DIVISION 22: PLUMBING DESIGN STANDARDS

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DIVISION 22: PLUMBING DESIGN STANDARDS

I. PURPOSE

This document is a narrative describing Beaverton School District’s (BSD) Basis of Design for mechanical plumbing systems. The information contained herein shall be used by the Project Design Team to develop a sustainable, integrated mechanical system that is economical to maintain and operate and that enhances learning by providing a suitable work environment for staff and students. This document shall be used as part of the District’s Construction Design Standards.

II. GENERAL

A. DESIGN DOCUMENTS

The Project Design Team shall provide to the BSD, as part of all Design Document Submittals, a narrative with detailed descriptions of system features, functionality, limitations, design assumptions, and parameters. The narrative shall be provided as a “deliverable” with the Schematic Design, and be updated with each subsequent design delivery including Design Development (DD) and Construction Document (CD) Phases. The narrative shall be detailed enough to provide necessary and beneficial information to future design teams, and be written in a manner that is informative and useful to building operations personnel. In its final form, this document shall be incorporated into the Construction Documents and placed on the first sheet of the Plumbing Drawings.

Drawings shall contain all equipment schedules. As-built drawings shall include valve and pipe schedules. The Design Team is responsible for obtaining room numbering assignments from the District. If room numbers other than District-assigned numbers are initially used on the drawings, final as-built documentation must cross-reference these room number assignments on the drawings. Design assumptions that define the capabilities of the building shall be documented on the drawings. These include, but are not limited to, natural gas calculations, water service calculations, sewer and storm sewer calculations, maximum occupancy, provisions for future expansion (if any). This will ensure that the information is retrievable years later when only the drawings are available to facility operations.

The Design Team shall review plumbing designs with District personnel at the completion of Schematic Design, Design Development, and at 95% Construction Documents.

B. INSPECTIONS

The Owner’s Representative and BSD’s Maintenance Administrator shall be notified at all under floor, framing, and top out inspections, so that piping routes, valves, connections, and any other pertinent plumbing applications can be verified and documented.

C. CLOSE-OUT

Project Record Documentation

Prior to Owner Acceptance, provide three hard copies and one set of PDF files of operation and maintenance (O&M) manuals to Owner. Submit three hard copies, PDF files, and AutoCAD files of all as-built drawings.
The Contractor’s red-line drawings will be copied (full scale, color copy) and provided to the Owner at Temporary Occupancy. The copied drawings shall include all approved change order drawings and details.

At Project Close-out, the Contractor’s red-line drawings, including all approved change order drawings and details, shall be copied and turned over to the Owner. The Contractor will then release the drawings to the Architect for preparation of the “Record Set.”

The Architect will prepare and submit as-built drawings in PDF and in AutoCAD format per Division 1 of BSD’s Construction Design Standards which shall include the following to reflect actual constructed conditions:

- Identify actual location and routing of buried pipes
- Include additional sheets with all approved change order drawings and details as well as the change order log for reference

As-built documentation shall include the following as a minimum:

- Documentation of all deviations from the shop drawing submittals, including equipment that was changed and the reason for the change
- Copies of final test reports and any deficiency lists
- Documentation of all deviations in O&M information from that provided with original equipment submittals

**Training**

Provide for training of maintenance and school personnel as detailed below. Video tape complete training session for future use by school personnel.

Training shall include a review of the O&M manual, including but not limited to:

- How to monitor status readouts and history logs of systems
- Required maintenance
- Troubleshooting, including contact names and phone numbers for factory support

Products making use of technology or materials that are new to the District shall require additional specialized training.

**D. ENERGY USE**

All piping and mechanical systems shall meet and/or exceed current Oregon Energy Code. Insulate all hot water, cold water, heating water, and chilled water pipes and fittings unconditioned spaces. Design goals should provide building energy use that would allow easy qualification as an Energy Star rated building. Fixtures that are chosen on the basis of energy saving should provide a 10 years or less payback with anticipated maintenance costs included. The Design Team shall provide Oregon Energy Code Compliance documentation to the owner concurrently with submittal to the building department. Oregon Energy Code Compliance documentation shall be included as a section in the O&M Manual.

**E. LABELING**

All piping systems shall be permanently labeled identifying type of fluid and direction of flow. All valves shall be labeled identifying function and valve number as set out in...
the posted valve schedules. All valves located above the drop ceiling shall be clearly marked on the grid with printed labels.

F. QUALITY OF MATERIAL
All piping systems shall be designed and installed in a manner that provides the best possible long-term value for the District. Take special care to minimize the effects of electrolysis and corrosion.

G. PIPING DEMO, REMODELS, AND RE-PIPES
All piping being demolished or abandoned must be removed, along with all resulting construction debris, with the following exceptions:
- Piping 1”Ø or less may be abandoned in place. Under special circumstances, piping larger than 1”Ø may be abandoned in walls (requires Owner approval).
- Underground piping and piping in slabs may be capped and abandoned in place.
- Piping in tunnels: If tunnel is being sealed off and abandoned, then piping may be abandoned in place. However, if tunnel is being reused or still being used (contains active pipes, conduit, or duct work), then demolished piping larger than 1”Ø must be removed from tunnel and all construction debris removed.

III. PIPING SYSTEMS

A. FITTINGS
No field manufactured fittings. No Tee pulling.

B. SUPPORTS
All piping must be supported per code. Double nut required on all threaded hangers.

C. VACUUM BREAKERS
Vacuum breakers shall not be installed in walls or in recessed cabinets. Overflow from vacuum breakers located inside the building must flow directly to a drain.

D. DISSIMILAR METALS
Minimum of 6” long, brass fitting shall be used between dissimilar metals. Use of dielectric unions is not acceptable in domestic water systems, with the following exceptions:
- Use 3/4”Ø dielectric copper flex connector for water heater connections
- Use 6” long, brass fitting, brass valve, or dielectric fittings where necessary in hydronic piping systems.

E. COPPER
Type “L” or better. Use sweat or brazed fittings. Grooved fittings with BSD approval on a case-by-case basis.

F. GALVANIZED STEEL
Galvanized pipe and fittings are unacceptable for domestic water use on District Projects. Acceptable for dry pipe systems, waste connections, or for use as sleeves.
G. Black Iron
Use of black iron pipe is acceptable for the following two applications:
- Natural Gas piping
- Fire Protection Sprinkler Systems: Groove-lock or Victaulic-type connectors are acceptable for use in wet fire sprinkler systems. This is the only allowed use of steel or iron groove-type fittings on District Projects.

H. EXPANSION JOINTS
Use where vibration or expansion is a concern. Braided stainless steel only.

I. WIRSBO AND PEX
WIRSBO and PEX piping systems require written permission from BSD’s Maintenance Department Administrator prior to 100% Design Development phase of Project. Use of PEX up to 1”Ø is allowable for branch lines. Any use of PEX greater than 1”Ø must be approved by BSD prior to release of Construction Documents (bid set).

Use of PEX requires connection details to be included in the Construction Documents. Details shall be provided showing transitions, manifolds, hangers, supports, connections, and attachments. PEX piping in locations not shown in Construction Drawings (Bid Set) shall not be allowed.

J. Drain and Waste Piping
Use ABS for all buried waste lines and all vent pipes. Cast iron pipe is to be used above ground only. Cast iron applications include noise suppression on waste piping stacks between floors and for upper floors. Fittings for each are as follows:
- ABS: Glued fittings only
- Cast iron: Hubless (no-hub) fittings only

**Clean outs:** Drain lines under 3”Ø, including floor sinks and floor drains, must have an accessible clean out.

**Trap Primers:** For single trap application, use Precision Plumbing Products P-1 or P-2 primers connected to flush-o-meters. For a bank of traps, exceeding four traps, use electronic trap primer. Connection of trap primer to DDC system will not be accepted.

**Laboratory Piping Systems:** Acid resistant piping and neutralization basins as required by code. Tank opening must be located outside of the building and be easily accessible for clean out.

**Grease Traps and Interceptors:** Only as required by code. Tank opening must be located outside of the building and be easily accessible for clean out.
## K. PIPING SCHEDULE

<table>
<thead>
<tr>
<th>Service</th>
<th>Size</th>
<th>Location</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydronic and Chilled Water Systems</td>
<td>Through 2&quot;Ø</td>
<td>All</td>
<td>copper-type “L” or better, soldered fittings</td>
</tr>
<tr>
<td></td>
<td>2-1/2&quot;Ø</td>
<td>All</td>
<td>copper-type “L” or better, brazed fittings</td>
</tr>
<tr>
<td></td>
<td>3&quot;Ø and larger</td>
<td>All</td>
<td>black steel w/ welded or flanged fittings</td>
</tr>
<tr>
<td></td>
<td>Potable Water</td>
<td>Through 2&quot;Ø</td>
<td>copper-type “L” or better, soldered fittings</td>
</tr>
<tr>
<td>(Hot and Cold Water) Systems</td>
<td>2-1/2&quot;Ø and</td>
<td>All</td>
<td>copper-type “L” or better, brazed fittings</td>
</tr>
<tr>
<td></td>
<td>larger</td>
<td>Requires written case by case approval</td>
<td>PEX or WIRSBO, brass or copper manifolds and fittings</td>
</tr>
<tr>
<td></td>
<td>1&quot; Ø or smaller</td>
<td>Requires written case by case approval</td>
<td>PEX or WIRSBO, brass or copper manifolds and fittings</td>
</tr>
<tr>
<td></td>
<td>All, except</td>
<td>All, except waste stacks between floors</td>
<td>ABS, glued fittings</td>
</tr>
<tr>
<td></td>
<td>Potable Water</td>
<td>Above ground only: between floors for noise suppression</td>
<td>cast iron, hubless fittings, no Bell &amp; Spigot</td>
</tr>
<tr>
<td></td>
<td>Drain and Waste</td>
<td>1-1/4&quot; to 3&quot; Waste connection</td>
<td>galvanized is permissible</td>
</tr>
<tr>
<td>Systems</td>
<td>Natural Gas</td>
<td>Through 2&quot;Ø</td>
<td>black steel w/ threaded or welded fittings</td>
</tr>
<tr>
<td></td>
<td>No threaded gas</td>
<td>No threaded gas pipe greater than 2 psi</td>
<td>black steel w/ threaded or welded fittings</td>
</tr>
<tr>
<td></td>
<td>pipe greater</td>
<td>inside of building</td>
<td>black steel w/ threaded or welded fittings</td>
</tr>
<tr>
<td></td>
<td>larger</td>
<td>black steel w/ welded or flanged fittings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fire Sprinkler</td>
<td>All</td>
<td>copper type “L” or better, soldered fittings, or black steel w/ threaded or welded fittings</td>
</tr>
<tr>
<td>Systems</td>
<td>Wet systems</td>
<td>All</td>
<td>copper type “L” or better, or black steel w/ grooved or Victaulic fittings</td>
</tr>
<tr>
<td></td>
<td>only</td>
<td>Dry systems: case by case approval</td>
<td>galvanized steel w/ threaded or black steel w/ welded fittings</td>
</tr>
<tr>
<td></td>
<td>Joining Dissimilar Metals</td>
<td>All potable</td>
<td>NO dielectric unions</td>
</tr>
<tr>
<td></td>
<td>¾&quot; Water heaters</td>
<td>¾&quot; Water heaters</td>
<td>water heater connections use ¾&quot;Ø dielectric copper flex connector FIP nut x FIP nut.</td>
</tr>
<tr>
<td></td>
<td>All other</td>
<td>All other</td>
<td>Use 6” minimum length brass nipple or fitting for dielectric protection when joining dissimilar metals.</td>
</tr>
<tr>
<td></td>
<td>Hydronic</td>
<td>Hydronic</td>
<td>Use 6” minimum length brass nipple or fitting for dielectric protection when joining dissimilar metals.</td>
</tr>
</tbody>
</table>
IV. VALVES

Provide adequate shut-off valves for service isolation. Isolation valves will be available for each plumbing branch and on both sides of any equipment.

A. SPECIFIC VALVE TYPES

Gate Valves: For steam systems only. No gate valves for potable water or hydronic systems (unless required by state boiler code).

Globe Valves: No globe valves in domestic water systems.

Ball Valves: Full-port bronze. Use for isolation, shut-off, drains, and throttling.

Butterfly Valves: 3”Ø and larger, shut-off and throttling.

Backflow/Check: Must be able to be disassembled for maintenance without breaking the line. Below 2”Ø, FEBCO only; 2-1/2”Ø and larger, FEBCO or Watts.

Pressure Reducing Valve (PRV): Watts, or equal.

Backwater Valve (Backflow Preventer): For sanitary and storm sewer, when needed.

Emergency Gas Shut-Off: NFPA rated.

B. VALVE SCHEDULE

<table>
<thead>
<tr>
<th>System</th>
<th>Service</th>
<th>Valve Type</th>
<th>Size</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydronic and Chilled Water</td>
<td>shut-off, throttling, drain</td>
<td>ball, full-port</td>
<td>All</td>
<td>bronze</td>
</tr>
<tr>
<td>Systems</td>
<td>shut-off, throttling</td>
<td>butterfly</td>
<td>3”Ø or larger</td>
<td>cast iron or bronze</td>
</tr>
<tr>
<td></td>
<td>throttling</td>
<td>globe</td>
<td>All</td>
<td>bronze</td>
</tr>
<tr>
<td>Potable Water (Hot and Cold</td>
<td>shut-off, throttling, drain</td>
<td>ball, full-port</td>
<td>All</td>
<td>bronze</td>
</tr>
<tr>
<td>Water) Systems</td>
<td>shut-off, throttling</td>
<td>butterfly</td>
<td>3”Ø or larger</td>
<td>cast iron or bronze</td>
</tr>
<tr>
<td></td>
<td>backflow</td>
<td>double check</td>
<td>FEBCO only</td>
<td></td>
</tr>
<tr>
<td>PRV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steam</td>
<td></td>
<td>Gate or other</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>steam rated</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>valve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drain and Waste Systems</td>
<td>backflow preventer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>when needed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Gas</td>
<td>shut-off</td>
<td>ball</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>emergency shut-off</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire Sprinkler Systems</td>
<td>shut-off, drain</td>
<td>ball</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
V. FIXTURES/CHROME, VITREOUS CHINA

A. FAUCETS AND FLUSH-O-METERS

Electronics

No electronic fixtures, faucets, or flush-o-meters. Under special circumstances, electronic fixtures may be approved on a case-by-case basis. On installations where electronic fixtures are approved, shut-off valves and strainers are mandatory. Hardwire only. No battery operated fixtures will be accepted. As an option to electronics, consider the use of the Chicago 802-VE2805-665CP. This is a pushbutton automatic shut-off faucet. It can also be ordered with quarter turn spring-loaded automatic shut-off stems.

Flush-o-Meters

Sloan Royal mechanical type flush-o-meters only. No Delaney or Zurn. No electronics. No air operated flush-o-meters or valves.

Faucets and Shower Valves

Chicago only. No Acorn, Delta, Powers, or Symmons

<table>
<thead>
<tr>
<th>Application</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lavatory</td>
<td>Chicago</td>
<td>802-VCP</td>
<td>2-hole, 4” center-set</td>
</tr>
<tr>
<td>Lavatory</td>
<td>Chicago</td>
<td>802-VE2805-665CP</td>
<td>2-hole, 4” center-set, metered shut off, low flow</td>
</tr>
<tr>
<td>Kitchen Sink</td>
<td>Chicago</td>
<td>1100-GN2AE3-317CP or 895-317CP</td>
<td>2-hole, 8” center-set</td>
</tr>
<tr>
<td>Kitchen Pre-rinse</td>
<td>Chicago</td>
<td>919-LCP</td>
<td>Single hole, deck mount</td>
</tr>
<tr>
<td>Kitchen Pre-rinse</td>
<td>Chicago</td>
<td>923-HCLCP</td>
<td>wall mount, integral checks</td>
</tr>
<tr>
<td>Kitchen Pot Filler</td>
<td>Chicago</td>
<td>512-GCCP</td>
<td>vacuum breaker</td>
</tr>
<tr>
<td>Kitchen Handwashing</td>
<td>Chicago</td>
<td>802-317CP</td>
<td>2-hole, 4” center-set, paddle handles</td>
</tr>
<tr>
<td>Pantry</td>
<td>Chicago</td>
<td>350-CP</td>
<td>single hole, cold only</td>
</tr>
<tr>
<td>Science Lab Sinks</td>
<td>Chicago</td>
<td>930-369 CP</td>
<td>single hole</td>
</tr>
<tr>
<td>Science Lab Sinks</td>
<td>Chicago</td>
<td>928-369 CP</td>
<td>single hole, cold only</td>
</tr>
<tr>
<td>Science Lab Gas Valve</td>
<td>Chicago</td>
<td>909-GASCP</td>
<td>ball valve</td>
</tr>
<tr>
<td>Classroom Sinks</td>
<td>Chicago</td>
<td>1100-CP or 1100-GN2AE3VPAXKCP</td>
<td>2-hole, 8” center-set, swing or goose neck spout</td>
</tr>
<tr>
<td>Classroom Sinks</td>
<td>Chicago</td>
<td>50-CP</td>
<td>Single hole, goose neck spout</td>
</tr>
<tr>
<td>Classroom Sinks</td>
<td>Chicago</td>
<td>748-665CP</td>
<td>bubbler drinking fountain</td>
</tr>
<tr>
<td>Restroom Hose Bib</td>
<td>Chicago</td>
<td>952-CP</td>
<td>loose key handle</td>
</tr>
<tr>
<td>Service Sinks</td>
<td>Chicago</td>
<td>445-897SRCXKCP</td>
<td>wall mount, vacuum breaker, integral checks</td>
</tr>
<tr>
<td>Shower Valve</td>
<td>Chicago</td>
<td>1762-ISVOCCP</td>
<td>integral service stops</td>
</tr>
</tbody>
</table>
B. VITREOUS CHINA

Lavatories
Use wall hung, cast iron wall bracket, 4” center-set. Assure proper backing is provided in the wall to support sink. Stamped steel wall brackets are not acceptable. No concealed arms on sinks. No single hole sinks. Standard ADA compliant lavatory Kohler 2032 porcelain sink mounted with cast iron wall bracket.

Classroom Sinks
Stainless Steel, Elkay #DRKR2517

Water Closets and Urinals
Kohler or American Standard

VI. DOMESTIC HOT WATER SYSTEM

Provide at least two independent hot water systems at all schools. One system is for general use delivering water at 120°F. The second is a dedicated system for kitchen use delivering water at 140°F. A booster will be required to provide 180°F water to dishwasher final rinse. Do not use single tank system with mixing valves to provide dual temperature system.

Preferred: Commercial, 199,000 Btu, high efficiency (condensing 92%+) natural gas water heaters, at least one water heater per domestic hot water system.

Electric water heaters should not exceed 4.5 kW. Dual element water heaters with two non-simultaneous 4.5 kW elements are acceptable.

Electric water heaters may be used in distributed point-of-use systems where natural gas piping is not readily available. Electric, tankless, instantaneous water heaters (e.g., Insta-Hot) will not be allowed. Use six gallon local water heater to serve remote restrooms and other small applications.

Use multiple point-of-use mixing valves at the sink or fixture rather than one large valve. Beaverton School District has found central station mixing valves to be unreliable. Point-of-use mixing valves allow greater flexibility in delivery temperatures and minimize disruption of service in surrounding areas should a malfunction occur.

VII. KITCHEN

Install all equipment per code and per manufacturer’s installation instructions. Design for ease of operation and maintenance. Design fittings, service, and outlets per manufacturer’s recommendations.

Shut-offs shall be protected from accidental damage or shut-off, but be readily accessible from the front side without requiring movement of any equipment. After exiting wall cavity, run piping exposed, tight to wall behind equipment. Stub out 3’-0” to shut-off, then transition to flexible hose. All equipment drops on gas lines shall be provided with a pressure tap (test tee). The test tee shall be located after the shut-off and prior to transitioning to flex. Pressure at equipment shall meet manufacturer’s requirements. Pressure drop calculations and appliance installation details shall account for pressure drop through flex and connectors. Design documents shall include maximum equivalent pipe length.
A. KITCHEN SPRAYERS AND HOSES
   T & S only

B. GARBAGE DISPOSALS
   Kitchen: Use Red Goat only.
   Staff room and other applications: 1/2 HP minimum ISE Badger 5, or equal

C. HANDWASHING SINKS
   Equip with 4” paddle handles.

D. FOOD PREPARATION SINKS
   Indirect drains with air-gap as required by code

E. FLOOR SINKS
   Cover portion of floor sinks exposed to foot traffic with grate. Design and locate floor sinks to minimize potential trip hazards but still allow access for maintenance.

F. STEAM OVENS AND STEAM KETTLES
   Provide quick disconnect hoses for ease of maintenance.

G. DISHWASHERS
   Design and plumb for high temperature machines. Along with ease of operation and maintenance, minimizing water use is a prime consideration when selecting and evaluating new dishwashing equipment.

H. DISHWASHER BOOSTER HEATERS
   To minimize electric demand charges, gas-fired booster heaters are preferred. Gas-fired boosters must have independent venting and adequate provision for combustion air to prevent odors in the building. Booster must be sized to provide 180°F water to dishwasher final rinse. Booster sizing must take into account all other hot water use at the site.

VIII. MISCELLANEOUS

A. DRINKING FOUNTAINS
   One chilled unit per school, ADA compliant (Elkay EZSTL8LC or equal). Others (non-chilled) use standard wall-mounted drinking fountain. Outside drinking fountains are discouraged. Elkay and Sunroc are the preferred manufacturers for both interior and exterior drinking fountains. Install Aqua Pure AP101T water filter on all chilled units and for any other units requiring filtration.

B. EYE WASH
   Eye wash required in all science labs and auto shops. HAWS #H8904 Deck-mount or equal for new construction. HAWS #7610 tower-mount or equal for retro-fits.

C. CAN WASH
   Provide frost-proof valves for all exposed assemblies.
   Jay R. Smith 3370/3371 Sani-ceptor Can Washing Floor Drain with 3380 valve box or equal.