

The Board Of Water Commissioners Denver Water

Engineering Standards Chapter 1 – General

1.01 AUTHORITY:

These Standards are promulgated by the Manager of Denver Water pursuant to the authority granted by the Charter of the City and County of Denver (Denver), as amended.

The administration of these Standards including interpretation, enforcement, revision, waiver and variance is hereby delegated by the Manager to the Director of Engineering or an appointed representative.

Any variance request must be submitted to the Sales Administration Section and forwarded to the Director of Engineering or an appointed representative for review.

1.02 EFFECTIVE DATE OF STANDARDS:

These Standards shall be effective after they have remained posted in a conspicuous public place in the principal business offices of Denver Water for a period of 15 days, and shall supersede all former Engineering Standards of the Board of Water Commissioners, Denver, Colorado.

1.03 REVISIONS, AMENDMENTS OR ADDITIONS:

These Standards may be revised, amended, or added to from time to time. Such revisions, amendments and additions shall be binding and of full force and effect when electronically posted in the manner set forth in 1.02, above.

1.04 DENVER WATER CONTROL:

These Standards shall apply to the installation, operation, and maintenance of all water facilities under the control of Denver Water. Such control shall be exercised in accordance with the Charter within Denver and by contract with Distributor Contract areas.

Notwithstanding any variance from these Standards that occurred or was authorized in the past, or that may be authorized in the future, Denver Water shall not be restricted or limited in the exercise of its lawful powers. No action in violation of these Standards, direct or indirect, of or by any person, including any owner, operator, or agent of an owner or operator of any water facility in making any connection, disconnection, repair, or otherwise doing work with respect to any water facility served with water from the Denver Water system, shall continue after discovery of such violation, or the enforcement of corrective action as to such violation.

1.05 ORGANIZATION AND INTERPRETATION OF STANDARDS:

These Standards are composed of written Engineering Standards, Materials Specifications, and Standard Drawings. The interpretation of any section, or of differences between sections, when appropriate, shall be made by the Director of

Engineering or an appointed representative, and their interpretation shall be binding and controlling in its application.

Whenever there is a conflict between these Engineering Standards and any referenced standard, specification, or code the most stringent requirement shall apply and shall mean the latest edition.

1.06 **DEFINITIONS:**

As used in these Standards, unless the context shall otherwise require, the words defined in this paragraph shall have the meanings herein ascribed:

- A. Applicant for System Extension:** Any person, association, corporation, entity, or government agency desiring water service for premises under their control and having been granted a license by Denver Water to receive service; often a subdivider or developer. Also referred to as Applicant.
- B. Automatic Meter Reading (AMR):** A system of electronic components that permit the collection of meter readings by wireless or wired electronic communication systems. Components of AMR may be attached to and become part of a customer's water meter; other components may include central data collection units, vehicle-mounted equipment, data transmission systems, and other components. Also known as Advanced Metering Infrastructure (AMI).
- C. Auxiliary Water Supply:** Any water supply on or available to a customer's premises other than Denver Water's approved public water supply.
- D. Back-Pressure:** Backflow caused by a pump, elevated tank, boiler, pressure in pipe, or any means that could create greater pressure within a piping system than that which exists within the potable water supply.
- E. Backflow:** The flow of water or other liquids, mixtures, gases, or substances into the distribution pipes of a potable water supply, from any source other than its intended source.
- F. Backflow Preventer:** A device or method designed to prevent backflow consisting of one of the following:
 - 1. **Air-Gap:** The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture, or other device, and the flood level rim of said vessels. An approved air-gap will be at least double the diameter of the supply pipe, measured vertically, above the top of the overflow rim of the vessel, and in no case less than one inch.
 - 2. **Pressure Vacuum Breaker:** A type of device in which the check valve is designed to close with the aid of a spring when the line pressure drops and at the same time the air relief valve is designed to open when the internal pressure is just above atmospheric pressure so that no non-potable liquids may be siphoned back into the potable water system. Being spring loaded, the check valve does not rely upon gravity as does the non-pressure type vacuum breaker. This type of device may not be installed where it might be subjected to any back-pressure condition.
 - 3. **Non-Pressure Vacuum Breaker:** A type of device which is better known as an atmospheric vacuum breaker; and is always placed downstream from the shut-off valve, and, which will cause its vent to

close when the water flows in the normal direction. But, as soon as the water ceases to flow, the air vent valve is caused to open, thus interrupting the possible back siphonage effect. This device should be installed at least 6 inches above the highest outlet and should not be used where it is subject to line pressure for more than 24 hours.

4. **Double Check Valve:** An assembly of two internally loaded, specially designed and independently operating check valves together with a tightly closing shut-off valve on the upstream and downstream side of the check valves. This type of device is used on all direct or indirect water connections through which pollutants may enter the potable water system under backflow conditions.
 5. **Reduced Pressure Principle Device:** An assembly of two internally loaded, specially designed, and independently operating check valves which also has a mechanically independent, hydraulically dependent relief valve between the check valves, specifically designed to maintain a zone of reduced pressure between the two check valves at all times. This assembly must also have tightly closing upstream and downstream shut-off valves. This assembly is used for the protection of the potable water supply wherever a direct or indirect connection is made to a point of use involving any substance, which might present a health hazard. The only exceptions are in the case of installations where sewage substances are handled under pressure (here no direct connection may be made which might be placed under a back-pressure condition); and, private water supplies (e.g., wells) that may be of lower quality than the public water supply.
- G. Backflow Prevention:** Prevention of the flow of any foreign liquids, gases, or substances into the pipe lines of a potable supply of water.
- H. Backflow Prevention Device:** A device accepted and approved by Denver Water as meeting an applicable specification stated or cited in this Chapter or as suitable for the proposed use and as approved and accepted by the Colorado Department of Public Health and Environment (CDPHE).
- I. Back-Siphonage:** A form of backflow due to a negative or sub-atmospheric pressure within a water system.
- J. Board:** The Board of Water Commissioners or an authorized representative as established by the Charter of the City and County of Denver.
- K. Certified Welder:** A skilled welder, welding operator or tacker who has had adequate experience in the method of materials to be used and is qualified under the provisions of the American Welding Society Standard (AWS) D1.1 using test position 6G.
- Welders shall be qualified by an independent, local, approved testing agency not more than 6 months prior to commencing work. Machine and electrodes similar to those used in the work shall be used in qualification tests.
- L. City and County of Denver:** The territorial limits of the City and County of Denver, inside which Denver Water has complete control of the water system, including ownership, construction, operation, and maintenance of all facilities, reading of meters, and billing of customers.

- M. Conduit:** A 24 inch or larger diameter pipe carrying recycled or potable water from or to treatment facilities and storage reservoirs, and to delivery points feeding the distribution system.
- N. Consecutive System:** A public water system that receives, through purchase or other means, treated water from a supply system and distributes that water, without additional treatment except disinfection, through a distribution system that it owns. A consecutive system may be included in an Integrated Water System.
- O. Consumer:** Any person, firm, or corporation using or receiving water from the public water system.
- P. Contamination:** An impairment of the quality of the water by sewage or industrial fluids to a degree which creates a natural hazard to the public health through poisoning or through the spread of disease.
- Q. Contractor:** In the context of these Standards, a Contractor employed by an Applicant for water system extension.
- R. Cross Connection Control:**
- 1. Containment:** Prevention of actual or potential cross connection in the plumbing system of a consumers premises from the public water supply system.
 - 2. Isolation:** Prevention of actual or potential cross connections within the consumers plumbing system.
- S. Detector Check Valve:** a device accepted and approved by Denver Water that will record low-volume water use through a fireline service. The Detector Check Valve may be combined with an appropriate backflow prevention device to form a Double Detector Check Valve Assembly or a Reduced Pressure Detector Check Valve Assembly.
- T. Denver Water:** The plant, facilities, system, assets, and personnel controlled by the Board pursuant to its Charter authority.
- U. Distribution Main:** A 12 inch or smaller diameter pipe along public streets or appropriate rights-of-way used for distributing water to individual consumers.
- V. Distribution System:** Mains of 12 inch and smaller diameter, together with all appurtenant and necessary valves, fire hydrants, taps, meters, service pipes, and associated materials, property, and equipment receiving recycled or potable water from Conduits and transmission mains distributing it to individual consumers.
- W. Distributor:** An entity located outside the City and County of Denver but inside the Combined Service Area, which contracts with Denver Water for delivery of potable water and does not commingle such water with potable water from any other source.
- X. Distributor Contract Area:** An area which is covered by a contract that furnishes potable or non-potable water to an entity having authority to occupy public streets, roads, and ways as a water utility serving some area outside the City and County of Denver. These areas are classified as "Master Meter" (treated or untreated water), "Read and Bill" or "Total Service" Areas. Also see [Master Meter Contract Area](#), [Read and Bill Contract Area](#) and [Total Service Contract Area](#).

- Y. Engineer:** The Director of Engineering, who is a member of the Manager's Executive Staff, or an appointed representative.
- Z. Fireline:** Pipe, fittings, and appurtenances of the licensee for conveying water from Distribution Mains to the consumer for fire protection purposes, specifically for automatic sprinkler systems. For the purposes of these Standards, the fireline extends from the corporation stop or tee on the water main to the edge of the public right-of-way or easement containing the water main.
- AA. Hydrant Branch:** That portion of piping that extends from the water main to the fire hydrant.
- BB. Hydraulic Grade Line:** In closed pipelines flowing under pressure, the hydraulic grade line is the level to which water would rise in a vertical tube (open to atmospheric pressure) at any point along the pipeline.
- CC. Industrial Piping System:** Any system used by a consumer for the transmission or confinement, or storage of any fluid, solid, or gaseous substance other than an approved water supply, including all pipes, conduits, tanks, receptacles, fixtures, equipment and appurtenances used to produce, convey or store substances which are or may be polluted or contaminated.
- DD. Inspector:** The authorized representative of the Engineer assigned to a jobsite.
- EE. Integrated Water System:** Two or more public water systems, one of which is a supply system, whose distribution systems are physically connected and are being operated using a common set of standards for the purposes of maintaining and protecting drinking water quality.
- FF. Licensee:** Any person, association, corporation, entity, or governmental agency having ownership or control of a licensed premises.
- GG. Main Extensions:** Extensions to the distribution system that are within the City and County of Denver or Total Service Areas.
- HH. Manager:** The chief executive officer of Denver Water, designated as such by the Board.
- II. Master Meter Contract Area:** An area, in which, by contract, the Distributor is responsible for construction, operation, and maintenance of the system to distribute water to the consumer and for reading the meters of the individual customers and for billing them accordingly.
- JJ. Meter Inspector:** An authorized representative of Denver Water's Customer Service Field Section, responsible for assuring that domestic water services and metering installations, including AMR systems, comply with applicable standards.
- KK. Non-Toxic Substance:** Any substance of a non-poisonous nature that may create a minor or moderate hazard to the domestic water system.
- LL. Pollution:** An impairment of the quality of the water to a degree which does not create an actual hazard to the public health, but which does adversely and unreasonably affect such waters for domestic use.
- MM. Private Pipe Extensions:** Extensions to distribution systems that are within Distributor Contract Areas and outside the territorial boundaries of the City and County of Denver.

- NN. Read and Bill Contract Area:** An area, in which, by contract, the Distributor is responsible for the operation and maintenance of the system to distribute water to the individual customer. Denver Water reads the meter of each customer and bills according to a specified rate.
- OO. Recycled Water Conduits:** Recycled water conduits are 24 inch diameter and larger mains carrying recycled water.
- PP. Section and Division:** The words Section and Division are used as organizational subdivisions of Denver Water (e.g., Sales Administration Section, Engineering Division, etc.).
- QQ. Combined Service Area (CSA):** The City and County of Denver, plus the area within the outer geographical boundaries of the existing and projected service areas of all of the Distributors combined, based on the legal descriptions contained in each Distributor's contract.
- RR. Service Line:** Pipe, fittings, and appurtenances of the licensee for conveying water from distribution mains to the consumer for domestic use or for irrigation. For the purposes of these Standards, the service line extends from the corporation stop or tee on the water main to the first valve inside the premises after the water meter; that is, to the stop-and-waste valve adjacent to the building for an outside meter set, or to the meter outlet valve for an inside meter set, or the irrigation control valve for an irrigation service.
- SS. Stop Box:** A valve box, service box or curb box set over the property line valve or curb stop on a domestic water service.
- TT. Stub-in:** A tap made for the purpose of installing service lines prior to the paving of streets. Such connection shall include fittings necessary to extend the service line to the valve at the property line. Conversion of a stub-in to an active service line shall be subject to conditions of the Operating Rules and stub-in agreement.
- UU. Tap:** Physical connection to a distribution main which, together with appropriate license, affects water service to individual consumers.
- VV. Total Service Area:** An area, in which, by distributor's contract, Denver Water is responsible for the operation and maintenance of the system to distribute water to the individual consumer and for reading the individual consumer's meters and for billing them accordingly.
- WW. Toxic Substance:** Any substance (liquid, solid, or gaseous) including raw sewage and lethal substances which, when introduced into the water supply system, creates or may create a danger to the health and well-being of the consumer.
- XX. Transmission Main:** A 16 inch or 20 inch diameter pipe receiving recycled or potable water from a conduit and distributing it to individual consumers.
- YY. Water Main:** A distribution main, transmission main or Conduit.
- ZZ. Water – Potable:** Water from any source which has been investigated by the health agency having jurisdiction, and which has been approved for human consumption.
- aa. Water – Recycled:** Treated domestic wastewater suitable for irrigation and commercial uses but not suitable for human consumption.

- bb. Water Purveyor:** The owner or operator of the public water system supplying an approved water supply to the public.
- cc. Water Supply – Auxiliary:** Any water source or system other than the public water supply that may be available in the customer's building or premise.
- dd. Water Supply – Unapproved:** A water supply, which has not been approved for human consumption by the official health authority having jurisdiction.
- ee. Water System – Consumer:** Any water system located on the consumer's premises whether supplied by a public potable water system or an auxiliary water supply.
- ff. Water Service Connections:** The terminal end of a service connection from Denver Water's water system; i.e., where Denver Water loses jurisdiction and quality control over the water at its point of delivery to the customer's water system. The service connection will mean the downstream end of the meter. There should be no unprotected takeoffs from the service line ahead of any meter or a backflow prevention device located at the point of delivery to the customer's water system. Service connection will also include water service connection from a fire hydrant, fireline, and any other temporary or emergency water service connection from Denver Water's potable water system.
- gg. Welder:** See [Certified Welder](#).

1.07 ABBREVIATIONS:

All references to Documents or Specifications shall be the latest edition or revision thereof.

- °: Degree
- @: At
- ±: Plus/Minus
- #: Number
- **AASHTO:** American Association of State Highway and Transportation Officials
- **AC:** Asbestos Cement
- **ACS:** Access
- **ADDL:** Additional
- **ADJ:** Adjustable
- **AFBMA:** Anti-Friction Bearing Manufacturers Association
- **AC:** Alternate Current
- **ALUM:** Aluminum
- **AMR:** Automatic Meter Reading (System)
- **AHR:** Anchor
- **ANGLE:** <
- **ANSI:** American National Standard Institute, Inc.
- **APPD:** Approved

- **ASC:** Automatic Sprinkler Connection
- **ASSY:** Assembly
- **ASTM:** American Society of Testing and Materials
- **AV:** Air Valve
- **AVE:** Avenue
- **AWG:** American Wire Gauge
- **AWS:** American Welding Society
- **AWWA:** American Water Works Association
- **BFV:** Butterfly Valve
- **BLDG:** Building
- **BO:** Blowoff
- **BOT:** Bottom
- **BRG:** Bearing
- **BSP-40:** Black Steel Pipe – Schedule 40
- **BSP-80:** Black Steel Pipe – Schedule 80
- **BSTC:** Bolted Sleeve Type Coupling
- **BTWN:** Between
- **BV:** Ball Valve
- **CAD:** Computer Aided Drafting
- **CB:** Catch Basin
- **C&G:** Curb and Gutter
- **CHKV:** Check Valve
- **CI:** Cast Iron
- **CL:** Centerline
- **CLR:** Clear, Clearance
- **CPLG:** Coupling
- **CONC:** Concrete
- **CONN:** Connection
- **CONT:** Continuous
- **CNR:** Corner
- **CTR:** Center
- **CU:** Cubic, Copper
- **DBL:** Double
- **DC:** Direct Current
- **DET:** Detail
- **DIAMETER:** Ø

- **DI:** Ductile Iron
- **DIM:** Dimension
- **DIST:** Distance
- **DR:** Drain, Drive, Drawer
- **DW:** Denver Water
- **E:** East
- **EA:** Each
- **EL:** Elevation
- **ELB:** Elbow
- **ELEC:** Electric, Electrical
- **EMER:** Emergency
- **EQ:** Equal
- **ERT:** Encoder-Receiver-Transmitter
- **ESMT:** Easement
- **ETC:** Et Cetera
- **EXIST:** Existing
- **EXT:** Extension
- **FD:** Floor Drain
- **FH:** Fire Hydrant
- **FIN:** Finished
- **FL:** Flow Line
- **FLEX:** Flexible
- **FLG:** Flange
- **FLR:** Floor
- **FMCT:** Fireline Meter and Compound Torrent
- **FT:** Foot or Feet
- **G:** Gas
- **GA:** Gauge
- **GV:** Gate Valve
- **GALV:** Galvanized
- **HGL:** Hydraulic Grade Line
- **HMWPE:** High Molecular Weight Polyethelen
- **HORIZ:** Horizontal
- **HS:** High Strength
- **HVY:** Heavy
- **HYD:** Hydrant

- **Hz:** Hertz
- **IBC:** International Building Code
- **ID:** Inside Diameter
- **IEEE:** Institute of Electrical and Electronics Engineers
- **IN:** Inch(s)
- **INSTL:** Install
- **INSUL:** Insulated, Insulation
- **INV:** Invert
- **IP:** Iron Pipe
- **IRR:** Irrigation
- **ISA:** Instrument Society of America
- **JT:** Joint
- **KB:** Kickblock
- **KVA:** Kilo-Volt-Amperes
- **LOC:** Location, Locate
- **LP:** Lighting Panel
- **MA:** Milliamp
- **MATL:** Material
- **MAX:** Maximum
- **MECH:** Mechanical
- **MEE:** Machined Each End
- **MH:** Manhole
- **MIN:** Minimum
- **MJ:** Mechanical Joint
- **MOA:** Machined Over All
- **MSS:** Manufacturer's Standardization Society of Valve and Fittings
- **MTD:** Mounted
- **MTG:** Mounting
- **MS:** Mild Steel
- **N:** North
- **N/A:** Not Applicable
- **NC:** Normally Closed
- **NEC:** National Electrical Code
- **NEMA:** National Electrical Manufacturers' Association
- **NFPA:** National Fire Protection Association
- **NO:** Number, Normally Open

- **NPT:** National Pipe Thread
- **NSF:** National Sanitation Foundation
- **OC:** On Center
- **OD:** Outside Diameter
- **OPNG:** Opening
- **OSHA:** Occupational Safety and Health Administration
- **PC:** Point of Curve
- **PE:** Plain End
- **PI:** Point of Intersection
- **PL:** Property Line
- **PL:** Plate (Steel)
- **PRESS:** Pressure
- **PRV:** Pressure Regulating Valve
- **PSF:** Pounds per Square Foot
- **PSI:** Pounds per Square Inch
- **PT:** Point of Tangency
- **PUD/PBG:** Planned Unit Development/Planned Building Group
- **PVC:** Polyvinyl Chloride Pressure Pipe (Potable and Non-Potable)
- **R:** Radius
- **REINF:** Reinforcing
- **REQD:** Required
- **RES:** Resistor
- **RH:** Right Hand
- **ROW:** Right-of-Way
- **S:** South
- **SAE:** Society of Automotive Engineers
- **SAN:** Sanitary Sewer
- **SCADA:** Supervisory Control and Data Acquisition
- **SCHED:** Schedule
- **SD:** Storm Drain, Supply Duct, Shop Drawings
- **SECT:** Section
- **SHT:** Sheet
- **SLV:** Sleeve
- **SPA:** Spacing
- **SPEC:** Specification, Specified
- **SPRT:** Support

- **SQ:** Square
- **SST:** Stainless Steel
- **ST:** Street
- **STA:** Station
- **STD:** Standard
- **STL:** Steel
- **STRM:** Storm Sewer
- **TEMP:** Temporary
- **THD:** Thread, Threaded
- **THK:** Thickness
- **TOP:** Top of Pipe
- **TYP:** Typical
- **UBC:** Uniform Building Code
- **UMC:** Uniform Mechanical Code
- **UPC:** Uniform Plumbing Code
- **V:** Volt
- **VB:** Valve Box
- **VERT:** Vertical
- **W:** Water
- **WOG:** Water-Oil-Gas
- **WRA:** Water Reducing Agent
- **WSC:** Water Service Contractor
- **WSP:** Working Steam Pressure
- **WTR:** Water
- **WWF:** Welded Wire Fabric
- **W/:** With
- **W/O:** Without
- **XMTR:** Transmitter
- **YD:** Yard