, galvanized, screwed pattern. Fittings, on 6 in. and larger, cast iron with Class 125 lb. flanges.

.5 DRIP LINES: Type L copper tubing with copper fittings.

.6 SPECIAL PIPING

.6.1 Distilled water: Schedule 80 CPVC, "Orion White Line" or Enfield "Purity Sustained" polypropylene plastic or tin-lined copper pipe with appropriate fittings may be used. If plastic is used, quality control of joint fusing is critical to performance.

.6.2 Compressed air piping: Seamless hard-copper tubing, type L or K, with cast bronze or wrought copper class 150 lb. socket solder fittings, or Schedule 40 A120/A53 or ASTM A120 galvanized steel pipe with screwed galvanized fittings, class 150 lb.

.6.3 Oxygen pipe lines: Cleaned seamless copper tubing, type K or L, or Schedule 40 brass pipe. Fittings shall be cleaned wrought copper.

.6.4 Other: Pipe and fittings for acid distribution, alkaline distribution, process piping, lubricating oil, high pressure, unusual gases, etc. shall be individually reviewed with the University Architect. Also see 22 20 07 (15453).

.6.5 Medical Gas piping: Medical gas designs, materials, and installations shall be compliant per Ohio Building Code, Ohio Plumbing Code, and NFPA 99C, ASME B31.1, NFPA 50, and NFPA 51.

.7 GAS PIPING:

.7.1 Conformance: Comply with requirements of the gas utility company that will supply gas to be used at the site.

22 10 00. PLUMBING PIPING AND PUMPS (Cont'd)

22 10 05. PIPE AND PIPE FITTINGS (Cont'd)

.7 GAS PIPING: (Cont'd)

.7.2 Underground piping

.7.2.1 Steel Pipe, if used, shall be Schedule 40, A120/A53, ASTM A-120, Type F, or ASTM A-53, Type F if 4 inch NPS or smaller. If 5 inch NPS or larger, steel pipe shall be ASTM A53, Type E, Grade B, Schedule 40. All pipe shall be black steel with factory applied plastic coating or factory applied tar and paper wrapper. Joints shall be welded and wrapped with asphaltum type tape. Use backing rings for welding 8-inch and larger pipe. Provide isolation fittings and cathodic protection for each underground piping system per Section 22 70 30 (15490).

.7.2.2 Plastic Pipe, if used, shall be high density heavy wall plastic piping with two No. 12 TW single strand, single conductor, copper tracer and lead wires together with plastic curb boxes and terminal blocks. Joints and fittings will be fusion welded. Quality control is critical to performance.

.7.3 Interior piping shall be Schedule 40, A120/A53, ASTM A-120, Type F, or ASTM A53, Type F, Grade B black steel pipe. Joints in 1-1/2 inch and smaller pipe may be screwed. Fittings, class 150 lb. banded, malleable iron, black. Use of bushings is prohibited. Weld joints in pipe 2 inch and larger. Use backing rings for welding 8 inch and larger pipe.

.8 PIPING FOR SOIL, WASTE, AND STORM DRAINS

.8.1 Exterior storm sewers: (Minimal pipe size shall be 8" for all piping that is not a roof leader) Acceptable materials are type PSM PVC pipe for 4 inch and 6 inch diameters conforming to ASTM D-3034, extra strength ASTM C700 vitrified clay pipe for 4 inch and larger diameters, and reinforced concrete pipe (ASTM C-76 deleting Sections 3.1.2 and 11. regarding design, concrete compression testing and production core and cylinder tests) for 6 inch and larger diameters, and corrugated polyethylene N-12 pipe conforming to ASTM-F405 and AASHSTO M252 for pipe 4" to 36" in diameter.

.8.1.1 For clay pipe, joints shall conform to ASTM C-425 Compression Joints for Vitrified Clay Bell and Spigot Pipe. For concrete pipe, joints shall conform to ASTM C-443 Type A Rubber Gasket. Also see 22 20 07 (15453).

.8.2 Exterior sanitary sewers: Acceptable materials are type PSM PVC pipe for 4 inch diameters conforming to ASTM D-3034, extra strength vitrified clay pipe for 4 inch and larger diameters and service weight cast iron pipe for 4 inch and larger diameters, and PVC SDR-26 pipe for 6" and larger diameters. .8.3 Interior acid waste and vents: Piping above grade may be either Borosilicate glass or Duriron. Duriron shall be used below grade. See 22 00 03 (15402) and 22 20 07 (15453).

.8.4 Interior vents, soil, waste and storm drains except underground: Extra-heavy or service weight centrifugally cast iron soil pipe with lead, rubber gasket or "no hub" joints may be used for 1-1/2 inch diameter and larger pipe. When rubber gaskets are used, specify "Dual-Tight" or "Ty-Seal" with lubricant equal to "Lubrifax". Schedule 40 ASTM A120, type F, galvanized steel pipe, with galvanized cast iron drainage type fittings may be used for 2-1/2 inch diameter and smaller. Type L copper tubing and copper drainage fittings for waste and

22 10 00. PLUMBING PIPING AND PUMPS (Cont'd)

22 10 05. PIPE AND PIPE FITTINGS (Cont'd)

.8 PIPING FOR SOIL, WASTE, AND STORM DRAINS: (Cont'd)

type M copper tubing for vents may be used for 4 inch diameter and smaller. Provide structural support for large pipe and lateral restraint for all kinetic forces. PVC piping for interior vents, soil, waste and storm drains including using as sleeves shall be prohibited.

.8.5 Interior underground vent, soil, waste and storm drains: Extra-heavy weight centrifugally cast iron soil pipe with lead, rubber gasket or "no hub" joints may be used. When rubber gaskets are used, specify "Dual-Tight" or "Ty-Seal" with lubricant equal to "Lubrifast". Type K copper tubing and copper drainage fittings may be used for 3 inch diameter and smaller.

.9 COPPER CONNECTIONS: Solder joints for copper water lines should be made with no-lead solder in order to minimize the exposure to lead; water coolers must be lead-free.

.9.1 Copper solder joints: Copper piping less than 2 inch may be soldered using 95/5 tin/antimony solder. Copper piping 2 inch and larger shall use a 6 percent silver alloy with a 1000°F solidus minimum and comparable to J.W. Harris Co., Dynaflo.

.9.2 Connections between copper and steel piping: Those carrying water shall be made with an approved type dielectric union. Specify that all dielectric unions used have the highest temperature rating. Where it is practical use a dielectric nipple on the equipment.

22 14 00. FACILITY STORM DRAINAGE

1 ROOF DRAINAGE:

.1.1 COORDINATION: Location and depth of drains shall be carefully coordinated to assure adequate pitch of the drainage area to drain.

.1.2 DRAINS: Roof drains shall be cast iron with removable combined beehive strainer and sediment cup. Roof drains for multistory building or one-story buildings equivalent to at least two stories in height shall be provided with integral expansion joint.

.1.3 FLASHING: Drains shall be installed with lead sheet weighing not less than 6 pounds per square foot extending a minimum of 12 inches in all directions outward from the clamping ring. Lead flashing shall be placed below the roof insulation, and insulation shall be tapered down to the drain. Specifications shall call attention to the requirement for coordination with the installation of roofing.

.2 AREA DRAINAGE:

.2.1 OPEN AREA DRAINS: Where drains are subject to clogging with leaves, select drains which will avoid pooling of water.

.2.2 AREAWAY DRAINS: In areaways, at landings at the foot of exterior stairways, and similar locations, provide angular strainers at the wall and floor intersection, so vertical face acts as an overflow when the horizontal portion of the grating is obstructed.

22 14 00. FACILITY STORM DRAINAGE (Cont'd)

.2 AREA DRAINAGE: (Cont'd)

- .2.3 WHEELCHAIR RAMPS: Where drainage is required at the base of wheelchair ramps, trench drains shall be used with slotted grating designed not to create a hazard to wheelchairs.

22 20 00. PLUMBING SYSTEMS

22 20 05. WATER SUPPLY SYSTEM

- .1 Refer to PART ONE and to paragraph 22 00 09 (15408) for particular items requiring coordination with General Construction.

- .2 STERILIZATION: Specify that new and reworked domestic water piping be sterilized by a firm regularly engaged in the performance of pipe sterilization. See 22 00 05.3 (15407.23).

.3 DESIGN OF SYSTEM:

- .3.1 Provisions for Expansion and Movement in piping shall be shown on the drawings.

- .3.2 Unions shall be provided at the following locations:

.3.2.1 Adjacent to and downstream from all valves.

.3.2.2 At final connections to all items of equipment.

.3.2.3 At connections to all plumbing fixtures.

.3.2.4 Unions or flanged connections - where required for construction or assembling purposes.

- .3.3 Water service lines shall not be caulked and leaded into a building wall; tar, rubber, or some other soft material shall be used. Special wall sleeve fittings with soft rubber seals are approved. A swing joint shall be provided on water lines just inside the building, to compensate for pipe movement. Specify that threading of cast iron or ductile iron pipe is prohibited.

- .3.4 In buildings containing laboratories, water lines to drinking fountains shall be run on separate risers connected to the mains ahead of laboratory equipment lines. Vacuum breakers shall be provided at all laboratory equipment and laboratory water lines.

- .3.5 Check Valves shall be provided on showers, automatic washers, and other items or equipment equipped with cold and hot water mixers. Refer to paragraph 22 05 25 (15435) for requirements for valves.

22 20 06. DOMESTIC HOT WATER

.1 DESIGN OF SYSTEMS

- .1.1 Domestic hot water systems shall be designed to reasonably assure an expeditious flow of hot water at ALL outlets. When the facility is large (i.e., multistory laboratory building) or the system is large to support heavy flow (i.e., hospital or gymnasium showers) with central domestic water heating, the design

22 20 00. PLUMBING SYSTEMS (Cont'd)

22 20 06. DOMESTIC HOT WATER (Cont'd)

.1 DESIGN OF SYSTEMS (Cont'd)

shall include recirculating line(s) and pump(s). When the total facility requirements are minimal and compact (i.e., fixture count of a small residence), or in the case of an isolated and remote minimal requirement in a large facility, the economics of space requirements and recirculating system must be calculated. An independent residential size water heater, backed up to the fixture(s) location, without recirculating system may be most appropriate. As a rough guide, domestic hot water systems shall dispense hot water after a flow of not over 1-1/2 quarts or within 10 seconds.

- .1.2 A Recirculating Line shall be provided for all mains. Except for short runouts, lines shall be a minimum of 3/4 inch for large facilities. See paragraph 22 20 06.1.1 (15452.1.1).
- .1.3 Unions or Flanged Connections shall be provided as specified in paragraph 22 20 05.3.2 (15451.2.2).
- .1.4 Maximum Fouling Factor shall be used in sizing domestic hot water heaters. Factory assembled units are recommended; installation should be by the manufacturer or his approved representative.
- .1.5 The use of heat exchangers without storage tanks is preferred to heat exchangers with storage tanks.
- .1.6 Shielding shall be specified around the packing areas of all circulating pumps.

22 20 07. SOIL AND WASTE SYSTEMS

.1 GENERAL PROVISIONS:

- .1.1 Preparation of Contract Documents: Refer to PART ONE. Consult the University Architect regarding labor jurisdictional decisions in the area where the project is located. Sewerage from 5 feet outside building walls might become a part of the General Contract. See 22 10 05.8.1 (15411.8.1).
- .1.2 Applicable Specifications and Codes: Sanitary sewers external to a building shall conform the City of Columbus Construction and Material Specifications to or State of Ohio Department of Transportation, Construction and Materials Specifications and to local building codes. When the City of Columbus or O.D.O.T. specifications and the code differ, the more demanding requirements shall govern.
- .1.3 Refer to paragraph 22 00 05 (15407), 01 33 13 (01341) and 01 77 00 (01700) for submittals, test reports and certificates required.

.2 DESIGN OF SYSTEMS:

- .2.1 Combined and Separate Systems: Combined storm and sanitary drains within the building structures are prohibited; each shall be run out of the building separately. (Part of the Columbus campus is served by a combined sewer system and part by separate sewer systems. The Associate shall obtain information from the University Architect relative to the sewer arrangement for each building area.) On regional campuses, storm and sanitary systems shall be designed as separate systems.

22 20 00. PLUMBING SYSTEMS (Cont'd)

22 20 07. SOIL AND WASTE SYSTEMS (Cont'd)

.2 DESIGN OF SYSTEMS: (Cont'd)

- .2.2 Storm Sewer Catch Basins and Roof Drains shall not be connected to sanitary systems except with specific permission from the University Architect. If such permission is granted, catch basins shall be parged inside and provided with inverted elbow traps with cleanouts large enough for easy cleaning. Manholes shall not be used for catch basins or yard drains.
- .2.3 Manholes shall be provided and shall be not more than 250 feet apart, except for large or very deep sewers. Lids shall be properly identified with cast-in lettering, indicating "STORM SEWER" or "SANITARY SEWER". Use the City of Columbus standard design.
- .2.4 Sewers shall be laid on a uniform grade from manhole to manhole. Double strength sewer tile shall be used when overburden is heavy or when sewer runs under roads. Sewers shall be extra heavy cast iron where buried under traffic areas with less than 3 feet of cover. Compression joints conforming to ASTM C-425 "Compression Joints for Vitrified Clay Bell and Spigot Pipe" shall be used on clay sewer pipe.
- .2.5 Cleanouts shall be provided on all downspouts before they enter the ground.
- .2.6 Joint Treatment: Caulked joints in soil pipe shall be caulked with white oakum and lead. The use of gaskets on joints as noted in paragraph 22 10 05.8 (15411.8) is acceptable. Lead shall not be used for caulking of joints in waste and vent lines where mercury might be used.
- .2.7 Floor Drains: In general, floor drains shall be provided in toilet rooms and in equipment and fan rooms. These drains shall not be placed in ducts or plenums, or places of negative air pressure. (This is to avoid drying traps and pulling sewer gas into the air system.) Floor drains with sediment bucket shall be provided in trash rooms serving kitchens. In emergency shower and eyewash areas, floor drains must be discussed with the University Architect.
- .2.8 Equipment Drains: Specify extra deep traps in locations subject to high pressure or vacuum such as fan housing, etc., to avoid loss of trap seal.
- .2.9 Drip Lines from pumps, automatic traps, automatic air vents and from equipment shall be located to discharge over adjacent floor drains. Drip lines from pumps shall be connected to stuffing box drip points, not at drip base of pump. A separate drip line from drip base to over adjacent floor drain shall be provided.
- .2.10 Flashing shall be provided for each vent. Flashing shall not be less than 4 lb. sheet lead and shall extend up and turn down inside top of vent. Specifications shall call attention to the requirement for coordination with the installation of roofing.
- .2.11 The Manufacturer's Detailed Instructions for the installation of acid waste and vent lines shall be included in the final specifications submittal.
- .2.12 Acid Neutralizing Sumps: Provide as required. Locate sumps for servicing ease.
- .2.13 Glass waste piping under slabs or underground is prohibited.

22 40 00. PLUMBING FIXTURES

- .1 FIXTURES AND APPURTENANCES: Fixtures shall be of standard types and design and shall be selected on the basis of providing low flow rates of water, either by design of by the installation of flow restrictors. Principal fixture consideration should be given to showerheads and faucets.
- .2 GENERAL PROVISION: Include in the specifications a statement that, during final inspection of the buildings, the contractor will be required to remove at least one randomly selected water closet in the presence of designated University personnel so that it can be checked for proper installation. If the one water closet is found to be installed in a defective manner, the contractor will be required to remove and properly reinstall all water closets.
- .3 DETAILS:
 - .3.1 Urinals and Water Closets: Siphon jet or blowout type urinals shall be used except where sound control is a problem. Water closets shall be elongated design with open front seat, color as approved by the University Architect's Office.
 - .3.2 Janitors' Sinks shall be precast terrazzo or molded stone (24 inch by 36 inch minimum) on the floor.
 - .3.3 Individual Electric Refrigerated Water Coolers shall be provided in new buildings. Wall hung types are preferred. The Associate shall determine the location of coolers for use by persons with disabilities and shall make adjustments in the building structures to assure accessibility to coolers by persons in wheelchairs. Water consumption shall not pass through, around or near lead of any form or sort.
 - .3.4 Shower Mixers shall be thermostatic mixing type.
 - .3.5 Built-up Shower Pans shall be detailed in the drawings and specified.
 - .3.6 Traps on Lavatories and Sinks shall be not less than 1-1/4 inch by 1-1/2 inch chrome plated cast brass "P" traps with brass nut.
 - .3.7 Supplies to Lavatory Fittings shall be flexible tube risers with steel handle stops, all chrome plated.

22 42 05. FIXTURE CARRIERS

- .1 FIXTURE CARRIERS: Lavatories, urinals, wall hung sinks, electric water coolers, and wall hung water closets shall be supported by chair carriers strongly anchored to withstand abusive eccentric loadings.
 - .1.1 Closet Chair or Carrier shall be selected so that the stud plate is supported by the wall back of the fixture. (It is important that this plate be against the wall to provide a rigid mounting.)
 - .1.2 Carriers shall be firmly anchored to the floor with maximum sized bolts that the feet will accommodate. Remember that people stand and bounce on fixtures so solid anchorage is imperative. Provide a template for bolts through the wall.

22 40 00. PLUMBING FIXTURES (Cont'd)

22 42 05. FIXTURE CARRIERS (Cont'd)

.1.3 Neoprene gaskets shall be used.

.1.4 The stud or nipple on the carrier shall be adjustable without cutting or defacing the wall and still maintain a tight joint.

22 70 00. SPECIAL SYSTEMS:

22 70 10. COMPRESSED AIR

.1 Refer to paragraph 22 70 10.4 for requirements for air compressors.

.2 AUTOMATIC CONDENSATE TRAPS shall be provided at all air receiver tanks and low points on compressed air line.

.3 COPPER PIPE shall be used where there is likelihood of rust or of dirt in the air.

.4 COMPRESSORS:

.4.1 Vibration isolation: Refer to paragraph 22 05 50.

.4.2 Air compressors (10 hp and under) shall be air cooled. Caution shall be exercised in locating compressors, with respect to heat producing equipment and room ambient temperature.

.4.3 Refrigerated coolers shall be used on air supply to building air control systems or equipment. If intake is extended, provide for easy maintenance.

22 70 20. AIR AND GAS PIPING SYSTEMS

.1 COMPRESSED AIR AND GAS PIPING: See 22 00 05, 22 00 09, 22 10 05.6, 22 10 05.7, 22 70 10.4, and 22 70 30.

.2 GAS BURNING EQUIPMENT: All gas burning equipment shall comply with the local gas company requirements, the State Code, and the City Code. Devices burning 20,000 Btu per hour or more shall be vented to the outside. Where applicable, appliances shall carry the AGA stamp. All such devices shall have approved safety pilots.

.3 LARGE GAS BURNING DEVICES (such as boilers, incinerators, ovens, and kilns over 50,000 Btu) shall comply with Factory Mutual or Industrial Risk Insurance recommendations. In buildings of high occupancy, Industrial Risk recommendations shall be followed.

22 70 30. GAS PIPING:

.1 Piping shall not be run under buildings or basement floors. Double pipe with a vent shall be used where piping passes through an outside wall of a building or tunnel or under pavement other than normal sidewalk. Piping shall not pass through plenum chambers.

.2 INTERIOR PIPING: An insulating flange shall be furnished and installed at the point of service entrance, to electrically isolate interior and exterior piping.

.3 CONCEALED PIPING shall be welded.

.4 REGULATORS: Properly vent to the outside where required by code or for safety.

22 70 30. GAS PIPING: (Cont'd)

- .5 UNDERGROUND SCHEDULE 40 BLACK STEEL PIPING shall be protected with anodes and shall be provided with test stations as follows:

Suggested Anode Size and Spacing:

Sched. 40 Pipe	Magnesium Anode	
Pipe Size Inches	Anode Size Pounds	Anode Spacing Feet
2 or smaller	5	100
2-1/2	5	70
3	17	180
4	17	140
6	17	95
8	17	75
10	32	110
12	32	95

Conform to Columbia Gas of Ohio, Inc. standards and specifications for magnesium anodes, anode size, and attachment method. Loop lead wire around the pipe to reduce possible stress on connection.

- .6 TEST STATIONS FOR ANODE PROTECTED GAS PIPE: Each isolated gas pipe system must have at least 2 test stations. Maximum spacing between test stations is 300 feet. Each test station shall be located in a plastic curb box identical or equal to those used by Columbia Gas of Ohio, Inc. Connections to the pipe shall be the same as required for anodes and shall have two single strand, single conductor, No. 12 copper lead wires extending from the pipe connection to the terminal block at grade in the curb box.
- .7 PIPING SHALL ENTER BUILDING ABOVE GRADE. Wall shall be sleeved and caulked at entrance.

END OF DIVISION 22 - PLUMBING