

DIVISION 22 – PLUMBING

See Part II for additional information regarding Energy Efficiency, etc.

DESIGN CRITERIA

Employ strategies that in aggregate use 20% less water than the water use baseline calculated for the building (not including irrigation) after meeting the Energy Policy Act of 1992 fixture performance requirements.

SYSTEMS DEFINITION

DOMESTIC WATER

Campus potable water system is used for all uses, including fire protection system. Due to the hardness level of the campus water system the domestic water shall be treated after it comes onto the project site. Where possible, the water treatment system(s) should be non-sodium-ion exchange type such as Scale Blaster, Vulcan, or other similar technology. The treatment system type shall be discussed with the university early in the design process before implementing a technology.

A domestic water booster pump has been required on past projects exceeding 3 stories. Water pressure calculations should be performed for the project to determine the need for a booster pump. Water booster pumps shall be controlled with VFDs in lieu of hydraulic controls. Incoming domestic water supply to the central mechanical room shall have an accessible strainer on it with “blow down” capability to prevent well water sediment from reaching the buildings’ water supply and fixtures. A #20 mesh (1/32”) shall be used in this strainer. Incoming domestic water shall be plumbed with injector fittings for water system chlorination testing.

UTILITY WATER

Utility water is a non-potable water supply system, primarily used for landscape irrigation. This system is connected to shallow aquifers with a dedicated piping distribution system serving the main Campus only.

INDUSTRIAL WATER

Industrial water is a non-potable water supply system inside a building. A building’s industrial water system is a branch of domestic water system. Industrial water is provided by installing approved reduced pressure backflow prevention (RFBP) devices at a tee, downstream of the domestic water services and the RFBP. This industrial water RFBP device is intended to protect the building’s occupant from labs and other research areas or mechanical spaces.

COMMON REQUIREMENTS 22 05 13

COMMON WORK FOR PLUMBING

1. Piping shall not be installed in, pass through, or enter the telecommunications room, except as needed to serve the room itself.
2. See Section 23 05 13 in Division 23 for motor requirements.

3. Section Zone Valves: Union ball valves.
4. Pressure Gauges: Pressure or vacuum type as required.
5. Gas Outlets: See Vacuum System requirements above.
6. Fuel Gas: Lubricated plug cock.

METERS & GAGES FOR PLUMBING PIPING

22 05 19

Refer to the Campus Standard Design Guide, Section 33 05 33 for metering requirements.

1. Repeater Totalizer is required only when meter cannot be easily read directly, as determined by the University's Representative.

The following meters are typically not required but may be requested on specific projects.

<p>Utility Water Meter (IF REQ'D) Size 3/4" - 2"</p>	<p>Sensus SR1 Series (to match existing)</p>	<p>Positive Displacement Meter with an Impulse Contactor Transmitting Register 10 gallons/contact http://www.sensus.com</p>	<p>* Repeater Totalizer. ACT-PAK Model 7112-1 with non-resettable totalizer. Totalizer to read in 10 gallon increments.</p>	<p>Design Engineer to size meter based on building maximum flow. 1 1/2" & 2" meters shall be flanged. Connect the impulse contactor to the remote totalizer (if provided) or the power monitor. Install a 3/4" conduit from the impulse contactor or remote totalizer (if provided) to a J-box within 5 feet of the electric panel housing the electric power monitor. Connect to power monitor for SCADA interface per connection diagram.</p>
<p>Utility Water Meter (IF REQUIRED) Size 3" - 8"</p>	<p>Sensus SRH Series (to match existing)</p>	<p>Compound Meter with an Impulse Contactor Transmitting Register 10 gallons/contact http://www.sensus.com</p>	<p>* Repeater Totalizer. ACT-PAK Model 7112-1 with non-resettable totalizer. Totalizer to read in 10 gallon increments.</p>	<p>Design Engineer to size meter based on building maximum flow. Provide & install a Sensus AWWA type Bronze strainer and valved meter by-pass assembly. Connect the impulse contactor to the remote totalizer (if provided) or the power monitor. Install a 3/4" conduit from the impulse contactor or remote totalizer (if provided) to a J-box within 5 feet of the electric panel housing the electric power monitor. Connect to power monitor for SCADA interface per connection diagram.</p>
<p>DI Water (IF REQ'D)</p>	<p>Badger AMCO Or Equal</p>	<p>Thermoplastic Disc Meter, Model 25 or Model 40 Positive Displacement Meter Model C700</p>		<p>Meter shall be located in the same space as DI equipment. If the facility is connected to campus DI system, a lockable valved bypass assembly shall be installed. For facilities that have RO units installed as part of the DI water treatment system, the meter shall be installed downstream of the RO unit.</p>

Waste Water (Sewer) & Storm Drainage Lift Station Discharge	Rosemount, ABB, Sparling TigerMag Or Equal			
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1. Repeater Totalizer is required only when meter cannot be easily read directly, as determined by the University's Representative.

HANGERS AND SUPPORTS FOR PLUMBING PIPING & EQUIPMENT	22 05 29
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LIFTING EYE AT SUMPS AND PITS

Provide a lifting eye or insert in structure over any pump pit or sump located in a building to aid in future removal of equipment.

ISOLATORS

Provide pipe isolator at all hangers for non-insulated lines.

FACILITY DRAINAGE PIPING CLEANOUTS	22 05 76
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Make all cleanouts accessible. If cleanouts are installed in an accessible ceiling space, the cleanout must be extended through the floor above. Use graphite on all cleanouts with all threads being thoroughly greased after acceptable pressure test.

TYPES

1. Exposed: Cast iron plug.
2. In Wall: Cast-iron body, stainless steel cover.
3. In Floor or Grade: Adjustable, cast-iron body, ABS thread plug.

PLUMBING INSULATION	22 07 00
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Insulate:

Roof and overflow drain piping inside the building; Water piping, 4" and smaller, exposed to the weather, including interior spaces subject to outside temperatures; Domestic hot water piping; Industrial hot water piping.

COMMISSIONING OF PLUMBING	22 08 00
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GENERAL

Commission the plumbing system in accordance with Specification Section 22 08 00 Commissioning of Plumbing System.

DISINFECTION OF WATER SYSTEMS

Disinfect all domestic hot and cold water systems in accordance with Standard Section 33 13 00 Disinfection of Water Utility Distribution Systems.

TESTS AND ADJUSTMENTS

Test only new piping. Final connection between new and existing piping shall be tested at normal system operating pressures. Make no test against a service valve or meter. Isolate from the system all existing piping systems and new or existing equipment which may be damaged by test pressure.

No loss in pressure or visible leaks shall show after 4 hours at the pressures indicated:

<u>System Tested</u>	<u>Test Pressure PSI</u>	<u>Test with Sanitary & Lab</u>
Sanitary and Lab, Waste, Drain, Vent	10 ft. head	Water
Compressed Air	150 PSI	Air & Soap
Deionized Water	100 PSI	Deionized Water
Industrial and Domestic Hot & Cold Water	150 PSI*	Water
Gas	100 PSI	Air & Soap
Vacuum	27 inch vac.	Air & Soap

*or 1.5x operational pressure, whichever is higher

FACILITY WATER DISTRIBUTION	22 11 00
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The building plumbing systems shall have appropriate shut off valve zoning to allow for ease of maintenance with minimal shutdown impact to building occupants. Shut off valves shall be provided on each system to isolate each toilet room.

PIPING

Domestic Cold Water

Underground: Type K copper tubing, hard temper, cold drawn.

Above Ground: Type L copper tubing, hard temper, cold drawn.

Domestic Hot Water

Underground: preinsulated piping system, Perma-Pipe "Polytherm", Thermacore "Copper-therm" or equal. Carrier pipe shall be type K copper with brazed joints with a polyurethane foam insulation and an HDPE or fiberglass jacket. System shall be rated to 250°F.

Underground (alternate system): field insulated piping system using engineered powder insulation such as DriTherm, Gilsulate 500XR or equal. Provide 1.5 times the insulation thickness recommended by the manufacturer for the system operating temperature.

Discuss with the University's Representative which underground domestic hot water piping system is to be used on a project by project basis.

Above Ground: Type L copper tubing, hard temper, cold drawn.

JOINTS

Copper Tubing: All above grade piping, 1-1/4 inch and larger, and all below grade piping, regardless of size, shall be brazed with silver solder 1000 degrees F.

FITTINGS

Copper tubing: Wrought copper or cast brass solder sweat type.

UNIONS AND FLANGES

Unions and flanges shall be provided at the inlet and outlet of all apparatus and equipment, at all valves, and elsewhere as required to facilitate removal of valves and equipment. Flexible lines shall not be used.

Two inches and smaller ground joint shall be cast bronze unions. Two and one half inches and larger shall be 150-pound flange, cast brass.

WATER HAMMER ARRESTORS

Air chambers 18 inches long and 1 pipe size larger than rough-in shall be installed at branches to plumbing fixtures. At solenoid valves and make-up valves, provide diaphragm type shock absorber, sized and located in accordance with Plumbing and Drainage Institute Manual WH-201. Provide access panels for arresters.

VALVES

Specify threaded or flanged, two piece, bronze body, full port, ball valves, with stainless steel ball and stem, for isolation/shut off valves. Valves shall be located in open, readily accessible areas, and laboratory utilities valves located in open, hallway outside each laboratory. Valves that are concealed are to be accessible via clearly marked access panels no less than 24 by 24 inches square when valves and piping are concealed above or behind new or existing finished surfaces.

Pressure Reducing Valve: All bronze, Teflon disc and diaphragm for hot water service.

Bench Valves: Ball type with tapered sockets with ball and seat compatible with piping material.

HOSE BIBBS

Exterior Hose Bibbs: Shall be served by industrial or utility water services (not domestic). Provide at 100 feet maximum spacing along exterior walls. Vacuum breaker, loose key handle, 3/4-inch hose outlet, CP rough bronze, vandal proof.

Interior Hose Bibbs: Vacuum breaker, loose key handle, 3/4-inch hose outlet, chrome plated brass, vandal proof.

BACKFLOW PREVENTORS

Reduced pressure type, with drain pan and piped to nearest floor drain. Refer to list of approved backflow prevention assemblies published by University of Southern California - Foundation for Cross-Connection Control & Hydraulic Research (USC-FCCCHR). Where required by University representative (laboratory, housing, food service buildings, etc), provide backflow preventors. Review sizing of parallel dual backflow preventors with University's Representative.

FACILITY SANITARY SEWERAGE

22 13 00

PIPING

Underground: Service weight cast iron no-hub or hub & spigot joined with compression gaskets.

Above ground:

1. >2 inch service weight cast iron no-hub with stainless steel and neoprene coupling.
2. <2 inch service weight cast iron no-hub with stainless steel and neoprene couplings, or schedule 40 galvanized steel pipe joined with Durham type threaded drainage fittings.

No reducing couplings allowed. Sewer lines at toilet room vanities shall be designed properly with sweeps rather than "Ts" to allow for snaking when blockage occurs.

All toilet rooms, laundry rooms and first floor trash rooms shall have floor drains.

FACILITY STORM DRAINAGE

22 14 00

Roof and overflow drains shall be piped independently to outside. Overflow drain piping shall be day-lighted through exterior wall, minimum 18" above grade.

PIPING:

Same as above Section 22 13 00 - Facility Sanitary Sewerage.

DRAINS

1. Area Drain: Cast iron top.
2. Roof Drain: Cast iron with flange, flashing ring, gravel stop, underdeck clamp, extension, sump receiver, dome strainer, vandal proof.
3. Overflow Drain: same as roof drain plus standpipe.
4. Floor Drain: Cast iron body, N.B. top, with sediment bucket.

COMMERCIAL PLUMBING FIXTURES

22 42 00

Water Closet: Wall hung, vitreous china, siphon jet action, Maximum Performance (MaP) tested by IAPMO to exceed 500g capacity. Provide white, open front seat, less cover. Cast iron floor mounted carrier. Dual level water-conserving flush valve (1.1 and 1.6 gal/flush).

Urinal, Accessible: Wall hung, vitreous china. Provide cast iron floor mounted carrier, ultra low flow (0.125 gal/flush). Cartridge free, liquid type waterless urinal, Kohler or equal may be acceptable if approved by University representative. University representative shall consult with Engineering, Facilities Custodial and Plumbing offices prior to approval.

Lavatory: Wall hung, vitreous china, 20 inch by 18 inch. Sanitary waste traps for equipment shall be "P" type, 17 gauge, cast brass, slip joint nuts, cast brass escutcheons, and cleanout plug. Visible traps should be chrome plated unless the project requires special finishes.
 Sink (Counter Mounted): 18 gauge, type 304 stainless steel sink counter mounted, single bowl, 19 inch by 18 inch by 10 inches deep stainless steel. Deck mounted low flow faucet, lever handle, gooseneck, rigid spout plain outlet. 17 gauge chrome plated 1-1/2 inch by 1-1/2 inch trap.
 Drain: 1-1/2 inch tailpiece, grid strainer.

EMERGENCY PLUMBING FIXTURES	22 45 00
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GENERAL

Emergency eye or eye/facewash equipment shall be provided in all work areas where, during routine operations or foreseeable emergencies, the eyes of an employee may come in contact with a substance which can cause corrosion, severe irritation or permanent tissue damage or which is toxic by absorption. This equipment must meet the performance and installation requirements of American National Standards Institute (ANSI) Z358.1 1998. UCDEH&S will make final determination on selection of equipment to ensure the equipment meets this standard.

LOCATION OF EQUIPMENT

All campus laboratories that use substances described above must have at least one emergency eye or eye/facewash located within the laboratory and as close as possible to the hazard.

A combination eyewash/emergency shower shall be located within a research laboratory using hazardous chemicals as described above; or a combination eyewash/emergency shower may be located outside the laboratory provided an approved eyewash is located in the laboratory. The combination unit must be located so that travel distance is no more than 10 seconds or 100 feet with no obstructions and only one door to pass through to reach the unit.

Hand held drench hoses are not considered eyewash units. They may be used in addition to equipment, which is described as meeting the ANSI standard above. In some cases, a sink-mounted eyewash and a drench hose may be installed in lieu of a combination eyewash/safety shower. Consult UCD EH&S for review and approval of this configuration.

EMERGENCY EYE WASH AND SHOWERS

The approved units must be:

1. Supplied by domestic water.
2. Readily visible and accessible to the laboratory or work site. The unit should be located as close to the hazard as possible and cannot be blocked by building structures, cabinets, supplies or equipment.
3. Provided with an activation device, such as stay open ball valve, that allows the user full movement of both hands after the valve is turned on.
4. Identified with a highly visible sign.
5. Drain will be plumbed to sanitary sewer.
6. Located so as not to pose an electrical shock hazard. No electrical outlets within 6 feet unless GFI protected.

7. Indoor units are not required to deliver tempered water. Units installed outdoors or in adverse climates may need to be tempered. The need for tempered water shall be reviewed and approved by University of California Davis Environmental Health & Safety (UCDEH&S) during the design phase.

EMERGENCY EYE WASH

Approved emergency eye or eye/face wash units are Haws 7611 or Guardian G1805 (laboratory unit – install at sink), Haws 7000BT or Guardian G1750PT (Barrier Free), Haws 7656WC or Guardian GBF 1735DP (recessed), or equal. In addition to the requirements above, the approved units must be:

1. Regulated to provide a spray force of three to six gallons per minute at 30 psi.
2. Mounted such that the water nozzles are 33 inches to 45 inches from the floor level; height should comply with Americans with Disabilities Act of 1990 (ADA) requirements.
3. Mounted so that spray nozzles, when activated, are no more than 18 inches from the counter front when located above work counters or benches.
4. Drain will be plumbed to sanitary sewer.

EMERGENCY SHOWERS

The unit must be installed and located so both the shower and eyewash can be used at the same time by one person. Approved eyewash/emergency shower units are Haws 8346 or Guardian G1909 HFC (GBF1909 Barrier Free), Haws 8355WC (recessed), Guardian GBF2150 (recessed), or equal. Eyewash component must meet the requirements for Emergency Eye Wash above. In addition to the requirements above, the approved units must be:

1. Adequately supplied with potable water to meet the requirements of each component. The shower must be able to deliver a minimum of 30 gallons per minute. The diameter of the water pattern of the shower measured 60 inches above the surface on which the user stands must be a minimum of 20 inches. The center of the spray pattern shall be located at least 16 inches from any obstruction.
2. Supplied by a minimum pipe size of 1 inch.
3. Installed so that the shower head is not less than 82 inches nor more than 96 inches from the surface on which the user stands.
4. Shower component activated yearly to verify proper operation.

COMPRESSED AIR SYSTEMS FOR LABORATORY FACILITIES	22 61 00
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GENERAL

Review with University representative the project specific requirements for compressed air quality, pressure and flow to identify the design and installation requirements.

Provide lead/lag systems for systems requiring 10 HP compressors and larger (i.e., split 1- 10 HP compressor into 2- 5 HP lead/lag compressors).

Provide inter-cooled and after cooled, 2 stage compressors/ pumps for all systems 5 HP and larger. Once through cooling water systems are prohibited.

PIPING

Above Ground: Type L copper tubing, hard drawn.

Below Ground: Type K copper tubing, hard temper, cold drawn with brazed joints.

JOINTS

Silver brazing alloy, melting point above 1000 degrees F, 15 percent silver, 80 percent copper 5 percent phosphorous.

FITTINGS

Wrought copper or brass, solder sweat type. Couplings shall be of the staked stop type.

VALVES

Ball valves

Lab Air Outlets: Line size, Ball valve or needle valves to match project requirements.

Points of connection to existing copper air piping in existing buildings shall be crimped or compression type fitting. Soldering is not permitted.

VACUUM SYSTEMS FOR LABORATORY FACILITIES

22 62 00

GENERAL

Review with University representative the project specific requirements for compressed air quality, pressure and flow to identify the design and installation requirements.

See Compressed Air System requirements above.

PIPING, JOINTS, FITTINGS and VALVES

See Compressed Air System requirements above.

VACUUM PUMP

Furnish air-cooled duplex vacuum unit, Ingersoll-Rand, Worthington, or equal. Unit to come complete with base mounted pumps, American Society of Mechanical Engineers Association (ASME) tank with sight glass, drain, flexible connection, scrubber, check valves, relief valves, control panel including fused disconnect, vacuum switches and gauges, motors, starters, electrical alternator. NEMA rating shall be specified based on the location of equipment.

GAS SYSTEMS FOR LABORATORY FACILITIES
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22 63 00

SPECIALTY GASES

This section applies to laboratories that require ultra pure piping system for special gases including compressed air, nitrogen, oxygen, CO2, Argon, etc.

Comply with NFPA 99 requirements. Although this standard applies to Health Care systems, the requirements noted in this standard shall be applied for special lab air system.

Laboratory Nitrogen and Argon; plug valve, Buna-N O-ring, Circle Seal 9259, or equal, (no known equal).

INSTALLATION

GENERAL

Screwed Connections: Wherever possible, screwed joints made in attaching valves, or other permanently connected equipment shall be silver brazed after assembly using precautions to avoid overheating the valve or equipment. Where conditions do not permit this method of assembly, the connection joints shall be tinned or sweated with solder. No joint compound shall be used.

Grounding: All oxygen, nitrous oxide and vacuum lines shall be grounded to the water supply system to reduce the possibility of static electric charges.

LABORATORY CHEMICAL WASTE AND VENT PIPING	22 66 00
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PIPING

All piping shall be Schedule 40 flame retardant polypropylene pipe and fittings joined with fusion coil joints, Enfield "Enfusion" or equal, except piping around the benches and equipment shall have mechanical joint fittings by Enfield, "Labline" or equal. Compression fittings are not allowed.

Above ground accessible: Schedule 40 flame retardant polypropylene pipe and fittings joined with grooved pipe mechanical joint fittings by Enfield "Labline" or equal. Compression fitting is not acceptable. All acid waste piping around benches and equipment shall have mechanical joint fittings. Chemically resistant glass drain line piping may be used for repair of material in existing buildings only.

TRAPS

Universal, 1-1/2 inch Polypropylene clear base, Enfield W5115, Harrington or equal. Acid waste traps for equipment shall be Nalgene 96025-1500, Sloane, or equal, drum trap with drain connection adapter and union connection. Sanitary waste traps for equipment shall be "P" type, 17 gauge, cast brass, slip joint nuts, cast brass escutcheons, and cleanout plug. Visible traps should be chrome plated unless the project requires special finishes.

SUPPORTS

Horizontal polypropylene piping shall have a continuous 16-gauge galvanized sheet metal trough support or maximum 2 foot support spacing system.

FIXTURES

Funnel Sink: Cast iron, with trap and 6 inch diameter inlet.

Cup Sink: Polyethylene, oval with integral waste fitting, 1-1/2 inch with polypropylene trap.

PROCESSED WATER SYSTEMS FOR LABORATORY FACILITIES**22 67 00****SYSTEM DESIGN**

When program needs for new campus facilities require specially treated water supplies (e.g., deionized water for laboratory needs), these needs shall be met by providing on-site treatment systems. Such systems may include carbon filters, water softeners, reverse osmosis units, ion exchange systems, and ultraviolet light disinfection systems with ultra filtration. Review with University representative the project specific requirements for water quality, quantity, pressure and flow to identify the design and installation requirements.

Life-cycle costing shall be used to select system components (e.g., the use of resin beds vs. reverse osmosis units). Consideration should also be given during design for future needs in the facility and/or adjacent areas to allow for future expansion of local water treatment devices to meet higher flow and/or water quality requirements. Leased systems shall not be used to meet new facility needs.

If Reverse Osmosis system is used, it must have a regenerating type of softener with backwashing carbon filters in lieu of exchange bottles.

Deionized water systems shall be designed to provide for a minimum 1 megohm system unless otherwise required by the University representative. The system shall be recirculating.

PIPING, JOINTS, FITTINGS AND UNIONS

Pipe, fitting, unions and control valves manufactured of polyvinyl chloride PVC, Gray Standard Schedule 80 manufactured specifically for deionized water service. Metric sizes are not acceptable. Pipe shall be sterilized and capped prior to shipment. Fittings, unions and valves shall be sterilized and individually packaged after production. Joining shall be by socket weld, procedure as recommended by pipe manufacturer. No threaded joint or flexible connection will be permitted.

VALVES

Control and Bench Valves: Ball type with tapered sockets with ball and seat compatible with piping materials. Use aluminum coupler to connect to bench valve.

Bench outlets: Self-closing, hot tin lined, Water Saver L-681, Chicago 969-244CTF, or equal. For foot operated outlets, use Water Saver L-3050TL floor mounted, tin-lined, single valve with L-181TL deck-mounted, tin-lined gooseneck spout.

SUPPORTS

Piping 2 inches and smaller and all horizontal piping shall have continuous 16-gauge galvanized sheet metal trough support or maximum 2 foot support spacing system.

CLEANING

All pipe, fittings, valves, and system-related materials shall be cleaned before use. Minimum requirements for cleaning procedures are:

1. Alconox detergent and 30 percent hydrogen peroxide cleaning agents.
2. Circulating pump.
3. 1 percent potassium permanganate testing solution.
4. The deionizer equipment may be used for cleaning the piping system.

ULTRA PURE DEIONIZED SYSTEMS

Piping, joints and fittings: Unpigmented (natural) polypropylene, copolymer Type 1, Schedule 40 butt-fusion and/or socketed fusion. The system shall be recirculating through deionized polishing bottles. The entire system shall be sterilized. For bench valves for ultra pure water, use Chicago 828PVDF (solid PVDF valve), or equal.