

22 Plumbing

NOTE: Significant revisions or additions to the previous standards are highlighted in italics.

GENERAL

Designers shall verify that all applicable portions of these standards are incorporated into the project's design, drawings, specifications and final construction. Request for variances from these standards shall be submitted in writing to the FPD Project Manager, using the KU Standards Variance Request Form found in [Appendix A1.1](#), for review and written approval or rejection as indicated on the form.

RELATED DOCUMENTS & REQUIREMENTS

Refer to the following for requirements that also apply to and need to be coordinated with the work of this section.

- ☐ **Division 1 - General Requirements:** Refer to sections regarding construction testing and field quality control requirements. Unless directed otherwise, the Owner shall separately contract for quality control testing and inspections during construction.
- ☐ *This section also refers to Hot Work Permit requirements, posted at the [FPD website](#).*
- ☐ **Division 11 - Equipment:** 114000 - Foodservice Equipment
- ☐ **Division 23 - HVAC**
- ☐ **Division 33 – Utilities:** General design guidelines applicable to all site utilities.
- ☐ **International Plumbing Code:** Latest version adopted by the State of Kansas, currently 2018 edition.
- ☐ **International Energy Conservation Code:** Latest version adopted by the State of Kansas, currently 2018 edition.

COMMON WORK RESULTS - 220500

General Project Description: The Designer shall include as one section of the specifications, a lay description of the design, operating function, loads, capacities, tolerances, sequence(s) of operation, etc., of the plumbing systems designed for this project. The intention of this document is to give all parties, including the Contractor's installation personnel and the University's maintenance personnel, a reference document for each particular system design. Samples of such documentation can be obtained from FPD.

- ☐ The Designer shall update this lay description at later stages of design and construction, if the systems' operation changes, and shall provide copies of updates to the building's commissioning agent, as well as to the FPD engineering project managers.

Building Aesthetics: The Designer is responsible for ensuring that plumbing materials or systems are not mounted on the outside of the building or outside of interior walls or chases, or if for some reason that is unavoidable, are designed to blend in with the building structure.

The University reserves the right to determine the location of all equipment located on the outside the building.

Pipe Penetrations and Sleeves: This work shall be coordinated with Division 7 Thermal & Moisture Protection.

- ☐ Floor sleeves shall *be provided at all floor penetrations, even those within plumbing chases, and shall* extend above the finished floor a minimum of 1-1/2-inches, and shall be sealed watertight.
- ☐ New penetrations shall be fire-stopped. Sleeve material shall be specified to suit the wall or floor type being penetrated.

Prohibited Pipe Fitting Materials and Methods: Due to University requirements for long system life and the need for uniformity and consistency of piping system installations, field fabricated pipe and tubing fittings of the type commonly referred to as “drilled” or “pulled” tees are not allowed.

Equipment Bases: Concrete bases, 3-1/2 inch minimum height, shall be provided under all floor mounted plumbing equipment. Base size and location shall be coordinated with the equipment specified and shall be shown on the architectural and structural drawings.

Designing in Existing Facilities: The Designer is expected to field-verify existing conditions so that construction conflicts are minimized. For remodeling projects, the University will provide openings in walls and ceilings where required and requested by the Designer to permit verification of existing piping and equipment. Lack of readily available access to hidden conditions during design is not considered to be an acceptable justification for unidentified and unresolved construction conflicts in construction documents.

Equipment and System Cleaning: *Refer to specific requirements in the Water Distribution Piping section of these standards, which follows.*

Jobsite Fire Safety Precautions: The Designer shall include in the specifications the following or a similar statement with regard to protective measures to be observed by the Contractor during brazing, sweating, or welding operations:

- ☐ All cutting, welding, brazing, or sweating operations carried on in the vicinity of, or accessible to, combustible material, shall be adequately protected to make certain that a spark or hot slag does not reach the combustible material and start a fire.
- ☐ When it is necessary to do cutting, welding, brazing, or sweating close to wood construction, in pipe shafts, or other locations where combustible materials cannot be removed or adequately protected, employ fireproof blankets and proper fire extinguishers. A helper shall be stationed nearby to guard against sparks and fire.
- ☐ Whenever combustible material has been exposed to molten metal or hot slag from welding or cutting operations, or spatter from electric arc, a guard shall be kept at the place of the work for at least one hour after completion to make sure that smoldering fires have not been started.

- ❑ Whenever welding or cutting operations are carried on in a vertical pipe shaft or where floor openings exist, a fire guard shall be employed to examine all floors below point of welding or cutting operation. The fire guard shall be kept on duty for at least one hour after completion of work to guard against fires.
- ❑ **Hot Work Permit:** Before any work involving cutting, welding, brazing, or sweating operations is started, *Contractors shall obtain Hot Work Permit from [FPD website](#).*

Building Service Interruptions / Utility Outages: The Designer shall include in the specifications the following or similar statement with regard to interruptions of any campus utilities:

- ❑ *The contractor shall contact the KU FPD Project Manager at least one week prior any utility shutdown for relocation or tie-in.*

Underground Utilities Surveys: Coordinate this work with other related specifications. The Designer shall include in the specifications provided in Division 01 these standards.

The following apply with regard to surveys of any new or relocated campus underground utilities:

- ❑ *Any plans showing excavation shall include the following text:*
 - ❑ *Contractor shall call both Kansas One Call (1-800 DIG-SAFE; 1-800-344-7233) to request a utility locate ticket and include as-built survey standards outlined in Division 01.*
 - ❑ *Prior to backfilling any underground utility lines personnel shall survey and establish location and depths of all lines per Division 01 of KU Design and Construction Standards.*
- ❑ *Underground Conduits and Sleeves: Provide marker at top of curb above all underground conduit or sleeve locations. Use a 2" high "S" symbol cast or embossed into concrete.*

Verifying Existing Conditions: On remodeling projects, the Designer is responsible for the verification of the actual operating conditions of Plumbing/HVAC systems requiring changes due to the proposed remodeling. The Owner shall not provide any equipment or labor for this purpose.

Pipe Routing: *Plumbing pipes shall not be routed over any electrical or telecom panels or equipment.*

Plumbing Equipment Efficiency: *Water heaters, boilers, etc., must meet or exceed minimum requirements of ASHRAE 90.1 (version in effect by State).*

Plumbing Equipment Sequence of Operation: Designer shall note sequences of operation and BACS coordination for plumbing equipment (water heaters, boilers, sump pumps, circulating pumps, etc.).

PLUMBING IDENTIFICATION - 220553

Identifying Devices and Labels: Piping system markers shall be pressure-sensitive, adhesive vinyl complying with ASME 13.1. Ducting systems and access door markers shall be specified to be stenciled in a manner complying with ASME 13.1. The MasterSpec requirements for color-coding and nomenclature shall be included in the text of this section. Installer to provide documentation ensuring marking is being completed.

All piping systems shall be labeled. Informational labels for piping not listed on the ASME guidelines shall be white lettering on black background.

EQUIPMENT INSULATION – 220716

Applicability: Shall be included in construction specifications for projects involving field applied insulation of mechanical equipment.

- ☐ Pieces of equipment with a surface temperature over 130 degrees F or with temperatures causing condensation at ambient relative humidity of 90 percent shall be insulated.
- ☐ *Add aluminum jacket for equipment in areas subject to high traffic and for high temp equipment. Outdoor piping shall have aluminum jacket.*
- ☐ *Specify removable insulation sections for equipment requiring maintenance.*
- ☐ Equipment condensate drain pans shall be insulated. Type and thickness of insulation shall be as specified for piping. *Prefer Armaflex insulation.*
- ☐ Steam traps, hot water and condensate return pumps, shall not be insulated.
- ☐ Specify factory insulation of autoclaves and sterilizers.

Insulating Valve Bodies and Piping Specialties: Specify preformed, removable insulation, blankets, sections and jackets for valves and specialties on insulated piping systems. Types of fittings included are valves, slip joints and steam and condensate meters. Each removable cover shall have a close contour fit for appearance and proper thermal performance.

Abatement of Asbestos Materials: Use of asbestos insulating materials is prohibited. Campus-wide abatement of existing asbestos-containing insulation materials is being undertaken on a project-specific basis.

- ☐ New insulation shall therefore be stenciled, per OSHA 29 CFR 1926.1101, to identify it as non-asbestos containing, to document the extent of abatement and replacement accomplished during each project.

PIPE INSULATION – 220719

Plumbing/HVAC piping and flue insulation thickness shall be designed to meet or exceed minimum requirements of ASHRAE 90.1 (version in effect with State).

Insulating Drainage Piping Systems: Where appropriate to the project, this section shall include the specification of insulation for roof drain bodies and rainwater conductors. Similarly, coil condensate drain piping *and the indirect waste receptor piping* routed through finished spaces shall be insulated.

Pipe Insulation in Wet Areas: Insulation in potentially wet and unburied installations shall be covered with 30 mil PVC Jacket. Jacket shall be sealed at all joints per manufacturer's recommendation. *Prefer Armaflex insulation.*

VALVES – 220523

Equipment Isolation: The specifications shall include isolation valves. All equipment must be installed with isolation valves for shutoff service. All systems such as potable water, heating systems, chilled water systems, etc. must have a minimum of one isolation valve per building level or as required by the University representative. *Utilize gear operator for butterfly valves.*

Reference to Controls System Specifications for Valves with Control Operators: The Designer shall identify that valves equipped with electric or electronic operators for automatic throttling control are specified and scheduled in Section 230900 - HVAC Instrumentation and Controls within the specification documents.

METERS AND GAUGES – 220518

Utilities Systems Ownership: The distribution systems for all major campus utilities, except natural gas, are owned and maintained by the University. The Designer shall edit this specification section to delete references to Utility-furnished products.

For billing purposes, each utility distribution system originates at a central campus entry point where master metering is provided. Individual metering described in this specification section is intended for University maintenance and administrative purposes only.

- ☐ *All meters will be installed in a manner that allows them to be manually read in locations that are easily accessible without the use of a ladder.*
- ☐ Utility meters with *modbus communication* connected for remote computer monitoring shall be supplied for each of the following: domestic water, cooling tower water, chilled water, *hydronic heating, irrigation water*, and steam or condensate return. *Coordinate the chilled water and steam system meters with Division 23.*
 - ☐ *Domestic water system and steam condensate meters shall be compound-type, and for high use applications (i.e., cooling towers, irrigation systems, etc.) a magmeter is preferred. The preferred manufacturer is Badger, connected via modbus connection to building electric meter. Register in gallons.*

- ☐ *Chilled water and hydronic heating systems shall have Onicon BTU meters installed with either mag type or ultrasonic flow meters installed and connected to Schneider Electric power monitoring network.*
- ☐ Remote Data Gathering Capability. Condensate and water meters shall be directly connected to the campus *Schneider Electric power monitoring system*. Refer to **Appendix A26.2**, Standard of Practice – *Electrical Power Metering* for interface requirements.

FACILITY WATER DISTRIBUTION PIPING – 221113

System Ownership and Authority: At the outset of design, the Designer shall determine, through discussions with KU personnel, if water service extensions are to be made from a source that is owned by the University or from a source that is owned by an outside authority. Subsequent design criteria and specification editing will be guided by this determination.

Water Metering: Refer to Section 220518 for metering requirements.

Backflow Prevention: *All domestic water lines entering KU buildings shall be provided with a backflow preventer. Locate just inside the building entrance point avoiding an exterior pit if possible, configured as approved by KU.*

Materials: Water distribution pipe to buildings may be one of the following.

- ☐ Lines 4" Diameter and Greater: *PVC DR14 per AWWA C900 with tracer wire. Alternatively, AWWA cement-lined ductile iron.*
- ☐ Lines less than 4" Diameter: *Annealed Type K copper.*

Thrust Blocks: All water services lines shall have cast-in-place concrete thrust blocks provided at all changes in direction, both horizontal and vertical. Thrust blocks shall be engineered for each condition and detailed by the Designer on construction drawings.

Fire Hydrants: All fire hydrants shall be painted OSHA yellow.

DOMESTIC WATER PIPING SPECIALTIES – 221119

Water Hammer Arrestors: 'Hydra-Rester', by Souix Chief, or approved equal. Bellows style water hammer arrestors are discouraged, since they tend to fail more easily over time.

FACILITY SANITARY SEWERS – 221313

Materials – Beneath Buildings & Structures:

- ☐ Cast iron piping (Class 500).
- ☐ Extend cast-iron piping to at least 5' outside of building's exterior walls.
- ☐ No other materials will be acceptable under concrete slabs within buildings.

Materials – Outside Buildings: The University will allow the use of the following, as indicated by the A/E for each project.

- ☐ Plastic pipe: ANSI/ASTM D3034-89, type PSM, SDR 35, polyvinyl chloride (PVC) material.
- ☐ Cast iron piping (Class 500).
- ☐ Vitreous clay piping (VCP) will NOT be allowed.

Joints: Bell and spigot joints shall be used; no-hub joints are NOT permitted.

Manholes: Provide a manhole at each point of connection of new lines to existing lines, and at changes in direction of underground lines.

Discharge Monitoring Flume: Designers shall consult with KU's Environment, Health and Safety (EHS) office to verify if a discharge monitoring flume shall be required for those projects that may carry sanitary wastes other than those from standard toilet or locker room sources. Comply with EHS and City of Lawrence recommendations or requirements.

SUMP PUMPS, ELEVATOR PUMPS, GROUNDWATER APPLICATIONS – 221429

Basis of Design:

- ☐ *Weil 1411*
- ☐ *Duplex pumps, cast iron construction with stainless steel hardware, 120V.*
- ☐ *Duplex alternating pump controller with tethered float control, 115V. Provide connection to campus JCI Metasys for alarm point. NEMA 3R or 4X enclosure.*
- ☐ *Fiberglass basin and cover.*

Project A/E to select;

- ☐ *Pump GPM and TDH.*
- ☐ *Basin size.*

LABORATORY AIR, GAS, AND VACUUM PIPING – 226313

- ☐ The specifications for plumbing work shall include providing all piping, sleeves, valves, stops, sink trim, laboratory bench and fume hood trim, sinks, and piping insulation required for the complete installation of mechanical services to laboratory benches, sinks, and fume hoods.
- ☐ The Designer will be responsible for coordinating the plumbing installation design with the laboratory furniture shop drawings. Provision shall be made in the drawings or in the specifications for minor location adjustments to meet the equipment requirements. These adjustments shall be made before the installation of the plumbing piping systems.
- ☐ Services such as hot or cold water, vacuum, and gas shall have a valve specified and shown on the drawings which will be easily accessible after installation of the equipment so that service to the unit may be shut off for maintenance or repair.
- ☐ New lab buildings shall have separate non-potable system to eliminate BFPs at each fume hood.

LABORATORY WASTE PIPING – 226653

- ☐ The Designer shall consult with the University in each case where corrosive wastes are to be disposed of to determine the extent of corrosion resistant waste and vent stacks, horizontal runs, and ground runs required. *Corrosion resistant piping is used in the interest of longevity.*
- ☐ Approved polypropylene or polyethylene waste and vent systems shall be used, subject to the following conditions:
 - ☐ All material furnished shall be fire retardant and self-extinguishing.
 - ☐ Plastic materials shall penetrate fire rated floors, walls, or partitions using U.L. listed penetrations and fire stop materials.
 - ☐ *Avoid fusion or butt-weld joints for plastic pipe.*
- ☐ All waste drain and vent systems shall be clearly shown by riser diagrams or equivalent means of identification. Diagrams shall be complete enough to show exact terminal fittings.
- ☐ Where long runs of horizontal acid resistant waste piping are required for high temperature wastes, install expansion joints to relieve stress on joints caused by expansion and contraction. Indicate where expansion joints are to be located in the system.
- ☐ Where traps are installed, corrosion resistant tailpieces shall be used. Adequate space shall be provided for servicing traps.
- ☐ Provide a waste water sampling port at the lowest common collection point.

WATER DISTRIBUTION PIPING – 221113

- ☐ The domestic hot water piping system can be either designed as a recirculating loop or with point of use water heaters. The Designer shall provide Life Cycle Cost Analysis for systems with total design deliveries of greater than 500-gph. Water heaters serving nonlooped systems must be within 25 feet of point of use.
- ☐ All exposed piping in toilet rooms shall be chrome plated.
- ☐ Piping 2" and greater in diameter shall be hard drawn copper, type L, with sweat or propress fittings.
- ☐ Piping less than 2" in diameter shall be hard drawn copper, type L, with sweat or propress fittings.
- ☐ Piping less than 2" in diameter, in residence halls, may be cross-linked polyethylene (*with oxygen diffusion barrier*). All such piping shall be in concealed locations, with access panels at isolation valves and manifolds.
- ☐ Manifolds are to be all brass construction.

Backflow Prevention: Comply with the University backflow prevention program. Copies are available from the Department of Facilities Services.

- ☐ *For new buildings, use backflow preventer with flood protection detection system for building entrance service.*

- ☐ *Provide large drain or install water detection for alarming in case of BFP failure*
- ☐ "Watts" is preferred as the base manufacturer for all backflow preventers.
 - ☐ *The exception to the above is for applications where backflow preventers shall be compatible with Zurn plumbSmart connected system.*
- ☐ Reduced pressure principle backflow preventers shall be piped to "dump" into a floor drain of adequate size to handle full flow.
- ☐ Laboratory buildings should have a dedicated non-potable water loop serving labs and other non-potable fixtures in the building. One dedicated backflow preventer should be provided and piping should be labeled throughout as non-potable. Individual backflow preventers should not be used at each fume hood or non-potable fixture.

Disinfection of Domestic Water Piping: The specifications shall include the requirement that all water main systems *and domestic water lines* are to be purged and disinfected by the Contractor, in accordance with AWWA C651 or 652.

- ☐ *Clean and disinfect water-distribution piping as follows:*
 - ☐ *Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.*
 - ☐ *Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, use procedure described in AWWA C651:*
 - *Prepare reports of purging and disinfecting activities.*
 - *Submit lab test reports confirming water system is safe to FPD Project Manager and to EHS Director.*

Special Laboratory Plumbing Requirements: Where applicable, the Designer shall coordinate specification sections 123553 for Laboratory Casework, and section 224500 – Emergency Plumbing Fixtures for special laboratory requirements.

- ☐ Laboratory sinks shall be epoxy resin, or University approved equal, to match laboratory counter tops.
- ☐ Laboratory sinks shall be complete with borosilicate glass or polypropylene tail pieces and traps.
- ☐ *Floor drains shall not be installed in laboratories, unless approved by KU EHS.*

Emergency Eye Wash and Safety Showers: *Shall be provided after consultation with KU EHS. At this time, tempering valves are not required.*

- ☐ *Preferred eye wash models include:*
 - ☐ *Haws 7610 barrier-free pull-down or 7611 swing-away eye/face wash.*
 - ☐ *Speakman 'integrated' eye/face wash/faucet with vacuum breaker.*
- ☐ *Floor drains shall NOT be provided under emergency safety shower installations in laboratories, unless specifically reviewed with and approved by the EHS Director.*

Special Kitchen Plumbing Requirements: Where applicable, the Designer shall coordinate with specification sections 114000 Foodservice Equipment.

- ☐ The specifications for plumbing work shall include providing all piping, sleeves, shutoff valves, and pipe insulation to kitchen equipment locations.
- ☐ Specifications shall require the piping to terminate at exact equipment locations in accordance with a shop drawing to be furnished by the Kitchen Equipment Contractor.
- ☐ *Plans shall call out inverts for grease traps.*

DRAINAGE AND VENT PIPING – 221316

- ☐ Chloraloy or approved equal membrane flashing to extend 12-inches from the clamping ring on all floor drains located in slabs not on grade.
- ☐ The lowest floor in the building, whether basement or grade level, must have adequate floor drains to the sewer. There should be more than one floor drain on this lowest level.
- ☐ Every restroom must have a floor drain.
- ☐ Floor drains in machine rooms must be accessible and must not be located under equipment.
- ☐ Floor drains shall not be located in air handling units unless the drains go to an indirect waste outside the unit.
- ☐ Drain, waste and vent piping below grade shall be *PVC, schedule 40 with solvent weld fittings, or service weight cast iron with bell and spigot Tyseal fittings.*
- ☐ Drain, waste and vent piping above grade shall be service weight cast iron with stainless steel no-hub couplings, *or PVC, Schedule 40 with solvent weld fittings.*
- ☐ *Janitors sinks shall be floor level.*

COMMERCIAL WATER CLOSETS & URINALS – 224213

- ☐ *Flush Valves shall be motion sensor-activated and shall be hard-wired to power or shall utilize a solar/photovoltaic power source.*
 - ☐ *Battery-operated flush valves are acceptable on case by case base upon approval by FPD and FS.*
- ☐ *Flush valves shall be compatible with Zurn plumbSmart connected system.*

<i>Fixture Type</i>	<i>GPF/GPM Requirement</i>
<i>Toilets and/or replacement flush valves</i>	<i>1.28 GPF or less</i>
<i>Urinals and/or replacement flush valves</i>	<i>0.125 GPF or less</i>
<i>Showerheads</i>	<i>1.25 GPM or less</i>
<i>Restroom faucets</i>	<i>0.5 GPM or less</i>
<i>Kitchen faucets</i>	<i>1.0 GPM or less</i>

COMMERCIAL LAVATORIES – 224216.13

Designers shall follow the principal of ‘universal accessibility’ in detailing and specifying accessible ADA-compliant lavatories, sinks and faucets. All of these elements shall be equally accessible, using standard components. *EX: Do not use an extended lavatory and wrist blade faucets at one location, to meet ADA, alongside standard units.*

- ☐ *Faucets shall be one of the following:*
 - ☐ *Faucets shall be motion sensor-activated, and shall be hard-wired to power or shall utilize a solar/photovoltaic power source. Battery-operated faucets are acceptable, subject to approval by FPD and FS.*
 - ☐ *Faucets shall be compatible with Zurn plumbSmart connected system.*
- ☐ *Standard single or double lever-type units, equally usable by disabled and able-bodied persons. Do not use wrist-blade or non-lever handles.*

DRINKING FOUNTAINS – 224713

All drinking fountains shall be ADA-compliant models, and include a high-low arrangement at each location. Designers shall use KU's preferred model, unless a variance request is submitted for other models, and are approved by FPD and University Architect. Expensive, 'architectural' units are discouraged.

- ☐ *Designers shall locate drinking fountains in new buildings or renovations in recessed alcoves, so they do not project into corridors or hallways, and so they comply with ADA protruding object restrictions.*
- ☐ *Designers are encouraged to provide a water bottle filler at each drinking fountain location, or at primary-use locations at a minimum, in addition to (and not in lieu of) the high-low drinking fountains.*
 - ☐ *Provide a minimum of one bottle filler per floor.*
- ☐ *Drinking fountains shall be filter less, except in cases where affiliated corporations (such as the Kansas Memorial Unions) provide to FPD and FS a written commitment to a filter changing protocol in accordance with the manufacturer's recommendations, for the life of the drinking fountain.*
- ☐ *KU Preferred Manufacturer/Product: Elkay Model #EZSTL8WSLK (Light Gray) or Model #EZSTL8WSSK (stainless steel), with EZH2O bottle filler, bi-level unit, filter less refrigerated water (see image below).*

