



## DIVISION 22 PLUMBING

### GENERAL

The Consultant shall provide a written description of how the entire system is designed to operate. This Basis of Design (BOD) narrative also shall describe how project objectives are being met. It shall be provided in a format that can be easily understood by a lay person, the end user. The narrative shall identify items that specifically meet the University's Project Requirements (OPR) and the most recent Facilities Management (FM) or department System Master Plan(s) and articulate a rationale for any variance.

For renovations, the systems selected shall be compatible with the existing building's mechanical and plumbing systems. The integrity of the basic existing building system shall not be compromised, except where agreed to by the University. Work shall be designed and sequenced to minimize impact and interruptions in occupied buildings. Consult with FM to identify the timing necessary for notifications and operational requirements (e.g. after hours work, backup systems, or field support).

For site work, the Consultant shall indicate all existing such as piping, valves, manholes, electric wiring and telephone underground work using the latest American University (AU) utility plan, whether new connections are being made or not. Profiles of all new storm and sanitary sewers need to be shown to facilitate coordination with the crossing of other utilities.

The Consultant shall incorporate any requirements from the University insurance carrier or Risk Management into the design and specifications.

### PLUMBING, DOMESTIC AND SANITARY SYSTEMS DESIGN CRITERIA

The Consultant shall allow for normal expansion and contraction of the piping system. In addition to construction drawings, the project as-built drawings shall indicate expansion joints or pipe swings where designed or added.

All fluid systems shall be designed to be fully drainable.

American University is committed to energy efficiency and water use reduction. Designers should consider water reduction methodologies if applicable for incorporation into the project. Do not discharge water-cooled equipment to drains.

Metering at the campus level and/or sub-metering at the building level is required. Meter records (size, purpose) along with a photograph of the installation with the meter number clearly shown shall be submitted to FM Energy and Engineering (E&E) when placed in service.



Meters associated with billing are required to be supplied by DC Water. This applies to domestic, irrigation, cooling tower makeup or similar applications. Sub-meters for irrigation and cooling towers should be programmed by DC Water to receive sewer credit on the utility bill.

Plumbing design shall be compatible with the latest version of the local energy code(s) as amended to include water conservation requirements. Energy conservation measures shall be incorporated into all projects.

Piping and plumbing equipment design and selection shall allow for anticipated future building expansion. The need for expansion should be discussed during the project design phase. The Consultant shall evaluate piping that might be subject to freezing and provide proper freeze protection as necessary.

Water or sanitary piping will not be allowed in telephone rooms, electric equipment rooms and closets, elevator machine rooms, emergency generator rooms or over motor control centers. In addition, sanitary drainage piping shall not be run at the ceiling of any food-preparation or serving area.

Water (and gas piping) shall not be run under buildings where access is not readily available except where necessary to pass through the exterior wall of a building and then immediately turn up into the building.

The following flow and flush rates are required minimums for all new and replacement plumbing fixtures. Indoor plumbing renovations must include plumbing fixture replacements compliant with the flush and flow rates below as a minimum or as required by local code, whichever is more stringent.

#### AU Plumbing Fixture Flow Rate Chart

Fixture	Flow / Flush Rate
Water closet	1.28 / .08 GPF dual flush
Urinal	0.125 GPF (pint flush) urinal
Lavatory faucet	0.5 GPM
Kitchen / janitorial sink	2.2 GPM
Shower	1.5 GPM

Where options exist for low flow rates for other fixtures, the lowest flow rate should be selected. Fixtures that exceed the flow rates above should be submitted for approval as an exception and will be considered only on a case-by-case basis.

The design of plumbing systems should consider serviceability of equipment, valves and accessories and isolation for repairs. Vents and drains shall be identified on the drawing. Design drawings should include a detail showing piping size, valve and hose connection. For large projects, isometric piping diagrams shall be included in the



drawings. Drains shall route to the closest or readily accessible drain in a manner to prevent a tripping hazard. System and branch drains located within areas occupied by non-FM departments should be avoided.

Orient valves, gages and indicators so that position is visible from the floor level without ladder use.

Backflow preventers shall be certified within one (1) week of occupancy with a copy of the required forms and printout formally transmitted to Facilities Management.

Include trap primers for drains in interior locations including under equipment, within restrooms and wash down areas. Mechanical rooms and locations with infrequent use shall have drain trap primers. Trap guards are acceptable on renovations to existing buildings not new construction.

The placement of cleanouts shall consider maintenance equipment requirements such as drain snakes or inspection cameras. Identify on drawing distance requirements and confirm access to a water source with hose bibb and a dedicated electric receptacle. Fixture removal as a cleanout should be the last resort and avoided if possible. All sanitary piping cleanouts shall be installed facing non-occupied spaces (i.e. hallways, corridors, etc.).

Equipment naming and labeling shall be consistent with other University systems and used consistently throughout the project., refer to the Equipment Naming Scheme document in the references section at [www.american.edu/standards](http://www.american.edu/standards) and related control naming document in Section 25 55 00.13 Control of HVAC Object Naming Convention. Submit equipment schedule during design phase for confirmation of the FM AiM asset identification. Include on drawings across all disciplines. See Division 26 for required color-coding of labels for equipment and components based upon energy source

Do not design a system that uses Victaulic or similar gasketed pipe for primary or secondary domestic hot water distribution within the building.

PVC piping is acceptable only for non-potable water applications such as condensate or similar applications. PVC pipe jacketing is not to be installed on the roof; only aluminum pipe jacketing is acceptable for exterior process piping.

On each floor, cold-water hose bibb connections are to be provided in a janitor's closet or if not feasible in discrete locations inside a lockable (2BB key) hose bibb box.

Roof mounted equipment condensate and/or service drains will not be permitted over sensitive spaces. If not possible, oversize drain size to prevent flooding.

Install one (1) hose bibb on each side of a building, as well as one (1) on the roof for equipment requiring cleaning or vegetative roofing.



Projects using BIM modeling shall detail all manufacturer's requirements for equipment service clearances.

Specialty plumbing equipment are to be purchased with an associated minimum two-year warranty on parts and labor. Examples include acid neutralization, vacuum pumps, air compressors, etc.

Type L copper piping is required for domestic water piping distribution. Type M copper is not acceptable.

The use of t-drill as an installation method on 2 inch and larger piping is acceptable.

Pro-press as a connection is allowed in accessible areas only and shall be so noted on the as-built drawings. FM possesses a complete Pro-press kit for maintenance purposes for sizes up to 4 inch; other manufacturers will not be considered.

All wastewater, injectors and sump pump pits and assemblies to have odor free lids and gasketing to manage odor. Include pump lift mechanism on pits exceeding three (3) feet. Sump pump must report and alarm to the Building Automation System and have associated graphics.

Test potable water systems per local code and utility requirements. Provide test and acceptance results to FM prior to occupancy or use.

Dielectric nipples are not allowed. On an independent chart (similar to the valve chart), all installed dielectric connections are to be documented. Laminate and post in closest mechanical room. Submit electronic version of posting in Excel and PDF during close-out.

All exterior utility tie-ins shall include a manhole for ease of operation, service and maintenance.

## BUILDING AUTOMATION SYSTEM REQUIREMENTS – DIVISION 25

During design development, submit for compatibility review a complete manufacture points list for controlled equipment provided under this Division, indicating if points are monitor-only or capable of remote control. Point mapping to the existing BAS system is an owner requirement. Variances require concurrence of Facilities Management.

Include a complete description of technical control requirements such as handheld devices needed for field adjustment, software and licensing (proprietary or open source), or gateway requirements. Refer to Division 25 for building automation requirements.

Packaged pumps and specialties, skid mounted are preferred over field-assembled units with components from multiple manufacturers. Integration with Building



Automation System (BAS) for monitoring, control and alarms shall follow the BAS Master Plan and the requirements listed in Division 25.

#### COMMISSIONING OF PLUMBING SYSTEMS – 22 08 00

In addition to required startup and performance testing, plumbing systems shall follow the connectivity and alarm requirements as described in the Building Automation Master Plan and the FM Commissioning Plan. See Division 1, Section 01 91 13 and Division 25. Additional requirements by DC Green Code may also apply.

#### COMMERCIAL PLUMBING FIXTURES – 22 41 00, 22 42 xx

For residence halls and high-traffic areas, low-flow toilets must incorporate a pressure-assisted technology (as opposed to the standard gravity-fed option).

Automatic flush valves shall be hardwired, not battery or wireless. Turbine or electrically powered with battery backup are to be used.

All fixtures and appurtenances should be selected based upon having a local (DC Metro area) manufacturer's representative and supplier.

#### HEAT TRACING – 22 04 29

Integrate heat tracing into the Building Automation System as a start/stop status point and alarm on failure to operate based upon Outside Air Temperature (OAT).

#### VALVES

Valves used for isolation and control shall provide absolute shut-off to full ANSI Class ratings with pressure in either direction, allowing flexibility in system design and utility during system maintenance.

The height preference for valve handle access is less than five (5) feet or as required by code. Valve handles over eight (8) feet shall have a chain operator or similar device. The same applies to installed access panels. Refer to Division 23 for size requirements.

Isolation valves to be high performance bubble free and required for all ball valves and butterfly valves 2 inches and larger.

Stainless steel is preferred for valve bodies, seats, retainers and associated packing gland retainer studs. Bearings shall be stainless steel with PTFE/fiberglass mesh liner. Composite materials shall not be used.

Valve tags are to be installed down to one-inch pipe. Valve charts are to be laminated



and kept accordingly in the closest mechanical rooms or floor service closets. Note that FM and University Housekeeping do not share access to the same service spaces and charts must be FM accessible.

During project closeout, the first fifteen (15) feet of sanitary and storm piping for all new roof and floor drains shall be bore scoped. Pipe condition documentation to be sent as a closeout submittal.

#### VALVES, BALL – 22 05 23.12

Valve selection criteria is chromium plated or stainless steel (full port) ball valve. Performance rating is minimum 400 psi CWS, 125 SWP with 600 WOG preferred and maximum temperature of 400F.

Where insulation is specified, provide factory installed extended stems to receive insulation. Service valves installed in systems below ambient temperature shall have Therma-Seal as manufactured by Apollo or approved equal.

Chain wheel operators shall be provided for all valves 2-1/2" or larger installed 72 inches or higher above finished floor. Extend chains to an elevation of 60 inches above finished floor.

Hand wheels fastened to valve stem shall be provided for valves other than quarter-turn types. Lever handles shall be provided for quarter turn valves 4" and smaller.

Gear drive operators shall be provided for quarter turn valves 6" and larger.

#### VALVES, BUTTERFLY – 22 05 23.13

Valve selection criteria is high performance positive shutoff on pressure or vacuum with zero leakage and bubble tight for all isolation valves over 2 inches. All shafts shall be one-piece construction.

#### VALVES, CHECK – 22 05 23.14

Standard swing check valves over 4" shall be rubber faced. Resilient coatings such as ethylene propylene diene monomer rubber (EPDM) or porcelain may also be appropriate.

Install check valve with a minimum of 5 (five) pipe diameters downstream from any flow disturbance (valve, pump, elbow or reducer) to reduce chatter and early valve failure.

#### VALVES, GATE – 22 05 23.15

Valve selection criteria is adjustable packing gland, blow out proof stem design, with



polytetrafluoroethylene (PTFE) seats and ethylene propylene diene monomer rubber (EPDM) stem packing.

Standard steel wedge type gate valves should be outside screw and yoke, rising stem, non-rising hand wheel, and bolted bonnet.

Gate valves are to be used in specific installations only with prior approval from FM. Do not use where dirty surface medium may cause seating problems.

#### WATER FOUNTAINS AND WATER COOLERS – 22 47 10, 22 47 13

All drinking fountains must accommodate a refillable water bottle. Fountains that accommodate reusable water bottles come at two price points, glass fillers and bottle filling stations. The filling stations have advantages with speed, visibility, sanitation, and vandalism prevention; however, they are more expensive. Type, including cost and frequency of fillers, is a prime selection criterion. Water bottle filling units should have a filter alarm and show calculation of disposable containers avoided.

New buildings are required to have water bottle filling stations. During renovation projects, water fountains must either be replaced with filling stations or modified with glass fillers in low traffic areas.

Fillers must have a feature that shuts off the water supply if the filler is disconnected.

#### EMERGENCY PLUMBING DESIGN REQUIREMENTS

In an area where eyewash equipment is required, the eyewash station must be designed to the following specifications:

- The eyewash must be plumbed and provide potable, tempered water between 60°F and 100°F, with an ideal sustained temperature of 85°F.
- Equipment must be made of stainless steel and/or high impact plastic.
- The eyewash must be able to be activated in one second or less and stay activated without further use of the operator's hands. It must stay activated until manually shut off.
- Nozzles must have caps that protect them from airborne contaminants. The caps must automatically discharge upon activation without additional operator effort.
- The eyewash must deliver at least 0.4 gallons of water per minute.
- The water pressure should be 30 psi.
- Exposed piping subject to damage must have PVC jacketing.
- Outdoor units must be equipped with freeze protection.

Hand-held emergency drench hoses are not acceptable alternatives to plumbed. It must stay opened without further use of the operator's hands. It must stay activated until manually shut off.

- The eyewash must deliver at least 20 gallons of water per minute.
- The water pressure should be 30 psi.
- At a height of 60 inches above the floor, the spray pattern must be at least 20 inches in diameter.
- Water service to the shower must be equipped with a ball valve and lever handle. The valve must be accessible with a 6-foot ladder to provide shut-off capability in order to service the fixture. The valve's handle shall be able to be turned/manipulated without the need for tools or equipment. A single valve shall serve to shut of both the hot and cold water.
- Exposed piping subject to damage must have PVC jacketing.
- Outdoor equipment must be equipped with freeze protection.

#### EMERGENCY PLUMBING FIXTURES - 22 45 00

The need to install a safety shower or eyewash is dependent upon the planned use of the space. All new construction and renovation projects that require installation of a safety shower or station must ensure that the equipment complies with the most recent ANSI Z358.1 standard. Final design approval should be obtained from the Risk Management office.

All installations shall meet the following standards:

- ANSI Z358.1 (most recent publication)
- OSHA – 29 CFR 1910.151(c)
- Americans with Disability Act of 1990

#### EMERGENCY SHOWERS – 22 40 00

An emergency shower is required in any area that contains or will contain more than 2.5 liters of caustics or corrosives that could cause injury to the skin or eyes. The product's Safety Data Sheets should be reviewed for any language that refers to the substance as an "injurious corrosive." Some examples of areas that require eyewash equipment are battery changing or charging stations, wet laboratories, pesticide mixing stations, chemical or pesticide storage areas, and fine art studios.

A sign shall be placed above each emergency shower that reads "Emergency – Safety Shower" and contains the safety shower symbol. The background may be white or green with black or white writing. The sign must be large enough and placed high enough above the station so that it can be easily seen and read from anywhere within the immediate space.







## CONFIGURATION

- The shower may not be located directly over or within three feet of electric power sources such as outlets, switches or power supply panels, regardless of whether or not they are Ground-Fault Circuit Interrupted (GFI).
- The center of the showerhead must be at least 24 inches away from obstructions (walls, benches, etc.)
- The activation pull shall not be more than 69 inches from the floor.
- The activation pull must be located out of the normal pathway in the room to minimize the likelihood of accidental activation, preferably within two inches of a wall or bench.
- The shower may not be obstructed by other permanent or temporary structures.
- Strainers are recommended in the hot and cold water lines ahead of the tempering valves and eyewashes or showers.
- The showerhead shall be between 82 and 96 inches from the floor.
- It is preferred that the shower be located near a floor drain, and the floor shall be sloped toward the drain. Floor drains with removable plugs are acceptable. For units not plumbed to a drain, the waste connection must point away from the wall.

## EYEWASH EQUIPMENT – 22 45 16

An emergency eyewash station is required in any area that contains or will contain caustics or corrosives that could cause injury to the eyes. The product's Safety Data Sheets should be reviewed for any language that refers to the substance as an "injurious corrosive." Some examples of areas that require eyewash equipment are: battery changing or charging stations, wet laboratories, mechanical spaces, housekeeping storerooms, theater set design studios, photography dark rooms, chemical or pesticide storage areas, and fine art studios.

Hand-held eyewash bottles and self-contained eyewash stations are not acceptable alternatives to plumbed eyewash units.

In an area where eyewash equipment is required as stated above, the eyewash station must be placed as follows:

- Eyewashes should be accessible within 10 seconds from any point in the work area, with the maximum travel required being 50 feet.
- If the eyewash station cannot be reached within 10 seconds or 50 feet, whichever is less, another eyewash station must be installed.
- The eyewash station must be present within the same contiguous area as the hazard. It must be positioned such that the user does not have to travel to a different room to use.
- The eyewash unit may be combined with safety showers or sink-mounted, as long as it still meets the design requirements discussed below.

A sign shall be placed above each eyewash station that reads “Emergency – Eye Wash Station” and contains the eyewash symbol. The background may be white or green with black or white writing. The sign must be large enough and placed high enough above the station so that it can be easily seen and read from anywhere within the immediate space.



## CONFIGURATION

- The eyewash may not be located directly over or within three feet of electric power sources such as outlets, switches or power supply panels, regardless of whether or not they are Ground-Fault Circuit Interrupted (GFI).
- The eyewash must be installed with sufficient space to allow the user to hold their eyelids open with both hands while the eyes are being rinsed
- Nozzles should be positioned between 33 and 45 inches from the floor, and at least 6 inches from the wall or nearest obstruction. The nozzles must be easily accessible to the operator with no obstructions. Combination drench hose/eyewash units must be positioned so that the eyewash can be activated without having to manipulate the drench hose.
- Strainers are recommended in the hot and cold water lines ahead of the tempering valves and eyewashes or showers.
- The eyewash should be located above a sink or floor drain. For units with a waste connection that is not plumbed to a drain, the waste connection should point away from the wall.

## SELF-CONTAINED EYEWASH EQUIPMENT – 22 45 19

Self-contained eyewash equipment may not be used in new construction or major renovation projects. Self-contained eyewashes may only be used in areas that have changed occupancy but have not undergone renovation.

The University Safety and Security Services office must be notified prior to the installation of a self-contained eyewash station.

## HANDHELD EMERGENCY DRENCH HOSES – 22 45 29

A hand-held emergency drench hose may serve as an additional piece of safety equipment but may not replace an emergency shower where one is required. Refer to section 22 45 13 to determine if a safety shower is required.

END OF DIVISION 22