



Boise State University

Division 22 - Plumbing Design Guidelines

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Summary

The purpose of this document is to provide design teams with an easy to reference document containing Boise State University's guidelines for construction projects on campus and is intended as a resource to inform the design process. This document does not remove responsibility from the designer, preclude the use of engineering judgment, or relieve the designer from meeting all adopted code requirements. Questions, clarifications, or suggestions can be directed to the Boise State University Project Manager (PM).

These guidelines have been developed as a joint effort between the Facilities, Operations and Maintenance (FOM) team and the Architectural and Engineering Services (AES) team to help ensure the resiliency of Boise State's campus by considering maintenance needs, sustainability goals, future expansion, and responsible stewardship of our resources. These guidelines are created from both common industry standards and lessons learned through the practice of engineering and maintenance. They are arranged using the Masterspec Divisions to help facilitate a common language.

Related / Supporting Documents

In addition to this document, see the following Boise State University Guidelines:

1. *Utilities and Metering Guidelines*
2. *Preferred Manufacturers - Plumbing (under development)*
3. *Building Automation Systems (BAS) Guidelines*
4. *Division 23- Mechanical, 230900 Instrumentation and Control for Mechanical Systems*

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Section 220500 – Common Work Results for Plumbing

General Requirements

The project team must use the latest editions of referenced design and safety guidelines available at the time of the design contract award. In cases of conflict between the adopted or selected code, and the requirements set forth in these guidelines, the most stringent, technically appropriate and conservative criteria applies. Where it is unclear which criteria is to be applied, clarify with the Boise State project manager. The code is typically a minimum standard, and in most cases these guidelines are more stringent. In cases where Boise State University does not identify requirements, meet the adopted code.

Maintenance Access

1. The design and installation of equipment, piping, conduit, etc., will facilitate service, maintenance, and removal / replacement of equipment and components. Careful coordination between disciplines allowing for ease of maintenance is expected to be reflected in the final construction documents. Consider sloped piping and other components that require a “right of way.”
2. The designer must coordinate with the University, equipment representatives, and other disciplines to identify equipment that will require extra structural supports and hoist anchor points for maintenance of large or heavy equipment. The use of mobile cranes must be minimized.
3. Coordinate roof access with architecture. See the General Requirements in Boise State’s Division 23 - Mechanical Guidelines for more information on preferred roof access methods.
4. When ceiling access panels are required, the minimum access panel size must be 24”x24” for ease of maintenance. Coordinate with architecture.
5. Coordinate with Mechanical and provide freeze proof roof hydrants for rooftop mounted equipment that requires periodic cleaning.
6. All components that require maintenance must be readily accessible and labeled.

Documents / Drafting / Deliverables

Sheets

1. Clearances for equipment and other areas intended for maintenance / replacement are **required to be identified on the drawings**. These areas must comply with manufacturer recommendations and include enough space / pathways for removal of internal components and other large pieces of equipment.
2. General notes and legends are required on the drawings.
3. Provide section views on drawings along corridors and other congested areas where equipment / valve access will require coordination amongst trades.
4. When possible, show furniture layouts on plumbing drawings to ensure that equipment is in an accessible location.
5. Construction documents must be a complete design.
6. Include floor plans showing all areas of work.

Specifications

1. State that paper and electronic copies of Operations and Maintenance (O&M) Manuals are required.
2. Specifications must state that electronic O&M manuals will be electronically bookmarked by section.
3. Where O&Ms include manufacturer / product literature that is searchable in its original format, it must also be searchable in the electronic O&Ms. Handwritten documents or as-builts are not required to be searchable.
4. Owner's Training must be provided for all equipment and is required to be recorded for the following applications:
 - a. New buildings / new construction.
 - b. Sequence of Operations. See 220900, and 230900 for more information.
 - c. General maintenance / procedures on large equipment including domestic water boilers, RO /DI systems, Vacuum systems, Compressed Air Systems, water softeners, pumps, etc.
 - d. When requested by the University Project Manager or Facilities Team.

As-Built Drawings

1. Record documents must contain actual installed inverts and locations of buried piping.
2. As-built drawings must identify the locations of any differential pressure (DP) sensors, high point air valves, and low point drains.
3. At the end of the project, provide Boise State University Facilities team with one full size physical set of as-built drawings.

Sustainability

Design of plumbing systems should consider the dynamic nature of the University and should take into consideration future growth, alternative energy sources, and energy saving measures such as:

- Utilizing geothermal heating to the greatest extent possible. At a minimum, consider reserving space for geothermal equipment and accessories for future connections to the geothermal system.
- Condensate Recovery.

The total cost of ownership (TCO) should be a primary consideration when reviewing the cost of construction projects.

Demolition

1. Where piping, equipment, and associated electrical, etc. is indicated for demolition, such items must be removed and capped at the primary source.
2. Coordinate and show items for demolition across disciplines. For example, plumbing equipment identified for removal should also be identified on electrical, architectural, etc. drawings.
3. General demolition notes should state that the University reserves the right to salvage any demolished components whether or not they are identified for salvage in the construction documents.
4. General demolition notes should state that all backflow prevention assemblies identified for removal must be salvaged to the University.

Mechanical / Plumbing rooms

1. All rooms with plumbing equipment or piping systems capable of freezing must have a permanent source of heating. Heating should be on emergency power (if available).
2. Coordinate with the University Project Manager to address how drainage requirements for mechanical rooms are being met (e.g. areas with reduced pressure principle backflow preventers).
3. Provide plumbed emergency eyewash stations near chemical feed(s).

Product Requirements

1. Specify a minimum of three (3) manufacturers or products of similar quality for each component. See the Boise State University Preferred Plumbing Manufacturers list.
2. In limited cases, sole sourced products are acceptable. All sole sourced products must be approved by the Boise State University PM and Facilities team.

Section 220513 – Common Motor Requirements for Plumbing

Variable Speed Motors

1. Controlled by variable frequency drives (VFDs) for motors over 1HP. ECM motors are acceptable for 1HP or below.
2. Inverter duty, premium efficiency rated motors.
3. Installed with hand off auto (H/O/A) controls.
4. Shaft grounding rings must be included on all motors served by a variable frequency drive. Coordinate with electrical to electrically ground the pump / motor casings as required by the shaft grounding ring manufacturer. Shaft grounding rings must be by AEGIS or equivalent.

ECM Motors

1. Allowed for 1HP and below. Provide VFDs above 1 HP.
2. Installed with hand off auto (H/O/A) controls.

Variable Frequency Drives

See the Boise State University Preferred Mechanical Manufacturers list for more information.

1. Provide a drive bypass on critical equipment. Coordinate with the University project manager.
2. All VFDs must be provided with 3% line side reactors.
3. Where VFDs serving inverter duty motors are mounted 100 feet or greater distance away from the motor, provide VFD with a load side reactor.
 - Provide load side reactors for all non-inverter duty rated motors with VFDs regardless of distance.
4. All VFDs must be monitored by the Building Automation System (BAS) and will generate an ALARM at the operator WorkStation whenever the drive is NOT in AUTO.

Section 220519 - Meters and Gauges for Plumbing Piping.

1. Meters and gauges for pressure and temperature must be placed for ease of reading and accurate measurements.
2. Install meters and gauges with isolation ball valves for ease of replacement.
3. Use snubbers for pressure gauges to dampen gauge reaction.
4. Round dial gauges should be 6" diameter for anything installed 7 feet above the finished floor and a minimum of 4" below 7 feet.

Thermometers

1. Thermometers must be bimetallic thermometers constructed of 304 stainless steel with an adjustable angle and a minimum dial diameter of three (3) inches.
2. Thermometers must be installed in thermowells for all fluid applications.

Pressure Gauges

1. Provide round oil filled gauges.

Flow Meters

See Boise State University Utilities and Metering Guidelines for more information.

1. Flow meters to integrate with the BAS system are required for all compressed air and RO/DI systems.
2. Provide flow meters to integrate with the BAS system for HVAC uses including make-up water for boilers and cooling towers. Sub-meters are not required to integrate with the campus energy management system.

Installation

Install pressure gauges and thermometers to meet the location requirements in the Thermometer and Pressure Gauge Locations Table below.

Thermometer and Pressure Gauge Locations			
Equipment	Location	Thermometer	Pressure Gauge
Pumps	Suction and Discharge		X
Pressure Reducing Valves	Inlet and Outlet		X
Water Service Entrance	Outlet		X
Heat Exchangers	Inlet and Outlet	X	X
Thermal Storage Tank	Inlet and Outlet	X	
Expansion Tanks > 5 gallon tank*	Inlet		X
Domestic Hot Water Heater	Inlet and Outlet	X	
Other Locations deemed appropriate by Boise State University or the designer		X	X

*External pressure gauge only required if not integral to the equipment.

Section 220523 - General-Duty Valves for Plumbing Piping

General

1. Isolation valves are required in the following locations:
 - a. At each floor.
 - b. All restroom blocks and groups of plumbing fixtures such that these zones can be shut-off for maintenance without affecting the rest of the building. If isolation by blocks is not feasible, at a minimum provide isolation valves for all fixtures with a flushometer.
2. Integral locking tabs must be included on isolation valves for convenience of system or equipment lockout/tagout.
3. Provide 2" and larger valves located more than 7 feet above finished floor in mechanical spaces with chainwheel operators. Chains should terminate 7' above the finished floor.
4. Provide valves installed with insulation with stem extensions.
5. Provide drain valves with threaded hose adapter and cap.
6. Valve handle swing must be installed in the direction of flow when the valve is open.

Valves Schedule

Isolation Valves, 100% positive shutoff:

- 2" and smaller: Ball Valves, Two-piece, Full Port.
- 2-½" and larger: Butterfly valves.

Balancing Valves

- Provide Armstrong Model CBV-VT balancing valves or equivalent.

Thermal Balancing Valves

- Provide Caleffi Model 116 thermal balancing valves or equivalent.

Section 220529 – Hangers and Supports for Plumbing Piping and Equipment

No Boise State University requirements at this time.

Section 220548 – Vibration and Seismic Controls Plumbing Piping and Equipment

1. All equipment containing rotational components must be provided with a vibration isolation system, either integral with the equipment or provided by the installer.
2. Isolation systems must be capable of resisting seismic and internal dynamic forces.
3. All moving equipment must be isolated from associated piping systems by use of flexible connections.

Section 220553 – Identification for Plumbing Piping and Equipment

General

1. All components that require maintenance must be labeled with a valve number that corresponds to a ledger.
2. Backflow preventers are required to be tagged, labeled and included in the valve tag schedule.
3. Piping systems must be labeled with the system abbreviation and include directional flow arrows.
4. Provide a ceiling label where key serviceable components such as valves, equipment, etc. are located.

Valve Tags / Schedule

1. Valve Tags and Schedules are required for all projects containing valves for control, emergency shutoff, or similar special uses.
2. In addition to extra valve schedule copies included with the O&M manuals, provide mounted valve schedules in frames located in mechanical rooms. Include floor plans in the O&M manuals and in mounted frames identifying the location of valves coordinated and tagged according to the valve schedule.

Frames

1. **Snap Type Poster Frame with Laminated Schedules:** Provide valve schedules and floor plans on laminated bond paper. Provide poster frames similar to SnapeZo (SNAP-8.5-11-SB-25MM) such that laminated valve schedules and floor plans can be removed from the frame. Provide frames of aluminum with screws for removable mounting on walls.
2. **Location:** Mount valve schedule frames and schedules in mechanical equipment rooms where directed by the University. Where more than one major mechanical equipment room is shown for a project, install a mounted valve schedule in each major mechanical equipment room, and repeat only main valves which are to be operated in conjunction with operations of more than a single mechanical equipment room.

Piping

1. Provide snap on type factory plastic pipe labels.
2. Piping must be labeled with the fluid conveyed and the direction of flow:
 - a. On both sides of wall or floor penetrations.
 - b. Once on every straight run of pipe.
 - c. No more than 20-foot intervals.
 - d. No more than 10-foot intervals in congested areas.
 - e. Within 3 feet of each piece of equipment, valve, or control device.

Equipment

Equipment tags must be color coded and attached in a visible location. Labels must include:

1. Component identification designation (coordinated with construction drawings).
2. Area served (Including areas or equipment of critical impact if equipment is shut-off).

3. Power source (coordinated with electrical).

Labels for backflow preventers are required and must include:

1. Component Identification designation (coordinated with construction drawings).
2. Hazard identification (e.g. coffee maker, eyewash, boiler make-up, ICW , etc.).
3. Location of Hazard (Room Number).

Label Color and Size Requirements

All pipes, ducts, and equipment must be labeled according to ANSI standard A13.1. See table below for examples.

Label Color Schedule Per ANSI A13.1	
Water (Heating, chilled, potable, boiler feed, etc.)	Green Background with White Letters
Compressed Air	Blue Background with White Letters
Natural Gas / Refrigerant / Steam	Yellow Background with Black Letters
Acid Waste	Orange Background with Black Letters
Equipment Labels*	Black Background with White Letters

*Label all equipment that is on generator power with a Red Background and White Letters

Text Height Requirements		
Equipment Labels	Main Designation Supplemental Info Large Equipment w/viewing distances beyond 10 feet	$\frac{3}{4}$ " high text minimum $\frac{1}{2}$ " high text minimum 3" high text main label
Piping	O.D. of $\frac{3}{4}$ " to 1- $\frac{1}{4}$ " O.D. of 1- $\frac{1}{2}$ " to 2- $\frac{3}{8}$ " O.D. of 2- $\frac{1}{2}$ " to 7- $\frac{7}{8}$ " O.D. of 8" to 10" O.D. over 10"	Letter Size: $\frac{1}{2}$ " high Letter Size: $\frac{3}{4}$ " high Letter Size: 1- $\frac{1}{4}$ " high Letter Size: 2- $\frac{1}{2}$ " high Letter Size: 3- $\frac{1}{2}$ " high Marker Size: 8" wide Marker Size: 8" wide Marker Size: 12" wide Marker Size: 24" wide Marker Size: 32" wide
Ducts	All Duct Sizes	Letter Height: 3.5"
Ceiling Labels	Letter height: $\frac{1}{2}$ " Minimum	

220593 - Testing, Adjusting, and Balancing

1. Provide a copy of the TAB report in the O&M manuals.
2. Systems to be tested, adjusted, and balanced prior to substantial completion include but are not limited to the following:

- a. Pumps
- b. Circuit Setters, flow control devices.
- c. Tempering stations, thermostatic mixing valves, etc.
- d. RO / DI systems

Section 220700 – Plumbing Insulation

1. At a minimum, insulation must be provided to meet the International Energy Efficiency Code.
2. Removable components such as valves, unions, manufacturer's label plates, and National Board (ASME) stamps must be insulated using removable and reusable insulation wraps or covers.
3. Insulation around valves must have removable blankets and not hard plastic-cased for ease of maintenance, repair or removal of valve.
4. Insulation around pumps must have access doors adequately sized and situated to allow access to pump strainers. Insulation must not hinder access of grease fittings for regular maintenance.
5. Plumbing insulation must be installed continuously through wall and floor penetrations.
6. Insulation on surfaces below ambient temperatures must maintain a continuous and unbroken vapor barrier.
7. Provide insulation with jacketing when domestic piping is interior and exterior exposed.

220800 - Commissioning of Plumbing Systems

1. Discuss commissioning requirements with the University Project Manager. Commissioning is desired for most projects on campus. Include provisions for commissioning by a 3rd party agent whenever budget allows and when required by code.
2. Central plant type, large, and critical equipment must be commissioned with a sampling rate of 100%.
3. Discuss the required sampling rate of terminal units, valves, and other downstream equipment with the University Project Manager
4. Commission the following plumbing systems:
 - a. Domestic water heating systems
 - b. Domestic water systems
 - c. Plumbing fixtures
 - d. Non-Potable hot and cold water systems
 - e. Compressed air systems
 - f. Lab Gas systems
 - g. RO/DI Systems
 - h. Emergency Showers and eyewash stations
 - i. Plumbing metering

220900 - Instrumentation and Control for Plumbing Systems

The following systems must integrate with the building BAS system via BACnet and must have their own graphic displayed at the BAS operator workstation. The requirements in the Plumbing Systems Controls Table below are minimum. Coordinate with the Boise State Project Manager for final requirements.

Plumbing Systems Controls	
Equipment	BAS Integration
Water Heaters	Industrial water non-potable hot water systems only: Monitor water heater status and display alarms at the BAS operator workstation.
Domestic Water Booster Pumps	Monitor the operating status and speed.
Sanitary Pumps	Monitor the pump status and display alarms at the building automation system operator workstation.
Sump Pumps	Discuss sump pump monitoring with the Boise State PM. When required by the Boise State facilities team, monitor the pump status and display alarms at the building automation system operator workstation. Auxiliary contacts required for integration with building automation systems to include general alarm, high water alarm, and loss of normal power.
Potable Domestic Water Recirculation Pumps	Schedule and monitor pump status via the BAS.
Circulation pumps - Non potable water, RO/DI systems, etc.	Building automation system to control pump speed, enable / disable, and alarming.
Flow Meters (DW, NG, CA, etc.)	BAS system must monitor all flow meters and display the flow at the operator workstation.
Water Softeners	Monitor water softeners status, water hardness, and totalization of the regeneration cycle.
RO/DI	Monitor RO/DI system status, alarms.
Bulk Tank Gas Systems	Bulk tank fill status must be monitored by the BAS system.

Section 221116 – Domestic Water Piping

General Requirements

1. Drain valves and stub out connections for future use must include a valve and an end cap to prevent accidental discharge.

Piping Materials and Methods

Not every situation is addressed below. Discuss deviations from the following materials with the University Project Manager.

Potable Water Systems – DCW, DHW, HWR

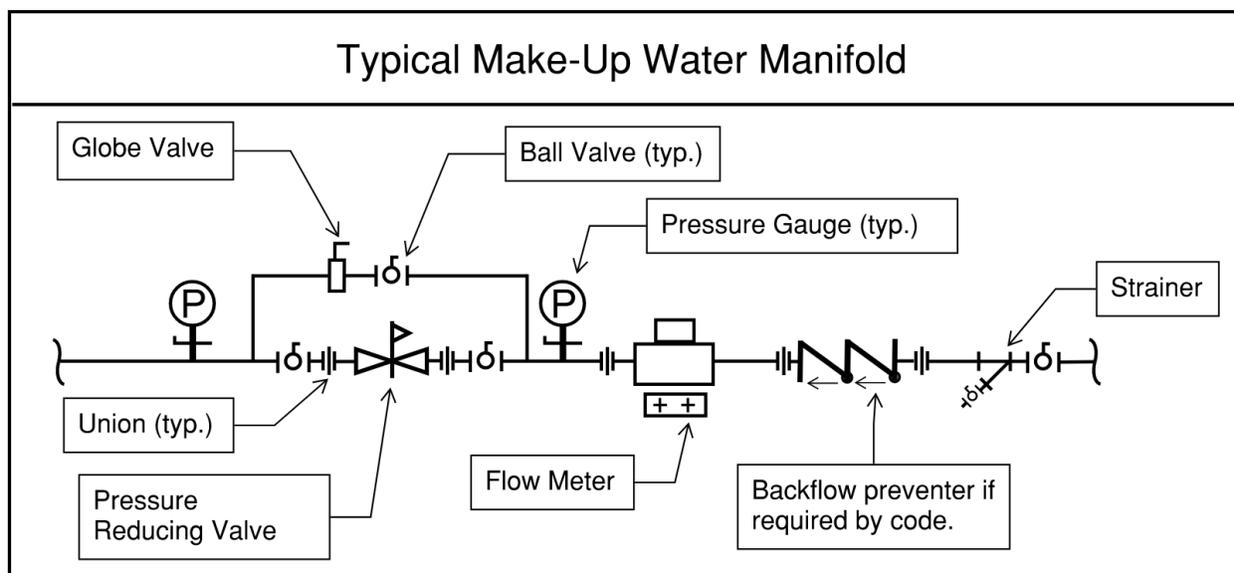
- NPS 2-¼" - 12"

- Type K or L , hard drawn copper tube with wrought copper or bronze fittings, silver tin alloy solder joints (Brazed joints for 2.5" and larger)
- By owner approval
 - Polypropylene Pipe and Fittings: PP-RCT pipe complying with ASTM-F 2389 and NSF-61. Heat Fusion fittings. When polypropylene pipe is used, 1 set of any specialized tools needed to install or maintain the system must be turned over to the owner at closeout.
- NPS 2" or less
 - Type K or L , hard drawn copper tube with wrought copper or bronze fittings, silver tin alloy solder joints.
 - Type K or L, hard drawn copper tube with pressure seal joint fittings and pressure seal joints.
 - By owner approval if cost savings can be proven over copper.
 - Cross linked Polyethylene (PEX) with press fit joints or PEX crimp fittings.
- Buried under slab or building service within 5 feet of building
 - Type K, hard drawn copper tube, brazed joint fittings, brazed joints.

Make-Up Water Manifolds

Makeup water manifolds should consist of the following components:

1. Reduced pressure backflow preventer (where required).
2. Pressure regulating valve.
3. Isolation valves on both sides of the pressure regulating valve.
4. Bypass loop with isolation ball valve and adjustable globe valve.
5. Pressure gauges before and after the pressure regulating valve, upstream and downstream of the isolation valves, and a flow meter to measure total makeup water volume.
6. Flow meters and associated alert systems preferred in critical and remote locations.



Section 221119 – Domestic Water Piping Specialties

Flexible Connectors

1. Stainless steel braided hose.

Shock Arrestors

1. All building water supply systems in which quick-acting valves are installed must be provided with devices to absorb water hammer.
2. The devices must be installed as close as possible to the quick-acting valves.

Backflow Preventers

General

1. Provide backflow preventers that are appropriate for the hazard zone they serve.
2. All backflow preventers that are removed for demolition must be salvaged to the owner. No backflow preventers should be permitted to be abandoned in place.
3. All backflow assemblies must be provided with a removable cartridge.
4. A strainer is required upstream of all backflow prevention assemblies and must be the same material as the backflow to prevent electrolysis.
5. Coordinate the plumbing system and the backflow preventer installation direction (left-to-right or right-to-left) such that access to the front of the backflow is maintained.

Labeling

1. Backflow preventers must be tagged and identified on a valve schedule and labeled. See section 220553 for labeling requirements of backflow preventers.

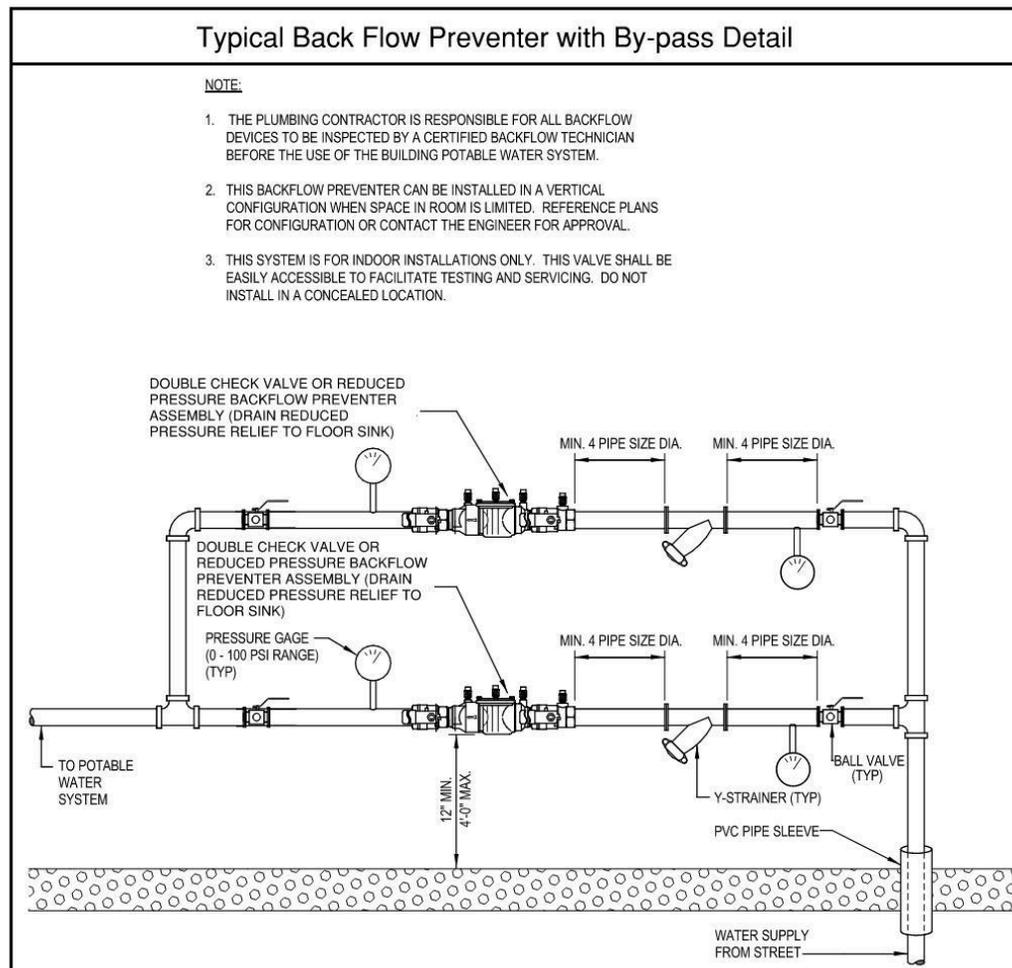
Accessibility

1. Backflow preventers require annual maintenance and testing and must be placed in an accessible and safe location.
2. It is not acceptable to install backflows near electrical outlets.
3. When possible, group multiple backflow preventers together in a common accessible location such as in a janitorial or mechanical room, or installed on racking in a wall with appropriate access covers.

Installation

1. A bypass assembly is required for backflow preventer assemblies serving:
 - a. The main water entrance to the building.
 - b. Non-potable or industrial water system that serves laboratory spaces.

Explanatory Note: Bypass assemblies allow maintenance and annual testing to occur during normal business hours and protects the investment of other plumbing components such as flushometers and other backflow prevention devices that can be damaged by dislodged dirt and piping material caused by the process of shutting-off / turning-on the building water supply.



2. Coordinate with the University Project Manager team to address how drainage requirements for reduced pressure principle backflow preventers are being met. Design must take into account the full flow of an RPBP relief valve during a failure event.
3. It is not acceptable to install any type of backflow preventer in an underground vault or similar confined space.
4. Provide leak detection in all rooms with Reduced Pressure Backflow Preventers larger than $\frac{3}{4}$ ". Leak detectors must be BACnet compatible and must alarm the campus Building Automation System (BAS).

Tempering Valves

No Boise State University requirements at this time.

Thermostatic Mixing Valves

1. Provide Unions and valves at all piping connections to the valve.
2. Master thermostatic mixing valve must be provided with a check valve and strainer with stainless steel screen at the inlet and a dial thermometer at the outlet.

3. Single or Point of use thermostatic mixing valves must be provided with a check valve at the inlet and an adjustable temperature selection at the outlet.

Pressure Reducing Valves

1. Pressure reducing valves must be installed with unions on both ends for servicing and bypass piping with shutoff valves.
2. Provide with a strainer and stainless steel screen.

Vacuum breakers

1. Hose bib vacuum breakers must be of a freeze proof design with automatic draining capability similar to Woodford Model 50.

Water Sterilization

Prior to substantial completion, all domestic water piping must be sterilized as follows:

- Disinfect in accordance with requirements of the U.S. Public Health Department and local authority having jurisdiction.
- Submit written certification of disinfecting completion and include it in the O&Ms.

Section 221123 – Domestic Water Pumps

1. All pump impellers must be metal. Plastic impellers are not acceptable.
 - a. Exception: Systems with fluids that are incompatible with metal impellers.

Booster Pumps

1. Variable frequency drives (VFDs) must be utilized for control of the booster pump output pressures.
 - a. See section 220513 - Common Motor Requirements for Plumbing more requirements on VFDs.
2. Provide booster pumps as a packaged skid. No field-assembled booster pumping systems will be allowed.
3. Provide VFD pumps with shaft grounding rings.

Hot Water Recirculation Pumps

1. Provide ECM pumps with BACnet compatibility. Recirculation pumps should be monitored via the building BAS system. See 220900 for more information.
2. Inline pumps must not be installed over other pumps or electrical components.
3. When feasible, schedule water recirculation pumps through the BAS system and control temperature with a thermostatically operated cut-off switch. A standard timer is acceptable when scheduling through the BAS system is not feasible.

221223.11 - Facility Indoor Potable Water Storage Tanks

Expansion Tanks

1. Provide floor-mounted bladder-type expansion tanks on concrete housekeeping pads whenever possible. Floor mounted tanks are not required when the acceptance volume is less than 5 gallons.
2. Provide Expansion tanks greater than 5 gallon acceptance volume with a ¾" NPT drain piped with an isolation valve and threaded end cap.
3. Provide a tank purge valve, air vent, and pressure gauge on inlet piping.
4. Provide expansion tanks with a display indicating if the internal diaphragm is ruptured or normal.

Thermal Storage / Buffer Tanks

1. Install tanks on concrete housekeeping pads.
2. Provide with pressure and temperature gauges.
3. Provide with a ¾" NPT drain piped with an isolation valve and threaded end cap.

Section 221316 – Sanitary Waste and Vent Piping

Piping Materials and Methods

Sanitary Waste Piping

1. All sanitary waste piping installed above grade, in noise sensitive areas, or where high-temperature discharge approaches the temperature ratings of plastic piping must be the following material.
 - a. Cast Iron CISPI 301, ASTM A888 hubless with cast iron fittings.
2. Horizontal under-slab piping must be any of the following materials installed with a tracer wire. Under-slab scoping of piping is required at the completion of the project.
 - a. Schedule 40 PVC-DWV and fittings.
 - b. Schedule 40 ABS piping and fittings.
3. Kitchen: Coordinate piping materials with temperature and properties of waste.
4. Condensate Piping: Install condensate piping per manufacturer recommendations and to fit each application.
5. Laboratory Waste Piping: See Section 226600 – Chemical Waste Systems for Laboratory Facilities for laboratory waste piping materials.

Vent Piping

1. Above Grade vent piping may be any of the following materials
 - a. Cast Iron CISPI 301, ASTM A888 hubless with cast iron fittings.
 - b. Schedule 40 PVC Pipe: ASTM D 2665, Solid-wall drain, waste, and vent.
 - c. Schedule 40 ABS Pipe: ASTM D 2661, Solid-wall, drain, waste, and vent

Section 221319 – Drainage Piping Specialties

Floor Sinks, Floor Drains, Trench Drains

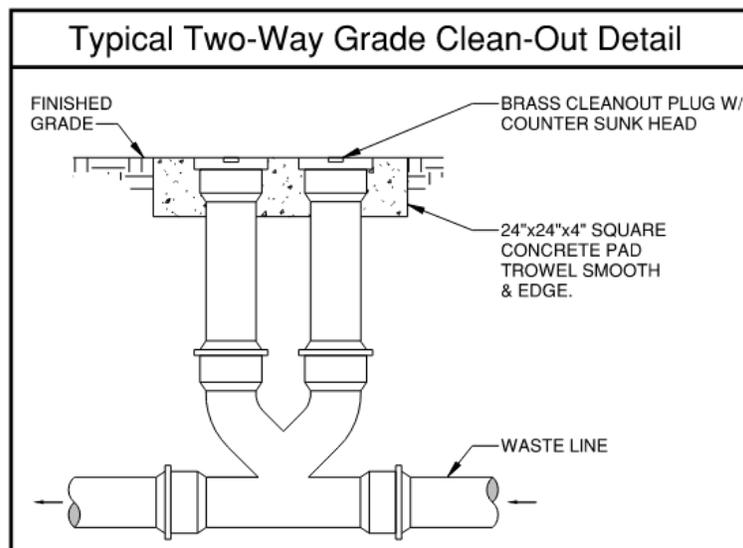
1. Coordinate with the University Project Manager to address how drainage requirements for mechanical rooms, fire riser rooms are being met (e.g. areas with reduced pressure principle backflow preventers).
2. Locate floor drains / sinks around the perimeter of the mechanical room and away from walking areas.
3. Pipes and floor must drain away from traffic areas and routes.
4. All floor drains must be provided with trap primers.

Trap Primers

1. Acceptable trap primer types include:
 - a. Electronic trap primers such as Precision Plumbing Model PTS Series.
 - b. Sink tailpiece type trap primers such as Dearborn Brass Model 832-1.
 - c. Pressure activated type trap primers such as Precision Plumbing CPO-500.
2. Flush valve style trap primers are not acceptable.
3. Provide ball valve type shut-off valve upstream of all trap primer valves.
4. Trap seals will be considered for existing drains and where trap primers are not feasible or when a cost savings can be shown over other trap priming methods. Subject to owner approval.

Cleanouts

1. Provide two-way grade cleanouts (GCO) for all waste piping GCOs.



Air Admittance Valves

1. Provide per manufacturer recommendations.

Section 221323 - Sanitary Waste Interceptors

Grease, Oil, and Sand Separators

1. Buried grease and oil separators must be provided with cast iron access lids. Plastic access lids for separators are not acceptable.

Section 221329 – Sanitary Sewage Pumps

1. Provide duplex sump pumps for all sanitary sewer applications.
2. Sanitary pumps should be on emergency power. See section 220900 for more information.
3. Control panel to be BACnet compatible and provide both audible and visual alarms, test and silence switches, status lights for power on and alarm conditions.
4. Auxiliary contacts required for integration with building automation systems include general alarm, high water alarm, and loss of normal power.
5. Provide pump lifting and removal system for pumps with greater flow than 50 gpm or 40 lb pump weight.
6. When sump pits are not accessible by pump trucks in the installed location provide exterior quick connection piping to pit drain for emergency evacuation

Section 221413 – Storm Drainage Piping

Piping Materials and Methods

1. All storm drainage piping installed above grade must be the following material.
 - a. Cast Iron CISPI 301, ASTM A888 hubless with cast iron fittings.
2. Horizontal under-slab piping must be any of the following materials installed with a tracer wire.
 - a. Schedule 40 PVC-DWV piping and fittings.
 - b. Schedule 40 ABS piping and fittings.
3. Under-slab scoping of piping is required at the completion of the project.

Section 221423 – Storm Drainage Piping Specialties

Downspout Nozzles

1. Provide lambs tongue style downspout nozzles.

Roof/Overflow Drains/scuppers

1. Coordinate with electrical to provide heat tape at all roof and overflow drains.

2. Coordinate location with mechanical equipment. Do not install roof drains in walkways or where the roof drain will prohibit servicing of equipment.

Section 221429 – Sump Pumps

Sump Pumps

1. Provide duplex sump pumps for stormwater applications. Simplex pumps are acceptable for elevators.
2. Provide high temperature rated sump pumps when installed near steam systems.
3. Provide slow closing check valve, shutoff valve, and balancing valve on discharge piping.
 - a. Additional check valves may be required if discharge piping has excessive length or changes in elevation.
4. Sump pumps should be on emergency power. See Section 220900 for more information.
5. Control panel to be BACnet compatible and provide both audible and visual alarms, test and silence switches, status lights for power on and alarm conditions.
6. Auxiliary contacts required for integration with building automation systems include general alarm, high water alarm, and loss of normal power.
7. Sump pumps that are installed near steam systems must be rated for high temperature.
8. Provide pump lifting and removal system for pumps with greater flow than 50 gpm or 40 lb pump weight.
9. Boise State has a high groundwater table. Discuss sump pumps for elevator pits with the Boise State Project Manager.
10. When stormwater sump pits are not accessible by pump trucks in the installed location provide exterior quick connection piping to pit drain for emergency evacuation.

Section 223100 – Domestic Water Softener

1. During the design phase of a project, provide a water quality report for Boise State Review indicating if filter system is required for the building or for equipment in the building.
2. Water softeners must be equipped with a local Human Machine Interface (HMI) control panel with a programmable logic controller.
3. Water Softeners must be connected to the building automation system for remote monitoring and alarming. Monitor the water softener status, water hardness, and totalize the regeneration cycle.
4. Softened water must not be supplied to ground-level exterior hose bibbs.

Section 223200 – Domestic Water Filtration Equipment

Sand Filters

No Boise State University requirements at this time.

UV Filters

No Boise State University requirements at this time.

Section 223300 – Electric Domestic Water Heaters

Tank Type Electric Water Heaters

1. The water heater pressure and temperature safety valve must be piped to the closest drain.
2. Provide temperature gauges on the inlet and outlet piping. Provide pressure gauge on the outlet piping.

Tankless Hot Water Heaters

1. Tankless style electric hot water heaters are not allowed without approval from the Boise State University Project Manager and Facilities team.
2. Instant hot under counter style electric water heaters are not allowed without approval from the Boise State University Project Manager and Facilities team.

Section 223400 – Fuel-Fired Domestic Water Heaters

Water Heaters

1. Provide high efficiency gas fired water heaters with a minimum thermal efficiency rating of 95%.
2. Provide with condensate neutralization kits.
3. Pipe the water heater pressure and temperature safety valve to the closest drain.
4. Provide temperature gauges on the inlet and outlet piping. Provide pressure gauge on the outlet piping.

Section 224200 – Commercial Plumbing Fixtures

1. Minimum residual pressure at the most remote fixture should be twenty five (25) psi for flush valves or fifteen (15) psi for flush tanks.

Flow Rates and Basis of Design

Plumbing fixtures should be designed to meet the following flow rates. In general, the minimum rate is preferred to conserve water usage.

Plumbing Fixture Basis of Design Schedule			
Fixture	Min Rate	Maximum Rate	Basis of Design
Public Lavatories	0.5 GPM	0.5 GPM	Sensor Faucet: AMTC AEF-301 Manual Faucet: Delta or Moen
Private Lavatories	0.5 GPM	1.5 GPM	
Break Room Sinks	0.5 GPM	1.5 GPM	None
Showers	1.6	1.6 GPM	Shower Valve: Symmons Temptrol

	GPM		
Water Closets	1 GPF	1.28 GPF	Sensor Flushometer: AMTC Model AEF-801-CT Manual Flushometer : AMTC Model MF-700-T12
Urinals	0.5 GPF	1 GPF	Sensor Flushometer: AMTC Model AEF-801-CU Manual Flushometer : AMTC Model MF-700-U10
Hose Bib	N/A	N/A	Exterior: Woodford Model 67 with 50HA backflow preventer and Tee Key
Drinking Fountain	N/A	N/A	ELKAY EZH2O

Sinks and Lavatories

1. Provide commercial grade sinks and lavatories.

Showers

No Boise State University requirements at this time.

Fixture Carriers and Supports

1. Provide heavy duty carriers.

Faucets

1. Provide chrome finished, battery operated sensor faucets with ceramic cartridges in restroom areas.
2. Manual single lever faucets can be provided in low-occupancy restrooms.
3. Provide manual faucets for breakrooms and other utility sinks.
4. Faucets with a hose end connection, pull out spray hose, or other similar hazard must meet ANSI/ASME A112.18.3 and must be installed with a vacuum breaker for backflow prevention.

Flushometers

1. Provide battery operated sensor flushometers with manual backup and diaphragm style valves.
2. Manual flushometers may be considered in low-occupancy areas.

Shower Valves

There are no Boise State University Standards at this time.

Mop Service Basins

1. Provide 24"x24" floor level service sinks with 10" lip heights (+ or - 2") in janitorial rooms with hot and cold water mixing faucet with a vacuum breaker.
2. Provide mop sinks with mop hangers, stainless steel bumper guards, 36" hose and wall hanger, and stainless steel wall guards.

Hose Bibs and Roof / Wall Hydrants

1. Freeze proof hose bibs, roof hydrants, yard hydrants, and wall hydrants must be installed in the following locations:
 - a. Roof: Where mechanical equipment is installed on the roof and requires periodic cleaning.
 - b. Exterior Walls and Mechanical Yards: Where mechanical equipment is installed exterior to the building and requires periodic cleaning.
 - c. Public Restroom Blocks: Provide an under counter lockable hose bib for cleaning.
2. Install hose bibs and hydrants with an accessible shutoff valve.
3. Install hose bibs and hydrants with backflow prevention devices per code.
4. Provide an interior hose bib with hot and cold taps and lockable wall box in multiple occupancy restrooms.

Water Closets

1. Provide floor mounted water closets with battery powered flushometers and manual backup.
2. Tank style water closets may be installed only when domestic water pressure is too low for flushometer valves.
3. Dual flush water closets may be considered in single use and low occupancy restrooms.

Urinals

1. Provide wall mounted urinals with battery powered sensor flushometers, manual backup, and diaphragm style valves.
2. Manual only flushometers may be considered for single occupancy restrooms.
3. Waterless urinals are not acceptable.

Garbage Disposal

1. Garbage disposals must be approved by the Boise State Project Manager.

Fixture Supplies, Stops, & Traps

1. Stops must be provided with packing nuts on handles with interchangeable parts.
2. Each fixture must be provided with quarter-turn, lead free stop valves.

Section 224300 – Laboratory Plumbing Fixtures

1. Material used in sanitary waste drains and piping that collect runoff from deionized water systems must be PVDF or similar non-reactive material.

2. Each laboratory must have emergency shut-off valves located outside the lab to isolate gas, air, water.

Section 224500 – Emergency Plumbing Fixtures

1. Provide backflow protection per code for emergency plumbing fixtures.
2. Verify tepid water temperature does not increase the risk to occupants for anticipated hazards / chemicals. Coordinate the hazard list through the Project Manager for review by Boise State Environmental Health and Safety.

Individual / Combination Eyewash and Emergency Shower Stations

1. Floor drains are required at all emergency eyewash or shower stations.
 - a. Where emergency fixtures may contain hazardous materials that cannot or should not be introduced to a sanitary sewer system, route waste-water to an appropriate neutralization system or connect to a building acid waste system.
 - b. Floor Drains in laboratories must be acid resistant. Coordinate drain material with chemicals in the lab.
 - c. Floor must be slightly recessed or sloped toward the shower drain.
2. Eyewashes must have a single actuator. Faucet activation must not be used.

Tempered Water and Tempering Stations

1. Tepid water must be supplied to emergency fixtures via one of the following methods:
 - a. An independent tempered potable water system designed to serve all emergency eyewash and shower fixtures. This system must incorporate its own recirculating pump system and adequate drain points to replenish the water on a periodic basis.
 - b. Individual ANSI 1071 thermostatic mixing valves installed at each emergency fixture.

Section 224700 – Drinking Fountains and Water Coolers

1. Provide Boise State University's Basis of Design (BOD) water cooler or equivalent. See Section 224200 - Commercial Plumbing Fixtures for BOD model.

Section 226100 – Compressed Air Systems for Laboratory Facilities

1. All new compressed air systems, or compressed air systems with a significant retrofit must be installed with Flow Meters. Flow meters will have BACnet capability to integrate with the Building Automation System.
2. Provide with HAND, OFF, AUTO Controls.
3. Compressed air systems must have a VGA display and internal controls for compressor staging.
4. Display Runtime hours for each compressor.
5. Include high temperature and dewpoint alarms.
6. Provide a hardwired Enable / disable point from the BAS system.

Air Compressors, Filters, Driers

1. Install compressors with vibration isolation.
2. For critical applications, provide redundant compressors, filters, and driers.
3. Install air compressors with vibration isolation.

Piping and Fittings

1. Acceptable CA piping materials include:
 - a. Aluminum
 - b. Copper - Type "L" or "K" hard drawn.
 - i. Type "M" thin wall copper is not acceptable.
 - c. Stainless Steel

Inlets and Outlets

1. Drain valves and stub out connections for future use must include a valve and an end cap to prevent accidental discharge.

Section 226200 – Vacuum Systems for Laboratory Facilities

1. In general, local laboratory vacuum systems are preferred over central vacuum systems. When a central vacuum system is necessary, separate chemical hazards from biohazards.
2. All new vacuum pump systems, vacuum pump systems with a significant retrofit must be installed with Flow Meters. Flow meters will have BACnet capability to integrate with the Building Automation System.
3. Provide with HAND, OFF, AUTO Controls.
4. Vacuum air systems must have a VGA display and internal controls for compressor staging.
5. Display Runtime hours for each compressor.
6. Provide a hardwired enable / disable point from the BAS system for central vacuum systems.

Vacuum Pumps

1. Install vacuum pumps with vibration isolation.

Piping and Materials

There are no Boise State University Standards at this time.

Section 226300 – Gas Systems for Laboratory Facilities

1. Where the type or volume of gas being used in laboratories poses a potential danger to human life, those labs must be equipped with oxygen sensors and warning devices to alert personnel of excessive concentrations of the gas.
2. Bulk tank fill status must be monitored by the BAS system.

Piping and Materials

There are no Boise State University Standards at this time.

Section 226600 – Chemical Waste Systems for Laboratory Facilities

1. Any drain system that will carry acidic or caustic materials (pH under 4 or above 9) must be constructed of resistant material and include a neutralizing system equipped with a pH monitoring and recording system.
2. Glass drain systems are not allowed.
3. Any drain system that will handle sediment should have interceptors installed at the source.

Materials

If the design believes another material should be considered, discuss with the Boise State Project Manager.

Acid Waste

1. Sch. 40 CPVC DWV pipe and fittings, ASTM E84, ASTM F2618, and ASTM D3311 with solvent weld joints, for 25/50 flame and smoke rating.

RO / DI

1. Material used in sanitary waste drains and piping that collect runoff from deionized water systems must be PVDF or similar non-reactive material. Any drain system that will come into contact with deionized water must be PVDF or stainless steel.

Section 226700 - Processed Water Systems for Laboratory Facilities

1. A separate and distinctive central laboratory/industrial water subsystem must be provided and distributed throughout the building, isolated from the domestic water system with parallel ASSE 1013 back-flow preventers sized for N+1 redundancy.
2. Processed cooling water systems are closed-loop systems and susceptible to biological and physical contamination. Processed cooling water systems must incorporate adequate means to filter and treat for contaminants, and adequate means for draining and recharging those systems.
3. Drain valves and stub out connections for future use must include a valve and an end cap to prevent accidental discharge.

Reverse Osmosis Water / Deionized Water Systems

Typical central equipment consists of flushable prefilters, multi-media filters, reverse osmosis unit(s), deionizers, carbon filters, ultraviolet lights, storage tank, and distribution pumps.

Requirements

1. Design system to circulate RO/DI water continuously in a closed series loop layout from the central equipment to lab outlets throughout the building. The distribution loop piping must be sized to circulate the water at a velocity in the range of 4 to 6 feet per second under no demand conditions.

2. Provide RO/DI system storage tank capacity for 24 hours of estimated usage.
3. Central RO/DI system controls must be capable of restarting automatically following a power outage.
4. Monitor RO/DI systems via the building automation system.