PART III - CSU TECHNICAL STANDARDS  DIVISION 22 – PLUMBING

DIVISION 22 - PLUMBING

See Division 20 – General Mechanical for common standards related to Plumbing.

22 00 00 - PLUMBING

A. Acceptable Products:
   2. Backflow Preventers
      a. Reduced pressure principal devices: Conbraco, Apollo, Wilkins/Zurn, Febco.
      b. Double check devices: Febco, Conbraco, Wilkins/Zurn and Watts devices only.

B. Products Not Permitted:
   1. Ames (all types).
   2. Watts for Reduced Pressure Principal.

C. General Information:
   1. All domestic water service piping, valves, accessories, fixtures, and appliances shall be listed and labeled as “lead free.”
   2. All restrooms shall have floor drains.
   3. Water heaters shall have floor drains installed in the area. Elevated water heaters shall have drip pans installed with indirect drain pipes to floor drains or other drain fixtures.
   4. Uncontaminated groundwater and uncontaminated storm water is prohibited from discharge to the sanitary sewer and must be routed to ground surface or storm sewer systems.
   5. Elevator sump pumps intended to pump fire fighting water must discharge to the sanitary sewer. Oil minder type pumps are prohibited in this situation. Elevator sump pumps in an elevator pit with continuous or periodic groundwater intrusion must discharge to the storm sewer system via an oil minder type pump.
   6. Facility water, sanitary and storm sewer pipes buried under structure shall be laid in on firm, undisturbed or compacted soil with a 6 inch bed of sand or 1/4 inch gravel below and above piping. Compaction tests shall be required when excavation removes soil below piping bed.
   7. ADA requirements shall be met for all restrooms, water coolers, etc.
   8. The Colorado State Water Conservation Act of 1991 shall apply to the design of water distribution systems and component selection. Specifically, the maximum flow rates shall be: lavatory faucets - 0.5 gpm at 80 psig; flushometer water closets – 1.28 gpf; urinals -1/8 gpf. Additionally, all water closets must meet a minimum MAP score of 1,000 grams.
   9. All underground utility piping shall conform to the requirements of Division 33 – Utilities.
   10. Valves for isolating sections of piping systems shall be provided. Valves shall be installed
to isolate separate wings, floors, laboratory rooms, toilet rooms, machinery rooms and
other natural subdivisions of building.

D. Water Service and Distribution:

1. Most buildings are served through University-owned, master metered system operated at about
   60 to 90 psig.

2. Design of water service to building shall include exterior fire hydrants, interior fire protection,
   main line tap and valve, main building shut-off valve inside and outside, and water meter
   located in the building near point of water entrance. See Drawing Appendix. See Division 21
   – Fire Suppression for more information.

3. Water service component arrangement shall be full port isolation valve, strainer, meter,
   reduced pressure backflow prevention device and full port isolation valve. A one inch meter
   and backflow prevention device bypass piping with backflow device and full port isolation valve
   shall be provided. See Drawing Appendix.

4. The domestic water piping distribution system should be evaluated to determine if cold and hot
   water piping could be economically connected at each toilet room to provide a single, tempered
   water supply to each lavatory.

E. Cleaning and Disinfection of Piping Systems:

1. The Plumbing Contractor shall be required to clean, disinfect and test all domestic hot and cold
   water systems, including fire systems connected to the domestic water systems. The
   procedure shall follow ANSI/AWWA Standard C651, most recent edition. For buildings already
   occupied, the procedure shall be modified as required to accommodate the occupants.

2. The Plumbing Contractor shall notify Facilities Management through University Representative
   when disinfection and testing are complete. Disinfection report shall be submitted to both
   University Representative and Facilities Management.

3. Super-chlorinated water shall be de-chlorinated before discharge. De-chlorination equipment
   is available for use from CSU Utilities Services.

4. A disinfection report shall be included in the O&M manuals.

5. Floor drains, other drain fixtures and all drain piping exposed during construction should be
   covered and protected from debris entering the pipes. The drain system shall be flushed in
   presence of University Representative at the end of construction and cleaning provided by
   contractor if blockage exists.

F. Backflow Prevention:

1. Backflow prevention devices and design shall comply with the current International Plumbing
   Code and the "Colorado Cross-Connection Control Manual" published by the Colorado
   Department of Public Health and Environment. Reduced pressure backflow prevention devices
   shall be installed for all main water services to University buildings, except residential buildings
   less than 400 feet in height. Backflow prevention devices shall be installed on fire protection
   systems, heating and cooling systems, irrigation systems, and other industrial water systems
   in conformance with the "Colorado Cross-Connection Control Manual" published by the
   Colorado Department of Public Health and Environment.

2. Water piping systems must be arranged and backflow prevention devices installed so that back
   siphonage or backflow into domestic systems is not possible. Any water discharging through
a faucet to which a hose would be attached must be considered to be potentially hazardous and shall require an atmospheric vacuum breaker.

3. Redundant backflow prevention devices shall be installed in parallel at the main water service to each building, except residential buildings less than 40-feet in height. Each device shall be sized to handle half the building’s full load. See Appendix A detail M-21.

4. Outdoor applications shall be enclosed within a University approved insulated enclosure with an integral electric heater. Heat tape is not an acceptable alternative.

5. Install backflow prevention devices on all laboratory faucets and other points where cross contaminations may occur in addition to backflow prevention devices at building supply.

6. Backflow prevention devices are not permitted inside of fume hoods.

7. Install backflow prevention devices on all makeup water lines to heating and cooling circulating systems.

8. Backflow prevention devices shall be tested by a certified Cross Connection Control Technician possessing a valid certification from the American Society of Sanitary Engineering (ASSE), the America Backflow Prevention Association (ABPA) or the Association of Boards of Certification (ABC). Tests shall be in conformance with the "Colorado Cross-Connection Control Manual" published by the Colorado Department of Public Health and Environment. Tests shall be performed through the Code Inspection process.

9. Test reports for all backflow prevention devices shall be included in O&M manuals at the completion of project.

10. Backflow prevention devices shall be tested again at 11 months from start of warranty period by the contractor according to the requirements listed above. Test reports shall be submitted to the Facilities Management-Plumbing Shop supervisor through the University Representative. Repair or replacement of devices which fail the test is the responsibility of the contractor.

11. Floor drains located near backflow prevention devices shall be sized according to the "Colorado State Cross Connection Control Manual" procedure.

12. All backflow prevention devices shall have a full port isolation valve and wye strainer with blowdown ball valve installed upstream. Unions or flanges shall be provided both upstream and downstream if the device is not fitted with integral flanges.

13. Backflow prevention devices shall be installed in accordance with the Colorado Cross Connection Control Manual’s recommended minimum clearances (12-inches above the floor, 36-inch clearance above the device, 12-inch out from wall on back side, and 24-inch clearance in front of test cocks), no higher that 5 feet above floor unless permanent platform is provided.

22 10 00 - PLUMBING PIPING AND PUMPS

A. See Division 20 – General Mechanical.

B. Acceptable Products
1. Trap Sealing Devices - ProSet Trap Guard, Sure Seal Trap Sealer, or approved equal.

C. Products Not Permitted:
   1. Drain, waste and vent interior piping - ABS and galvanized piping.
   2. Copper pipe in pressure service application – Types DWV and M.
   3. Trap “primers” of any kind.

D. Potable Water Piping:
   1. Lead pipe or lead solder is prohibited for all potable water piping systems.
   2. Isolation valves shall be provided for each floor branch, outside of each individual laboratory and toilet rooms and other locations where isolation for component replacement or repair is necessary.
   3. Domestic water piping design shall separate laboratory piping from other piping either at the building service or at each floor. A reduced pressure backflow preventer shall be installed on the laboratory domestic water pipe supply in an accessible location according to code. As specified above, full port isolation valves and wye strainers shall precede the backflow preventer.
   4. See Drawing Appendix for water service piping arrangement.
   5. Hose Bibbs
      a. Cold-water freeze-proof hose bibbs without handles shall be provided at outside locations near entrances to a building for wash down and grounds crew use. Hose bibbs shall have integral backflow preventers. These should be located as inconspicuously as possible consistent with accessibility. Provide separate shut off valve inside.
      b. Hose bibbs shall be provided at all major equipment locations in mechanical rooms, on roofs or outside.

E. Sanitary Sewer Piping Systems:
   1. All floor drains shall be protected by an evaporation resistant sealing device.
   2. Interior accessible cleanout caps and plugs will be located such that they can be removed without damaging the floor or floor covering.
   3. All building cleanout openings will be two-way type, to permit cleaning in both directions. Plugs shall be lubricated at installation.
   4. Provide manholes at major junctions of exterior sewer lines, and provide cleanouts on all other junctions.
   5. All sump pumps receiving floor drains located in boiler rooms shall be designed to handle hot water because boilers are flushed or emptied at intervals into floor sumps.
   6. Chemical waste, carcinogens, biological waste and other hazardous materials shall not be put into the sanitary sewer. Hazardous materials shall be disposed of by proper methods as approved by Environmental Health Services through the University Representative on a case-by-case basis.
7. Kitchen grease traps are required at each building providing food services using meat or
   grease. Each trap should be located for easy access and servicing, preferably outside, and
   properly vented.

8. Saddle taps on sanitary sewer pipes are not permitted. Pipes shall be cut and fittings installed
   for new or replacement branch pipes.

9. All underground utility piping shall also conform to the requirements for Nonmetallic Utility Lines
   in Division 33 – Utilities.

F. Storm Drain Piping Systems:

1. Roof drains or drains located in outside areaways, not subject to regular foot traffic, shall be of
   the type to minimize clogging with leaves or other debris.

G. Gas Piping: See Section 23 10 00 - Facility Fuel Systems

22 30 00 - PLUMBING EQUIPMENT

A. Acceptable Products:

1. Domestic water circulation pumps – Bell & Gossett, Taco, Grundfoss, or approved equal.

2. Instantaneous Steam-Water Heaters - Leslie Constantemp by Leslie Controls, Inc.; Micro-Mix
   II by Graham; or Flo-Rite-Temp from Armstrong.


4. Submersible Sump Pumps for Storm or Groundwater Service - Weil-McLain, Crane, AMT, or
   approved equal.

B. Domestic Water Heaters:

1. Where steam is available, the domestic water heating shall use instantaneous steam heat
   exchangers. Storage tank systems with steam coil may be considered if requirements are
   unusual.

2. Instantaneous heaters shall have feedforward control. Selection shall be based upon 2-15 psig
   inlet steam, ductile iron shell with single wall copper coils heat exchanger. See Drawing
   Appendix for piping arrangement.

3. Instantaneous heaters shall be floor mounted on custom fabricated frames made of 1-1/2 inch
   angle iron as shown in See Drawing Appendix for Leslie Water Heater Stand.

4. Final selection will be based on space requirements, hot water requirements, available steam,
   and installation cost.

C. Domestic Hot Water In-line Circulating Pumps:

1. Specifications shall include all bronze construction with optional stainless steel body, ground
   and polished steel shaft with integral thrust collar, horizontal arrangement, sleeve bearings, oil-
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lubricated, mechanical carbon face seal with ceramic seat, self-aligning flexible coupling, non-overloading, open-drip proof motor with built-in thermal overload protection, 125 psig working pressure, 225°F water temperature.

2. "Quiet" operation shall be specified for pumps outside of mechanical rooms where noise is a consideration.

D. Submersible Sump Pumps:

1. Specifications shall include cast iron body and impeller, stainless steel shaft, factory-sealed oil-lubricated ball bearings, ceramic mechanical seal, perforated steel strainer, hermetically sealed capacitor-start motor with built-in overload thermal protection.

2. Provide 20 feet of 3-conductor PVC cord and molded grounding plug.

3. Controls shall include float-operated mercury switches with duplex control panel in NEMA-3R enclosure with high water alarm with flashing light and bell, seal failure alarm with auxiliary contacts for connection to BAS.

4. Sump pump operations shall have high water alarms connected to Building Automation System. See Division 25 – Integrated Automation.

5. Sump pump controls shall have an alternating relay to switch lead-lag operation.

6. See Drawing Appendix for sump pump piping arrangement.

22 40 00 - PLUMBING FIXTURES

A. Acceptable Products:

1. Flushometer Valves – Sloan or Zurn only.

2. Lavatory Fixtures - American Standard, Kohler, Zurn or Chicago. Toto not allowed.

3. Lavatory Sinks – Bradley Verge L-Series or approved equal.

4. Laboratory Sinks/Tubs – Dura Top, Just, Zurn, American Standard, Chicago, Kohler, or approved equal.

5. Laboratory Faucets – American Standard, Kohler, Zurn, Chicago or T&S. Toto not allowed.

6. Trim – American Standard, Kohler, Zurn, Chicago, or approved equal.

7. Water Coolers – Elkay Model VRC8S or approved vandal-resistant equal.

B. Fixtures and Trim:

1. All faucets and flushometers shall be manually operated. No automatic devices are allowed.

2. All vitreous fixtures shall be of a quality known commercially as 'Twice-Fired Vitreous China'.

3. All enameled ware shall be cast-iron with 'Acid-Resisting Enamel'. Fixtures shall be complete as described in the manufacturer's catalog.
4. All lab sinks and tubs shall be listed as chemical resistant. Acceptable materials are stainless steel and epoxy. Lab sinks and tubs that are integral to the casework are not allowed.

5. All water closets shall be wall mounted or wall hung. Floor mounted fixtures are prohibited.

6. All lavatory faucets shall have four or eight inch center spread. Eight inch center spreads are allowed for laboratory, food service or custodial sinks.

7. Shower rooms shall have tempering valves for domestic hot and cold water. A faucet with hose thread spout and key handles for building services cleaning work shall be connected to the tempered water supply.

8. Restrooms should have a faucet with hose thread spout and key handles for building services cleaning work.

9. Restrooms should have floor drains with positive slope to the drain. The trap should be 3 inches minimum to help keep it from drying out.

10. All fixtures should have ¼ turn service stop valves that are easily accessible. Provide access panels where needed.

C. Electric Water Coolers:

1. Mechanically cooled drinking fountains shall be self-contained wall mounted type drinking water coolers. The cooler shall have a minimum cooling capacity of 6 gallons per hour of 50°F drinking water at the inlet water and room ambient temperatures of 80°F with adjustable water temperature control. Water coolers shall be equipped with handicapped fittings and be located according to ADA requirements. Care shall be taken to specify coolers with basins and spouts to minimize dripping, etc. on floor.

2. Water coolers shall have an isolation valve located above the ceiling in an accessible location.

3. The design of multiple water coolers shall include an evaluation into the use of a single refrigeration cooling system with multiple water cooler outlets.

4. Water coolers shall not include a filter, either integral or after-market. Filters are not allowed.

22 61 00 – COMPRESSED AIR SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES

A. Control Air Systems:

1. Pneumatic controls are prohibited. All controls shall be electronic.

B. Process or Lab Air System:

1. Piping systems shall be zoned appropriately and be provided with zone isolation valves.

2. A building duplex compressor will be used as the source of process compressed air.

3. Process air compressors shall be selected to operate with a receiver pressure of 125 to 150 psig with pressure reducing valve to the designated system operating pressure. Install a pressure relief valve on all reduced pressure systems, set for 25 psig over reduced pressure.
4. Compressed air piping should be sized on the basis of number of outlets, using a figure of 0.5 cfm at 30 psig per outlet.

5. Diversity must be determined by the designer.

6. System loss should not exceed 5 psig loss at estimated demand.

7. Any continuous demands shall be added to the above quantities.

8. See Drawing Appendix for process supply piping arrangements.

22 62 00 – VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES

A. Acceptable Products:
   1. Vacuum Pumps - Nash or equal. See Division 20 – General Mechanical for pumps.

B. Vacuum Pumps and Piping Systems:
   1. Vacuum piping should be sized on the basis of inlets. Use a figure of 1 cfm per outlet and 40 percent simultaneous use for typical laboratory rooms.
   2. Friction loss should not exceed 5 inches of mercury column drop at estimated demand for system. The above should be modified to meet special conditions and types of rooms or service.
   3. Vacuum pumps shall include conical porting, liquid rings, one piece body and a shrouded rotor. Pumps equal to or larger than 15 hp shall operate at 1200 rpm. Flat plate porting is not permitted nor desirable because it uses more domestic water.

22 66 00 – CHEMICAL WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES

H. Chemical and Acid Waste Systems:
   1. Acceptable Products for Chemical and Acid Drain, Waste and Vent Piping:
      a. Enfield Industrial Corp., Orion or Zurn.
   2. Chemical and acid drain waste and vent systems are sole sourced products. Pipes shall be acid resistant, flame-retardant polypropylene pipe. Below grade pipes shall be Schedule 40 with heat fusion joints. Above grade pipes shall be Schedule 40 with heat fusion joints for inaccessible fittings and mechanical joints for accessible fittings.
   3. Treatment and handling of acid wastes shall be discussed with Environmental Health Services through the University Representative and specified in the specifications.
   4. Neutralization tanks are required and shall be installed at either point of use for individual sinks or labs. Neutralization tanks shall be polypropylene type and shall be accessible and have a smaller, removable access cover separate of the tank cover. Tanks five gallons and smaller tanks shall be close coupled without a vent. Tanks larger than 5 gallons with a longer drain run shall be vented to the acid DWV system at a point above rim level.
   5. Glass DWV pipe systems can be retrofitted with polypropylene pipefittings and components if glass is determined to be too expensive.
22 67 00 – PROCESSED WATER SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES

A. Deionized and Distilled Water Systems:

1. Laboratory areas may require deionized or distilled water systems. The deionized water station or water still may be provided by the Department or furnished with the project.

2. Deionized water systems typically will have the cartridge systems and accessories provided and serviced by an outside vendor under existing purchase order contracts. The quantity and quality of the deionized water shall be established by the user in cooperation with the vendor through the University Representative. Design requirements shall be coordinated through these parties through the University Representative. All deionized water systems shall conform to Clinical and Laboratory Standards Institute (CLSI, formerly NCCLS) guideline C3-A4. A copy of this guideline is available from Facilities Management Utilities Services Group.

For applications that are susceptible to microorganisms and their byproducts (e.g. pyrogens and endotoxins), small, point-of-use systems shall be used to minimize the possibility of contamination from biofilms in the piping system. Additional components, such as ultrafiltration or reverse osmosis units may also be required. Where centralized systems are acceptable, the piping shall be configured in a closed loop with circulation to maintain the water velocity at 6 ft/sec or greater. Branches shall be fitted with appropriate flow control and metering devices. Piping systems shall be configured so as to minimize dead legs.

Utilities shall be provided by the project to the deionized system and shall include domestic cold water and an electrical power outlet. For centralized systems, power for circulating pumps, sterilizers and controls will be required.

The distribution piping for deionized water systems shall typically be unpigmented, natural polypropylene conforming to ASTM D4101 with thermal welded fittings and mechanical joints. Any metal components shall be 316 Stainless. For applications that require higher quality water, other materials may be needed. The University Representative must approve any material substitutions with the recommendation of the deionized water vendor. The piping distribution system shall include accessible isolation valves before and after all components and at major branches, and appropriate gooseneck faucets at laboratory benches.

3. Distilled water systems may be connected to existing stills. Check with Facilities Management Plumbing Shop through the University Representative for existing capacity information.

A new water still may be provided by the client or furnished with the project. Stills may be steam or electric driven depending upon the capacity demand by the user and availability of steam.

Utilities shall be provided by the project to the still and shall include domestic cold water and steam or electric power.

The piping distribution system shall typically be PVC, Grade 1, Type 1, Schedule 80, unplasticized material equal to MFG Celenesse Type 1 (formerly Cabot). For higher quality requirements other piping materials may be necessary. The piping distribution system shall be gravity feed and include accessible isolation valves at major branches and appropriate gooseneck faucets or spigots at laboratory benches.

4. Check valves shall be installed upstream of supply service to bottles.

5. Two pressure gauges shall be installed across the final filter. Gauges shall be stainless steel.