

22 00 00. PLUMBING**22 00 01. SUSTAINABILITY**

- .1 AE shall reference Division 18 “Sustainability” where some of the requirements are related to this division and adopt applicable requirements into the design.

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 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, the current Ohio Plumbing Code, and the current versions of ASHRAE 90.1 and the International Fuel Gas Code adopted by Ohio.

Wexner Medical Center: All materials and installation shall also be compliant with the current FGI Guidelines for Design and Construction of Health Care Facilities.

- .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 Engineer before preparation of final documents. Also see Division 33 – Utilities.

22 00 04. MOTORIZED EQUIPMENT

Basic requirements for electrical work and equipment are covered in Division 26 of these standards. The requirements included herein cover specific items that have been troublesome in the past and require that the specifications incorporate adequate provisions for electrical work and equipment furnished by the Plumbing, HVAC, and Fire Protection Contractors. The A/E shall specify motors, drives, and equipment to meet all operating requirements for the installation. Consideration for motors should be for voltage, phase, frequency, frame size, temperature rise, and sufficient starting torque to start loads with high inertia. Performance requirements should include capability to make multiple starts per day to meet energy conservation control requirements. Where necessary, non-recycling shall be specified to protect the equipment from short time recycling.

- .1 WIRING: Specifications shall clearly point out the responsibility for wiring related to Plumbing, HVAC, Fire Suppression and Fire Alarm equipment. In general, it is

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required that power wiring be provided by the Electrical Contractor and control wiring be provided by the Plumbing, HVAC and Fire Suppression Contractor. Also see Communications Wiring Standard in Appendix M.

- .2 STARTERS: Specifications shall require that motor starters be provided by the Electrical Contractor. Exceptions to this requirement will require the approval of the A/E and his review is necessary to ascertain that standards stipulated in the electrical specifications are followed. Variable Frequency Drives (VFD's) shall be specified by the A/E and furnished by the Mechanical Contractor as part of the AHU or pump package.
- .3 MOTORS shall be sized in accordance with applicable NEMA standards for the operating conditions of each specific items of equipment with a 1.5 1.15 service factor. Motors must be selected to operate within nameplate HP and shall not operate on the service factor. Short shaft motors shall not be used for belt drives. In general, motors one-half horsepower or smaller shall be single phase; larger motors larger than ½ horsepower shall be three phase. Motors shall be provided with electrical overload protection to prevent burn-out under operating conditions. Large motors shall have adequate internal overload and thermal protection in addition to the overload elements in the motor starter. Definite purpose inverter fed motors shall be specified for use with VFD's.

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 Project Manager.
 - .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: See Division 33 Section 33 11 13 Site Water Distribution.
- .2 Interior Water Piping: Test with water, at 125 psig pressure, for a period of not less than 6 consecutive hours.

Student Life: prior to water testing interior water piping, test with air where it is permissible with Ohio Plumbing Code.

- .3 Domestic Water Supply Piping: Flush and sterilize under the supervision of a qualified consultant. Provide the University Project Manager 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



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or AWWA C652 or their successors, or as described in the Ohio Building Code, Ohio Plumbing Code Section 610.1, whichever is the more stringent.

- .4 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 to University Project Manager through A/E.
 - .4.1 A minimum of 48-hour notice shall be given in writing to the University Project Manager 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 (regular pressure): 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 Engineer for any special testing or purging requirements.

Wexner Medical Center: Medical gas systems: Test as recommended by current editions of National Cylinder Gas Codes and NFPA 55, 99C. Systems shall be certified by a third party certifier with ASSE 6001 certification. Certifier shall be hired by the Architect/Engineer.
- .9 Recording Line Charts shall be specified for all gaseous pressure testing.
- 10 Compressed air and laboratory gases above 150 psig shall be inspected, examined, and tested per the requirements of Chapter VI of ASME B31.3. A third-party inspector shall be hired by the A/E (Criteria A/E for design-build) and subject to approval by the University.
- 11 Commissioning: Refer to Owner's Project Requirements (OPR) for systems to be commissioned.

22 00 09. RELATED WORK IN GENERAL CONSTRUCTION:

- .1 WATER SUPPLY PIPING INSTALLATION:
 - .1.1 Provide a minimum of 48 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 A/E 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. Color for the exterior exposed gas pipes should be consulted and approved by University landscape Architect and University Utilities.

22 05 05. PLUMBING MATERIALS AND METHODS

22 05 07. SLEEVES:

Sleeves shall be provided for piping through all walls and floors. All penetrations shall maintain existing wall fire and/or smoke rating.

- .1 PROTECTION FOR INSULATED PIPES: When insulated pipes penetrate floors that will be covered with finish flooring, specify that a sheet metal protective covering be installed around the insulation jacket. Sheet metal jacket shall extend through and above the pipe sleeve far enough to protect the insulation from bumping by floor polishing machines and vacuum sweepers. Space between the pipe sleeve and the sheet metal must be sealed. Where insulated pipes pass through wall sleeves, cover insulation with sheet metal and seal both ends of the space between the sleeve and sheet metal with non-combustible packing.
- .2 CLEARANCE: Provide not less than 1/4 inch clearance on all sides for both insulated and non-insulated pipes which penetrate walls and slabs.

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- .3 LENGTHS: Except where greater lengths are required for penetrations through floors, sleeves shall be fabricated to a length equal to the thickness of construction through which they pass.
- .4 SLEEVES THROUGH WATERPROOFED FLOORS shall project a minimum of 4-inches above the floor.
- .5 SLEEVES IN HVAC AND PLUMBING EQUIPMENT ROOMS shall extend no less than 1-1/4 inches above the curbs.
- .6 SLEEVES IN ALL OTHER FLOORS shall extend 3/4 inch above the finish material on the floor.
- .7 SEALS: Special wall sleeve fittings with soft rubber seals shall be specified for water service piping. In other installations, the void between pipe and sleeve shall be sealed with mineral wool or other non-combustible material to prevent passage of flame and smoke. In locations exposed to public view, the packing materials shall be concealed with sheet metal cover plates or split type, chromium plated brass escutcheons.
- .8 FIRE-STOPPING: Specify and show fire stopping at all penetrations of fire-rated assemblies.
- .9 Sleeves for copper pipe shall be fabricated of copper pipe for up to 4 inches in diameter.

22 05 20. GAUGES AND THERMOMETERS

- .1 METERS: Permanent utility services to each building require permanent metering.
Student Life: requires metering and submetering for each individual building. Meters must also be accessible remotely.
- .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.
Wexner Medical Center: Gauges shall have ball valve shut-off.
 - .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 regulators.
- .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.

.3 THERMOMETERS:

- .3.1 Thermometers shall be digital or mercury-free, red or blue-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. Provide a building automation sensor well adjacent to thermometers at major plumbing system equipment (e.g. domestic hot water heaters, central distribution mixing valves, etc.)
- .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 domestic hot water supply and return.

Wexner Medical Center: Additionally, thermometers are required at the inlet and outlet of all pressure reducing stations, domestic hot water pumps and master mixing valves.

22 05 25. VALVES

.1 GENERAL REQUIREMENTS

- .1.1 Each valve-type (e.g. flush valves, ball valves, balance valves, etc.) provided for a single project shall be products of a single manufacturer. Specify three (3) equivalent manufacturers, approved by University Engineer, for the contractor to select from.
- .1.2 Valve tags: Specify that each valve in each piping system be tagged with a brass tag numbered consecutively for each system and attached to the valve with a brass chain. Valve tags shall have stamped abbreviations of the system in addition to the valve number. Valves tags shall be tagged with Ohio State nomenclature as: service-building ID (2 letter designation)-floor-valve number. For example, a domestic cold water valve on the 2nd floor of Rhodes would be tagged DCW-RH-2-34.
- .1.3 Valve chart: The A/E shall determine the location for installation of a valve chart and shall specify that a typewritten directory of all valve numbers (by



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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, along with an electronic copy, and delivered to the A/E for forwarding to the University's Project Manager.

Student Life: The A/E shall provide an additional electronic copy of the valve chart to Student Life's Office of Facility Management & Logistics for the project.

Wexner Medical Center: Concealed valve locations shall be indicated by color coded tags adhered to the ceiling T-bars. Colors shall match pipe labeling color specification.

.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. Shut-off valves shall be located as necessary to allow maintenance/repair of system components with no disruption to building services. Required locations for shut-off valves include, but are not limited to, the inlet and outlet of all pieces of equipment, at each floor branch from the riser, and at each branch off the main floor distribution piping.

.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 quarter turn ball valves. Handwheel stops are prohibited.

.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.

Student Life: This rule only applies to valves three inches or larger.

Wexner Medical Center: Unions and Fittings: A union or bolted flange fitting shall be provided downstream of, and within approximately 12 in. or at least 3 pipe diameters, and adjacent to both inlet and outlet of pumps and other equipment. Unions should be independent devices. Combination valves/unions are not acceptable.

.1.4.4 Flush Valves: Expose for easier maintenance.

Wexner Medical Center: Flush Valves: Expose for easier maintenance except in high security areas where enclosure would be required (prisoner holding or psychiatric population as examples).

.2 GATE VALVES:

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- .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.

Wexner Medical Center: Gate valves 2-1/2 inches and smaller are prohibited.

- .2.2 3 inches and larger, iron body, bronze trimmed, O.S. & Y. 125 pounds flanged, (conforming to the City of Columbus Item 802).

- .2.3 All gate valves shall be full port.

- .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.

- .5.3 All globe and angle valves shall be full port.

Wexner Medical Center: Globe and angle valves are prohibited.

- .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.



Student Life: Only allows the spring loaded type check valves. Deviations from this requirement shall go through BDS variance process.

.7 BALL VALVES:

.7.1 3 inch or smaller, two or three piece bronze body, full port, 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 body, bronze disc, extended neck, geometric drive, molded-in seat liner, stainless steel stem, EPDM rubber liner, 125 pounds. Lug or wafer style.

.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
1/2" through 10"	BEECO	MIFAB, Inc Chicago, IL 60643
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.

.10 BALANCE VALVES: Install balance valves in domestic hot water return systems as necessary. Provide separate shut-off valves and balance valves. Applies to all building at The Ohio State University

22 05 50. VIBRATION AND SEISMIC CONTROLS

.1 DESIGN REQUIREMENTS: Refer to Division 00 PROCESSING THE WORK, paragraph 00 00 35. Specify sound emission and transmission controls as required



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to meet standards indicated in the Table entitled, "Ranges of Design Limits for Sound Control" in Appendix J, 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.
Wexner Medical Center: Collaborate with Medical Center Facilities Engineering to provide a domestic hot water system that meets their waterborne pathogens program.
- .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 or its successor.
 - .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.
Wexner Medical Center: Domestic hot water storage tanks are prohibited.
 - .1.2 For cold water tanks: Recommended thickness 2 inch, density 9 pound/cubic foot, compressive strength 530 psi at 10 percent deformation.
Wexner Medical Center: Domestic cold water tanks are prohibited, unless approved by OSUWMC Facilities.
- .2 FLUE INSULATION: Domestic hot water heater flues shall be insulated when required for safety or for reducing heat transfer.
Student Life: Closed cell elastomeric flue insulation shall be used on all non-steam applications. The materials shall be rated for proper application temperature and code compliant fire/smoke rating.

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 current version of ASHRAE 90.1 adopted by Ohio.

Student Life: Closed cell elastomeric pipe insulation shall be used on all non steam applications. The materials shall be rated for proper application temperature and code compliant fire/smoke rating.

- .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 1-1/4 inch and smaller shall be 1 inch thick. Insulation on piping 1-1/2 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.
- .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 Glass 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)** See Division 33 Section 33 11 13 Site Water Distribution.
- .3.2 New domestic cold water utility piping shall not be designed to be routed through campus tunnels or through campus facilities. If no other reasonable alternative exists, routing the underground domestic cold water utility through a tunnel or through a campus facility requires a design variance submitted to the University Engineer. Any exposed domestic cold water pipe must be designed with restraints to account for thrust forces. The project designing and installing the exposed domestic cold water line shall provide third party inspection on the installed water line prior to the water line being energized for testing.

- .4 INTERIOR COLD WATER AND DOMESTIC HOT WATER PIPING: 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 or press fittings made out of bronze or copper conforming to ASME B16.18 or ASME B16.22 and performance requirements of IAPMO PS 117. Press fittings shall have factory-installed EPDM sealing element and leak detection feature.
- .4.2 6 inch and larger, 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 10 in. and larger, cast iron with Class 125 lb. flanges.
- Wexner Medical Center: 5 inch and larger, hard drawn type L copper pipe with cast bronze or wrought copper class 150 lb. brazed fittings.**
- .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.
- Wexner Medical Center: The above piping for distilled water can be used for reverse osmosis water systems and deionized water systems also.**
- .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. Galvanized steel piping is prohibited.
- .6.3 Oxygen pipe lines: Cleaned seamless copper tubing, type K or L, or Schedule 40 brass pipe. Fittings shall be cleaned wrought copper.
- Wexner Medical Center : This section is not applicable for medical oxygen.**
- .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 Engineer. Also see 22 20 07.
- .6.4.1 Compressed air and laboratory gases above 150 psig shall be designed, fabricated, and installed to comply with ASME B31.3. Such piping shall be inspected, examined, and tested per the requirements of Chapter VI of ASME B31.3. A third-party

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inspector shall be hired by the A/E (Criteria A/E for design-build) and subject to approval by the University.

- .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.
- 6.6 Reverse osmosis permeate (product water) piping: Specify schedule 80 PVC, 316 stainless steel, or high purity polyvinylidene fluoride (PVDF) (complete system by SYGEF or Simtech) piping and fittings as appropriate for application. Do not specify copper.
- 6.7 Process cooling piping: Material selection shall be suitable for the application and compatible with laboratory equipment being served.

.7 GAS PIPING:

- .7.1 Underground Natural Gas Lines (piping): See OSU BDS Division Underground Natural Gas Line 33 51 13.
- .7.2 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.
- .7.3 Specify that all steel pipe risers shall be cathodically protected from corrosion and electrically isolated from building grounds. A/E shall retain the services of a Consultant specializing in Cathodic Protection System design.

.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.
- .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 vent: Piping above grade may be either Borosilicate glass or Duriron or polypropylene. Duriron shall be used below grade. See 22 00 03 and 22 20 07.
- .8.4 Interior aboveground vents, soil, waste and storm drains: 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 "Lubrifest". Schedule 40 ASTM A53, 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 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 required prior approval from University Engineer.

Commentary: Approval from University Engineer on interior aboveground PVC piping is typically contingent upon whether the following issues have been addressed or not:

- Project manager has verified with User that noise will not be an issue to the User should PVC piping be used.
 - PVC will not be used in plenum areas.
 - A/E has confirmed that the waste to be discharged is compatible with the PVC material and the temperature tolerance.
 - A/E has specified the appropriate cement for the PVC pipe joining.
 - A/E has included details for PVC piping penetrating floors and/or fire rated walls.
- .8.5 Interior underground vent, soil, and waste 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 "Lubrifest". Type K copper tubing and copper drainage fittings may be used for 3 inch diameter and smaller.

Wexner Medical Center: Type M copper tubing is prohibited.

- .8.6 Interior underground storm drains: Same requirements as .8.5 above.
- .9 COPPER CONNECTIONS: Solder joints for copper water lines shall be made with no-lead solder in order to minimize the exposure to lead; water coolers must be lead-free.
- .9.1 Copper joints: Copper piping less than 2 inch may be soldered using 95/5 tin/antimony solder. Copper piping 2 inch and larger shall be brazed, using 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 of dielectric nipple or flange. Specify that all dielectric nipples used have at least 250°F temperature rating.

22 10 10 PUMPS

- .10.1 Domestic water pumps: iron housing with brass impeller

Wexner Medical Center: Domestic water pumps shall be on emergency power.

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. Roof overflow drains shall not empty onto public access areas.
- .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.
- .1.4 CONNECTIONS: Preferred approach is to drain roof drainage to storm water best management practices (BMPs) rather than direct connection to piped storm water conveyance systems.

.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.
- .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.



Wexner Medical Center: trench drains shall also be designed to not create a hazard with gurneys, in applicable areas

22 20 00. PLUMBING SYSTEMS

22 20 05. WATER SUPPLY SYSTEM

- .1 Refer to (Division 0) and to paragraph 22 00 09 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.
- .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, housekeeping closet decks and other items or equipment equipped with cold and hot water mixers. All check valves shall be easily accessible.

Student Life: check valves are not required on shower valves; however, shower valves must meet the following criteria: single handle pressure-mixing valve, with single bronze stem, housing stainless steel balancing piston sealed in stem assembly. Must

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hold shower temperature steady with pressure fluctuations up to 85%. Double seal packing with adjustable brass nut. Brass adjustable limit stop screw to prohibit valve handle to be turned to excessive hot discharge temperatures. All trim to be copper nickel chrome plated. Service stops to be brass and cast integral with valve body. Combination diverter and volume control to be cast integral with the valve.

22 20 06. DOMESTIC HOT WATER

.1 DESIGN OF SYSTEMS

Wexner Medical Center: Work with OSUWMC Facility Engineering team to obtain the most up to date Waterborne Pathogen Management Plan

Design Concept: Domestic hot water systems utilize steam reduced down from 70#, 400 degF steam stations. The domestic hot water is to be generated at 140 degF, with the capability of providing thermal shock up to 160degF. Domestic hot water is circulated throughout the complex to deliver 125-135 degF at the outlets. Monitoring of the domestic hot water supply and domestic hot water return shall be through the building automation system at the domestic hot water heaters and on the branch risers of each floor served. Consult with OSUWMC Facilities for additional special monitoring requirements on OSUWMC buildings. Provide a master mixing valve with isolation valves and bypass for maintenance in lieu of individual mixing valves at each faucet. **Wexner Medical Center:** The domestic hot water system shall be on emergency power.

- .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 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. Efficiency of hot water heaters shall meet minimum requirements of the current version of ASHRAE 90.1 adopted by Ohio.

Wexner Medical Center: The domestic hot water system shall be designed with recirculating lines and pumps, regardless of system size. Branches greater than 20 feet from the main shall include a domestic hot water return line.



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- .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.
- .1.3 Unions or Flanged Connections shall be provided as specified in paragraph 22 20 05.3.2.
- .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 Domestic Hot Water Heaters: Integral heat exchangers with storage tank assemblies are prohibited. Separate heat exchangers and storage tanks or instantaneous heat exchangers are acceptable, dependent on the application. Water-to-water heat exchangers shall be double-wall construction. Refer to Owner's Project Requirements (OPR) for equipment redundancy requirements.

Wexner Medical Center: Storage tanks are prohibited. Steam fired semi-instantaneous water heaters shall be provided. Water heaters shall be designed with 100% redundancy such that if the largest water heater fails the building will continue to be fully served with domestic hot water.

- .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 (Division 00). Consult the University Project Manager 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 .
- .1.2 Applicable Specifications and Codes: Sanitary sewers external to a building shall conform to the requirements of local jurisdiction.
- .1.3 Refer to paragraph 22 00 05 , 01 33 13 and 01 77 00 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 A/E shall obtain information from the University Project Manager relative to the sewer arrangement for each building area.) On regional campuses, storm and sanitary systems shall be designed as separate systems.

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- .2.2 Storm Sewer Catch Basins and Roof Drains shall not be connected to sanitary systems except with specific permission from the University Engineer. 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 Construction and Material Specifications, State of Ohio Department of Transportation (ODOT) Construction and Material Specification Item 207, and/or local codes for minimum requirements.
- .2.3.1 Each manhole or catch basin that meets the OSHA definition of a confined space shall have an entry opening that measures 30" or larger in diameter or 30" or more on a side.
- .2.3.2 Steps or ladder rungs shall be built into manholes, catch basins, pits, and vaults as appropriate to provide foot and hand holds.
- .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 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 are required unless there is an appropriate means to drain the water or permitted by University Engineer.
- Commentary:** *Eyewashes are required to be tested weekly per ANSI standards.*
- .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



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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 specification 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.
- .2.14 Sewage ejector pumps: Where required, shall have a minimum of two (2) equally sized pumps so that a pump is available in the event of one pump failure. Pumps shall be automatically alternated on a monthly basis. Pumps shall have dual mechanical seals with a seal failure alarming to the BAS. The pump shall be designed to operate for a minimum of three minutes per cycle to prevent short cycling and premature pump failure. Sump capacity shall be designed to not exceed 12 hours of discharge load.

Wexner Medical Center: Pumps shall be on emergency power in the event of normal power failure to prevent sewage backup.

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 or 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: Use siphon jet or blowout type urinals except where sound control is a problem, rated at 0.125 gallons per flush (GPF).
Water Closets: Wall hung water closets are University standard except where in certain medical facilities as noted at the end of this section. Water



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closets shall be elongated design with open front seat, color as approved the University Project Manager. Use low flow toilets that have been tested and rated to function reliably at 1.28 GPF. EXEMPTION: Renovations/Retrofits use toilets rated to function reliably at 1.6 GPF.

Lavatory Faucets: Use lavatory faucets with a maximum flow rate of 0.5 gallons per minute (GPM). EXCEPTION: **Wexner Medical Center lavatory faucets will have a minimum of 1.5 GPM.**

Patient Room and Exam Room Faucets: Use faucets with a minimum flow rate of 1.5 GPM.

Public Metering, Self-Closing Faucets: Use faucets with a minimum flow rate of 0.25 gallons per metering cycle.

Kitchen Faucets: Use index-levered low-flow kitchen faucets with maximum flow rate of 1.8 GPM. Kitchen faucets shall be permitted to temporarily increase the flow greater than 1.8 gpm but shall not exceed 2.2 gpm and must automatically revert to the established maximum flow rate of 1.8 gpm upon physical release of the activation mechanism or closure of the faucet valve.

Showerheads: Use low-flow showerheads with institutional head and built-in 1.5 GPM flow control.

Dishwashers: Use dishwashers that operate on 10 gallons per cycle or less; or commercial dishwashers that use 120 gallons per hour or 1 gallon or less per rack.

Clothes Washers: Use clothes washers that meet EPA ENERGY STAR® requirements. Consider ozone laundry systems for facilities handling large quantities of textiles.

Wexner Medical Center: Bariatric water closets and private restrooms, where needed, shall be floor mounted, back outlet.

- .3.2 Janitors' mop sinks shall be precast terrazzo or molded stone (24 inch by 36 inch minimum), with a front edge stainless steel cap, on the floor.
- .3.3 Individual Electric Refrigerated Water Coolers shall be provided in new buildings. Wall hung types are preferred. The Architect/Engineer 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.

Student Life: Require pressure balance with positive stops to be used for showers.

- .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 riser to faucets, water closets, water fountains, residential dishwashers shall be copper tubing with steel handle stops, all chrome plated. Braided flexible hosing is prohibited.

Wexner Medical Center: All sinks shall have aerators removed. Approval may be granted from medical center engineering to allow water conservation mechanisms that mitigate bio-growth, support water quality efforts and minimize splash risk.

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.
 - .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.

Wexner Medical Center:

22 60 00 MEDICAL GAS SYSTEMS

- .1 INSTALLATIONS: All medical gas piping systems shall be installed by ASSE 6010 certified installers. Documentation of certification shall be provided prior to installation and maintained on the jobsite. The installation shall be certified by a third party hired by Architect/Engineer. All installations shall conform to the latest edition of NFPA 99.
- .2 MASTER ALARM PANELS are currently located in Doan 009 and in Rhodes S126. Any new master alarms shall be tied into these existing systems. If existing master alarm points are no longer available in these panels, provide a new master alarm panel adjacent to these existing panels. Coordinate number of points for new panel with OSUWMC Facilities Operations.
- .3 ZONE VALVE BOXES: Existing zone valve boxes shall be replaced when renovating an area served by an existing zone valve box that does not meet the requirements of the current code. Coordinate with OSUWMC Facilities Operations. Zone valve

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boxes shall be labeled by the contractor with the rooms served, per NFPA 99. Zone valve boxes shall also be labeled with a unique identifier, corresponding to OSUWMC nomenclature – VB-building-floor-number – such as VB-RHH-4-3 for a zone valve box in the Ross Heart Hospital on the 4th floor. Consideration shall be given for zone valve boxes with provisions for area alarm sensor connections.

.4 MEDICAL GAS INLETS/OUTLETS: Shall be Chemetron adapter compatible. Coordinate replacement of existing medical gas inlets/outlets with OSUWMC Facilities Operations.

.5 LABELING: Ensure that all labeling required by the current NFPA 99 is specified and installed as part of the project.

22 61 00 MEDICAL AIR SYSTEMS

.1 Piping: Medical air piping shall be brazed, ASTM B819 specification hard drawn Type L copper seamless medical gas tubing. Compression fittings, flared fittings and memory-metal couplings are prohibited.

.2 Equipment: Medical air compressors shall be triplex units designed such that such that the full load of the building can be carried with the largest compressor out of service. Medical air compressors shall be single stage reciprocating type, oil free compressors, Liquid ring compressors are prohibited. Automatic alteration of compressors shall be provided to allow division of operating time. All medical air compressors shall be on emergency power. Air dryers shall be desiccant type.

22 62 00 MEDICAL VACUUM SYSTEMS

.1 Piping: Medical vacuum piping shall be brazed, ASTM B819 specification hard drawn seamless medical gas tubing. Compression fittings, flared fittings and memory-metal couplings are prohibited. Main and branch piping shall not be less than ¾" in size. Any existing medical-surgical vacuum less than ¾" in the area of renovation shall be increased in size to meet this requirement.

.2 Equipment: Medical vacuum pumps shall be triplex units designed such that the full load of the building can be carried with the largest pump out of service. Medical vacuum pumps shall be oil flooded rotary screw type. Liquid ring vacuum pumps are prohibited. Automatic alteration of pumps shall be provided to allow division of operating time. All medical vacuum pumps shall be on emergency power.

.3 Waste anesthetic gas disposal (WAGD) shall be piped individually out of each room, where required, and then ties into the medical vacuum piping. A dedicated WAGD producer shall not be provided.

22 63 00 MEDICAL GAS SYSTEMS

.1 Existing manifolds in Rhodes and Doan Hall exist for nitrous oxide, nitrogen and

carbon dioxide that serve Rhodes, Doan, James and Ross Heart. Any tie-in to these existing manifolds shall include analysis into the size of the manifold, number of cylinders, frequency of change out, current code compliance, etc to ensure that the manifold can support the additional load being added.

.2 Piping: Medical gas piping shall be brazed, ASTM B819 specification hard drawn Type L copper seamless medical gas tubing. Compression fittings, flared fittings and memory-metal couplings are prohibited.

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.
- .5 PIPING SHALL ENTER BUILDING ABOVE GRADE. Wall shall be sleeved and caulked at entrance.

END OF DIVISION 22 - PLUMBING