

## **PLUMBING SYSTEMS**

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**Codes:** See *Codes, Standards and Regulations* within these *Design Guidelines* for governing plumbing code.

**Design Drawings:** Design drawings shall include schematic diagrams or riser diagrams for all domestic CW / HW / HWC and process water systems. Show all valving and pipe specialties.

Provide riser diagrams for all waste / vent systems.

**Domestic Water System:** Avoid locating domestic water lines in exterior walls and unheated spaces within the building. Routing water lines near un-ducted outside air louvers where exposure to freezing temperatures may occur shall not be permitted.

Domestic water pressure booster pump assemblies shall have bypass capability.

Isolation valves for domestic cold and hot water service shall be installed at every branch tee connection  $\frac{3}{4}$ " and larger serving more than one fixture.

No below grade domestic hot or cold water piping shall be allowed inside buildings.

All valves shall be readily accessible.

Provide water hammer arresters on all CW branch piping (i.e., restroom groups, counter sinks, etc.). Arresters shall be shown on plumbing plans.

**Fixtures:** All toilets, urinals, and lavatories must be wall hung.

All toilets, urinals, and lavatories shall be vitreous china. Urinals shall have integral flushing rim, semi-concealed overflow, and integral trap.

All toilets, urinals, and lavatories shall be mounted with carriers.

Fixtures and appurtenances shall be of the water conservation type.

Stainless steel sinks shall not be less than 18 gauge thickness.

Consider using single handle faucets (rather than two-handle type) for breakroom or lavatory type sinks. Single handle allows one hand operation, takes up less real estate on counter, and stays neater/cleaner. Also, consider pull down hose for break room faucets.

Bathroom/handwash sinks to have aerated nozzles, not laminar flow sprays (they tend to be too powerful (high velocity) and water ends up out of sink on counter everywhere).

Electronic, battery powered flush valves are preferred. See 22 40 00 for acceptable manufacturers.

Urinals shall be scheduled / specified to have a removable strainer option so that a strainer can be added later.

**Thermostatic Mixing Valves:** Water heaters should be designed to produce at least 140F water. 120-degree water should be supplied to the building with point of use mixing valves.

**Circulating Pumps:** Hot and tempered water systems shall be recirculated to provide hot or tempered water upon demand at each fixture unless the water heater is located directly adjacent to the fixture(s) served.

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**Drinking Fountains:** We prefer that water coolers and drinking fountains be located in alcoves, while maintaining handicapped accessibility. All water coolers and drinking fountains shall be provided with a bottle-filling feature including sensor for no-touch activation and automatic time delay shutoff.

**Sill Cocks:** Buildings shall be provided with an appropriate number of exterior sill cocks to facilitate landscape maintenance operations and exterior window washing. Minimally, one sill cock shall be provided on each side of the facility. On larger buildings, two or three may be necessary to prevent placement of hoses across sidewalks.

**Floor Drains:** Provide floor drains / floor sinks in all mechanical equipment rooms, areas serving emergency showers, toilet rooms, wet labs, and custodial rooms where a mop sink is not floor mounted.

Architectural drawings should be detailed or noted such that floors slope toward floor drains.

Floor drains shall be flashed.

**Building Sanitary System:** Sewage ejectors shall be avoided when possible. When these become necessary, only those fixtures requiring pumping shall discharge to these pumps. Self-priming pumps are preferred. Sewage ejectors shall be specified as a duplex system so that either pump may be removed for maintenance without disturbing the other. A high-level alarm shall be part of the system.

No combination waste/vent systems shall be designed into any facility.

Sanitary sewer vents must terminate vertically through the roof of the building.

Acid waste piping shall be connected to sanitary piping at a point creating optimal dilution.

Cleanouts located above ceilings shall not be allowed for waste systems. In areas requiring waste drain piping under supported structural floor slabs, the cleanouts shall be accessed at least 6" above the flood level of the highest fixture served. All risers shall be properly plugged and painted to match the adjacent surface.

### **Building Storm Water System:**

**Water Quality:** In conformance with UNLs NPDES SMS4 Permit all land-disturbing projects shall consider the feasibility of post-construction runoff control. All new development or significant redevelopment projects on the UNL City and East Campuses that disturb land in excess of 1/2 acre in size shall include post-construction Low Impact Development (LID) Best Management Practices (BMPs) to provide for water quality control to the maximum extent feasible but no less than the first one-half inch of runoff from the site.

**Water Quantity:** To the extent practicable, consideration must be given so that post-development flow rates and volumes do not exceed pre-development conditions during the 100-year, 24-hour storm event.

Primary roof drains shall discharge to a stormwater BMP, if feasible. Otherwise, primary roof drains shall discharge to the underground storm sewer system.

A secondary roof drainage system (when scuppers or other non-piped overflow methods are not used) shall discharge to a visible location without causing a safety hazard.

Provide a grated area drain at all below grade building entrances to intercept water that may accumulate within the area way.

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The use of storm water pumps should be avoided.

Vertical storm piping should avoid offsets below the uppermost floor line.

**Lab Gas Systems:** Gas isolation valves serving single appliances or laboratory benches shall not be located above ceilings. Locate isolation valves as close to the appliance as practicable in readily accessible and clearly observable or identified locations.

**Process Water:** Selection of material for process water systems must be done in consultation with FPC Engineering and BSM and early in the design process.

**Compressed Air Systems:** Compressed air systems shall be designed to a particular ISO 8573 Class (which defines maximum allowable particulate content, water content, and oil content). This classification shall be listed on the plans. A dewpoint of (-)15 deg F will eliminate growth of microorganisms.

Preference for compressors is variable speed/capacity scroll compressors (for quiet operation and oil-free operation), unless there is compelling reasons to use reciprocating. Typical max system operating pressure shall be nominal 125 psig, however ideally the system will operate at a lower pressure (90-100 psig) for energy conservation. All compressors shall come with air-cooled aftercoolers. If reciprocating multi-stage compressors are used, air-cooled intercoolers shall be provided.

Compressors to have after-coolers. The mechanical space containing compressors, dryer, and receiver shall be designed to remove or dissipate the heat generated from the compressor, heat of compression, and dryer. Consideration shall be given to draining water prior to the header turns up to the dryer assembly. Also, have compressors discharge down into a common header, so one compressor isn't sending water down the piping into the other compressor header.

Air compressor air intake to have robust particulate filtering (to keep contaminants out of the air system in the first place), be easily replaceable, and with dP gauge.

No carbon steel piping (because of potential for corrosion). Consider Copper or push-fit Aluminum piping (Parker Transair).

System piping shall be designed assuming there will be condensing moisture in the piping. In other words design pipe to be sloped with the flow to low points with drip legs and drains. Branch takeoffs shall come off the side or top of piping. Drip legs to have timed solenoid blowdown valves (with drip legs of adequate volume). Main drip legs (as well as air receiver) shall have two timed solenoid blowdown valves on each drip leg (for redundancy). Timed solenoid blowdown valve discharges shall have a minimum length of oversized piping and/or silencers to help reduce noise depending on location of valves/drains.

Size air receiver to reduce compressor cycling, and to handle any high instantaneous loads. Design system with a healthy margin, or leave space for a future compressor.

Receiver to have long-life anti-corrosion internal surface coating, as condensate will collect/form inside the air receiver as it dissipates heat of compression. Receiver itself shall have a relief valve even if other relief valves in the system.

Central twin-tower desiccant drying system (rather than refrigerant-based dryer) to be supplied on all air systems. Dryer to be placed downstream of the air receiver, unless high instantaneous loads are expected. Dryer to have upstream cyclonic bulk-water separator (including timed solenoid blowdown valve), oil filter (even if oil-less compressors), particulate filter, and have

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downstream post-particulate filter and backup coalescing water filter. Dryer to have local and alarm contacts for malfunction, maintenance, and water carry-over.

Building Individual Air Users (Point-of-Use): All point-of-use air 'drops' shall have root isolation valve, drip leg with timed valve, isolation valve upstream of: particulate filter (5 micron), coalescing filter (0.01 micron), air pressure regulator, oiler (if needed/desired for air tool service), and drain valve (to relieve pressure). If a machine needs positive de-energizing of compressed air (for safe maintenance), add a dedicated combination block/bleed lockout valve. Some machines may benefit from a soft-start / quick dump valve as well. All point-of-use components shall be easily replaceable, either via quick disconnect filters, or unions or quick disconnect fittings in the piping for the regulator and de-energizing lockout valve (to avoid a complete disassembly of the piping).

All timed solenoid blowdown valves shall have isolation valves directly upstream, and unions or quick-disconnect fittings to allow periodic replacement (the timed valves will fail with time). Do not use mechanical/float drain valves due to potential for gumming up and plugging. Any area that could collect water on a dryer malfunction shall have a timed solenoid blowdown valve.

**Miscellaneous:** Water, steam, or gas piping terminated for future use shall be valved and capped.