

Design Standard Basic Plumbing System Design

Revisions Log:

Version	Date	Description of changes/updates
2b	May 25, 2015	<ul style="list-style-type: none"> • Expansion of section on Sustainable Design • New language on Documentation
2a	April 11, 2015	<ul style="list-style-type: none"> • Fixed minor typo error
2	March 8, 2015	<ul style="list-style-type: none"> • New language clarifying that ESUHSD provides cold water only in student restrooms • Expansion of section on Sustainable Design • New section on Start-Up Training

Purpose:

This design standard has the purpose of creating a consistent application of plumbing system design throughout the East Side Union High School District. The intent is to achieve a standard of quality for maintenance, water efficiency, energy efficiency and reliability throughout all renovation and new building projects.

Design Standard:

Codes – Systems will be designed in accordance with the latest edition of the following codes:

- International Building Code; California Building Code.
- International Mechanical Code; California Mechanical Code.
- International Plumbing Code; California Plumbing Code.
- International Fire Code; California Fire Code.
- National Electrical Code; California Electrical Code.
- State of California Code of Regulations (CCR).
- Energy Efficiency Standards and Title 24 Regulations.

Standards – The following reference standards shall be used for the design:

- ANSI – American National Standards Institute.
- ASME – American Society of Mechanical Engineers.

- ASSE – American Society of Sanitary Engineering.
- ASTM – American Society for Testing and Materials.
- AWS – American Welding Society.
- AWWA – American Water Work Association.
- CISPI – Cast Iron Soil Pipe Institute.
- CS – Commercial Standards.
- EPA – Environmental Protection Agency.
- NEMA – National Electrical Manufacturer’s Association.
- NFPA – National Fire Protection Association.
- NFPA 10 – Portable Fire Extinguishers.
- NFPA 101 – Life Safety Code.
- NSF – National Sanitation Foundation.
- PDI – Plumbing and Drainage Institute.
- UL – Underwriters’ Laboratory.
- LEED – U.S. Green Building Council.

Water Piping:

- **Electrical Equipment Clearances:** Do not route piping through electrical rooms, transformer vaults, elevator equipment rooms, and other electrical or electronic equipment spaces and enclosures. Within mechanical or plumbing equipment rooms, provide minimum 3 feet lateral clearance from sides of electric switchgear panels, MCC’s, etc. Do not route piping above any electric power or lighting panel, switchgear, or similar electric device. Coordinate exact pipe routing with electrical design to provide proper clearance with such items.
- **Welding Qualification:** Qualify welding procedures, welders and operators in accordance with ANSI B31.9 for shop and project site welding of piping work.
- **All piping shall meet the piping material requirements set forth:**
 - **Equipment:** Provide pipe, tube and fittings of the type, fitting requirements, grade, class, size and weight indicated or required for each service, as indicated in other Division 22 Specifications, codes and standards, whichever is most stringent.
 - **Piping:** Piping shall conform to ASTM or ANSI Standards and be approved by the governing Code for the application intended.
 - **Excavation:** Perform necessary excavation and backfill required for the installation of the plumbing work.

- Tests: Test piping according to the requirements of Plumbing Code and submit "Certificate of Accessibility" to Owner. Test water piping at 150 PSIG for a period of 2 hours with no loss in pressure.
- Determine cold water service and building domestic hot and cold water demands by the fixture unit method as outlined in the California Plumbing Code. This determination should be made for the building as a whole. Although the particular renovation may not involve the entire building, such determination should be made to ensure that there are no existing inadequacies or noncompliant conditions that should be addressed.
- Add known continuous demands to the total estimated demand.
- Size water piping with velocities not exceeding 7.5' per second and minimum of 35 pounds per square inch residual pressure at the highest, or last, fixture or hose rack. For copper pipe, size with velocities of 5' to 8' per second.
- Take particular care in designing and sizing of cold water piping to any shower, or shower room, where the use of adjacent flush valve fixtures could affect the pressure and cause excessive temperature fluctuations. Consider the use of a pressure balancing valve between hot and cold water supplies, or separate line from a point that would not be affected by flushing of fixtures and discuss recommendations with ESUHSD.
- ESUHSD provides hot and cold water to staff restroom lavatories, and cold water only to student restroom lavatories.
- Provide hot water recirculation systems for the following types of locations:
 - Kitchens
 - Science Labs
 - Locker Room Showers
 - Childcare Facilities
 - Home Economics Classrooms
 - Life Skills Classrooms
 - Staff Restrooms
 - Long runs from heater to point of use
- Control hot water recirculation pumps through the EMS to conserve energy

- ESUHSD's strong preference is to avoid the use of dielectric unions or dielectric pipe nipples on heating hot water, domestic and chilled water piping applications, exterior and interior. The inevitable corrosion issues present unacceptable maintenance headaches. ESUHSD prefers high-grade brass nipples and brass unions at transition points. If the use of dielectric unions is unavoidable, the design professional shall specify Elster Perfection Clearflow[®] Dielectric Waterway Fittings (or equivalent), which separate dissimilar metals in the electrolyte (waterway) - reducing the local galvanic cell.



Soil and Waste, and Vent Piping

- Size soil and waste piping by the fixture unit method as outlined in the California Plumbing Code (CPC).
- Grade interior piping, above grade, at 1/4" per foot minimum; 1/8" is acceptable if the pipe size is increased to compensate for the 1% slope as required by California Plumbing Code (CPC).
- Vent all sanitary fixtures as required by code.
- Kitchen or Food Service Waste System: Design a separate waste system for any kitchen or food service and discharge through a grease trap/interceptor. Keep this system separate and connect at a point in the building sanitary sewer system where a stoppage below the connection will not back sewage up to kitchen or food service floor drains or sinks.
- Use corrosive-resistant pipe in any location where the waste may contain corrosives. Keep such waste and vent system separate from the building plumbing soil, waste and vent systems to a point outside the building. In buildings with minor isolated points of corrosive use, discuss the method of handling with ESUHSD.
- Use gravity flow for all building drainage systems. Where this appears to be impractical, discuss installation of pumps with ESUHSD and obtain approval before proceeding with design.

Storm Piping

- Rainwater Leaders and Storm Drains: Compute rainwater quantity on the basis of 1.5" rainfall per hour minimum (.935 gallons per hour/square foot horizontal drainage area). Size all piping per CPC.

- Grade interior piping, above grade, at 1/4" per foot minimum as required by California Plumbing Code (CPC).
- Insulate underbodies and horizontal mains.

Industrial Water Systems

- The industrial water system shall serve all points of water use that could cause contamination by their backflow into the domestic water system.
- Where an industrial water system is selected for a project, protect the domestic water system by installation of two approved reduced pressure backflow prevention devices in parallel at the point of connection.
- Detail the installation of the devices in an accessible location with the lower a minimum of 1' above the floor and the upper a maximum of 5'. Provide adequate drainage below the devices for testing or malfunction, via floor drains.
- Each outlet or connection to the industrial water system shall be posted with a sign reading Industrial Water - Do Not Drink. These may be waterproof cloth tape with printing protected by clear vinyl and self-adhesive back; 1/4" high, black letters on yellow background.

Reclaimed water systems

- Piping systems containing recycled water shall be clearly marked via signage and color coding (purple).

Connections to Kitchen Equipment

- Kitchen equipment is normally furnished under the specification section for kitchen equipment. Work shall be coordinated with Kitchen Equipment Installation Contractor to provide a complete, code compliant installation.
- Include a schedule in the plumbing drawings for the rough-in and final connections to all kitchen equipment.
- Coordinate the furnishing of all equipment trim, such as traps, faucets and valves, with the kitchen equipment drawings and specifications.
- Provide a pressure regulating valve, pressure gauge, pressure relief valve, thermometer and shock absorber in the 180° rinse line to the dishwasher connection.

Garbage Disposals

- Provide garbage disposals in all sinks in staff lunch rooms, or rooms that may be used as staff lunch rooms even if the room's primary or originally programmed function is not as a staff lunch room. If the sink is required to be ADA compliant,

the design professional shall specify a double bowl sink with one bowl meeting ADA requirements, and then install the disposal at the other bowl. The switch shall be placed on a reachable wall or on the front of the casework. Provide garbage disposals in home-like educational settings such as a Life Skills lab.

Back Flow Prevention

- The proper design, selection, installation and maintenance of cross-connection control devices is imperative for the protection of potable drinking water and distribution systems. Appropriate backflow prevention assemblies shall be selected.
- Provide backflow protection at any building water system where there are connections, actual or potential, to a contaminating liquid. Examples include connection from domestic system to HHW makeup and cooling towers.
- Backflow may be prevented by installing a backflow prevention device at each individual point of possible contamination, where devices such as vacuum breakers or air gaps may be employed, or at a single point where an industrial water piping system takes off from the domestic water piping.
- Back flow devices, including Double Check Detector Assemblies must not be sited adjacent to or visible from building entries and public spaces. Coordinate location of such assemblies with ESUHSD during schematic design phase.

Roof, Floor, and Areaway Drains

- Include provisions in the design for coordination of drain and clean-out elevations and other work such as concrete and waterproofing.
- Locate toilet room floor drains out of foot traffic below water closet partitions or between urinals.
- Where floor drains are roughed in for future use, cover with a flush plate and gasket for protection against fume leakage.
- Provide trap primers to retain trap seals on floor drains.
- All floor drains to have 3" or larger traps.
- All horizontal drain runs to have cleanouts on the end of the run on every floor.
- Main drain stacks must have cleanouts installed on each floor.

Hose Bibs

- Provide keyless hose bibs at important outside entrances to a building, along each side of the building, and never more than 40' from a paved entrance for wash down purposes. Locate these as inconspicuously as possible consistent with accessibility, and concealed behind locked access doors.
- Provide a rooftop hose bib when HVAC equipment is located on the roof.

- Provide a hose bib for wash down at exterior courtyards, quads and plazas.
- Hose bibs may be supplied from a reclaimed or industrial water system, or have separate reduced pressure device or vacuum breaker and backflow preventer on each hose bib. However, hose bibs located near exterior eating areas will be used to wash down tables, and should dispense potable water.

Disinfection of Water Systems

- Clean and disinfect the domestic hot and cold water systems, including fire systems connected to the domestic water systems, in accordance with the generally accepted standards and Codes.

Plumbing Isolation Valves

- Show all valves on drawings.
- Arrange and valve all utility services so that, as a minimum, each floor may be isolated.
- Arrange and valve domestic hot and cold water piping so that toilet rooms can be isolated without interrupting service to other parts of the building.
- Show sectionalizing valves in top center and bottom of risers in hot water supply and return systems.
- Place valves on each side of backflow or check valve to permit servicing.
- Show valves on all services left for future connections (tees, stubs, etc.) unless they are in a valved zone, or isolated by other valves, that permits only a minor loss of pipe contents when opened.

Pipe Installation

- Specify a proper corrosion preventive wrapping for any black steel piping installed below grade (bituminous and paper wrapping or extruded plastic).
- Provide water hammer arrestors in water lines to equipment or fixtures having quick closing or flush valves and any equipment that might produce water hammer. Water hammer arrestors shall be certified by the Plumbing and Drainage Institute (PDI). Show location and size of all water hammer arrestors on plans and access for maintenance or replacement. Provide access panels if required.
- Show clean-outs in sewer lines as required by code. In addition, vertical to horizontal changes in main risers that occur above furred ceilings shall have a clean-out extended from the base to a floor clean-out or a wall clean-out above the change in direction.
- Do not embed piping in concrete.

Kitchen Grease, Plaster, Sediment and Sand Traps

- In general, grease traps should be avoided except where required by code or other regulations. If required, locate for easy access and servicing, preferably outside, with proper venting.
- Provide a sand and oil interceptor or plaster trap where required for separation of sediment or solids from the sanitary sewer system.

Fixtures, General

- Specify fixtures using a minimum of water consistent with fixture application. Install flow control devices to limit water use, except in tank and flushometer water closets and urinals.
- Vitreous ware shall be institutional quality.
- Design cast iron enameled ware with acid-resisting enamel.
- Design fixtures complete with trims, where applicable. Exposed trims shall be coordinated with finish of plumbing fittings.
- Provide accessible fixtures per architectural documentation.
- Provide stops in hot and cold water lines serving all fixtures, including hose bibs.

Fixture Connections

- Exposed water supply pipe, tubing and waste piping connections shall be chrome-plated brass.
- Fit supply pipe, tubing, and other connections with chrome-plated brass escutcheons at walls and floors.
- Cover exposed bolt heads in floor flanges of any fixture, in the back of any fixture, or in the fixture itself, with porcelain bolt caps securely held in place with putty.
- Fit fixtures tight to walls and seal joint. Coordinate sealant with architectural.
- Specify red brass for all nipples from copper water lines to fixture stops. Do not allow galvanized nipples.

Sustainable Design

- ESUHSD has a desire to design and construct sustainable buildings and grounds. Sample sustainable design opportunities are provided in the table located in the ESUHSD Sustainability Design Standard. Each strategy needs to be integrated appropriately into their respective projects. Development of design strategies for each item is beyond the scope of this Plumbing Design Standard and requires careful consideration for proper application. The District will select on a case by case basis the projects that are to achieve LEED™ certification, CHPS certification, pursue utility company incentive grants, etc. The design team shall discuss green

design and certifications with the Facilities Director during the project's programming phase, in order to make a recommendation and seek the Director's approval for pursuit of certifications and incentive grants.

Engineer shall provide consulting and construction assistance to the District as needed to achieve LEED™ certification, CHPS certification, pursue utility company incentive grants, etc.

- a. LEED™ certification: Provide design and documentation as required by United State Green Building Council to achieve the targeted certification.
- b. CHPS certification: Provide design and documentation as required by the Collaboration for High Performance Schools to achieve the targeted certification.
- c. Savings by Design energy incentive financing from PG&E. Refer to Savings by Design Participant Handbook, published by PG&E. Create and submit to PG&E Savings by Design application(s).
 - i. Provide energy modeling software and simulations required by the Savings by Design Program.
 - ii. Establish the Title 24 baseline.
 - iii. Demonstrate to PG&E the energy model and energy savings in excess of Title 24 minimums.
 - iv. Complete the Savings by Design contract with PG&E for available rebates to the owner.
- d. Other certification, incentive and grant programs: Provide design and documentation as required to achieve the targeted certification, incentive financing, grants, etc.

Start-Up Training:

- Specify preparation of a formal training program for operating staff prior to the scheduled start-up date. The program will consist of the design, start-up, and operation of the plumbing systems. The training program is to be coordinated with production of the operation and maintenance manuals. Operations and Maintenance data is to be available for training sessions.
- Specify provision of 4 hours of on-site training in the operation and maintenance for installed system and major pieces of equipment. Verify this quantity with the Facilities Director during the construction documents phase of design.

Documentation

- Construction Layout Drawings: Direct the contractor to prepare and submit layout drawings to coordinate installation and location of plumbing equipment.

Prepare composite drawings showing all equipment on a single sheet. The architectural floor plans, reflected ceiling plans, and access floor layout plan shall form the base for the coordination drawings. Prior to completion of Drawings, coordinate proposed installation with the Architect, structural requirements, and other trades (including FFE, electrical, HVAC, fire protection, ceiling systems, and raised floor system), and provide required maintenance access.

- As-Constructed Drawings: Final construction drawings and specifications, together with final layout coordination drawings, with as-constructed information added, are to be submitted as record drawings at completion of project. Plans are to incorporate all addenda items and change orders.
- Closeout Documentation: Submit plumbing authority certification of inspection. Include documentation of on-site plumbing system testing that was performed.

Approved Manufacturers:

- Elster Perfection Clearflow© Dielectric Waterway Fittings

Substitutes Allowed:

Yes, if performance and quality equivalency can be evidenced.

Associated Design Standards and Construction Specifications

- Acoustic Design Standard
- Sustainability Design Standard
- Division 22 Plumbing Design Standards
- Division 23 HVAC Design Standards
- Division 25 Integrated Automation Design Standards
- Division 26 Electrical Design Standards
- Division 27 Communications Design Standards
- Division 28 Electronic Safety and Security Design Standards
- 01 91 00 Commissioning Design Standard
- 01 91 13 Commissioning Requirements Construction Specification

End of Document