Water Mains

Water distribution system mains are laid out in grid, loop, or tree (branching) systems. Tree or branching systems produce dead-end lines which can cause taste and odor water quality problems. These lines must be frequently flushed. Grid or loop systems permit greater water flow to an area when there is a fire or other source of high demand.

The basic requirements of pipes for water distribution systems are adequate strength, durability, maximum corrosion resistance, and no adverse effect on water quality. The size of a pipe must be sufficient to carry anticipated flows. The desirable minimum pipe diameter is 6 inches and pipes should be not less than 4 inches in diameter.

A wide variety of pipe materials is available for carrying water under pressure including ductile iron, steel, reinforced concrete, asbestos-cement, and plastic. Service pipes are made of copper, plastic, iron, steel, asbestos-cement, and brass.

The considerations that should be considered when choosing which type of pipe should be used for a specific installation include: cost of pipe, cost of construction, corrosive conditions of the soil and water, and water pressures.

Type	Advantages	Disadvantages
Ductile Iron Pipe	• Long service life • Can withstand high pressures • Will resist bending and twisting without breakage	• Prone to internal and external corrosion • Heavy
Steel Pipe	• Available in a wide range of sizes • Lighter than ductile iron or concrete • High tensile strength	• More susceptible to corrosion • Requires a lining or coating to maintain its service life
Concrete Pipe	• In large sizes, it is usually less expensive compared to other types • Easily installed • Low maintenance	• Heavy • Hard to tap • May deteriorate in corrosive soils
Asbestos-Cement Pipe	• High tensile strength • Lightweight • Easy to handle and join	• Low flexural strength in small sizes • Difficult to locate when buried • Hazardous to breath asbestos fibers; no longer manufactured
Plastic Pipe	• Available in a wide range of sizes • Smooth interior and low friction head loss • Corrosion free • Inexpensive	• Requires special bedding • Susceptible to chemical attack • Strength affected by sunlight

Common Suppliers

National Rural Water Association Online Buyer's Guide - http://nrwa.officialbuyersguide.net/

Source

- Office of Water Programs CSU Sacramento – Fifth Edition, 2005, "Water Distribution System Operation and Maintenance"

Water Mains (continued)

Other Links

- National Environmental Services Center – Tech Brief. “Fundamentals of Hydraulic Pressure” http://www.nesc.wvu.edu/pdf/dw/publications/ontap/2010_tb/hydraulics_pressure_DWFSOM147.pdf
- National Environmental Services Center – Tech Brief. “Fundamentals of Hydraulic Flow” http://www.nesc.wvu.edu/pdf/dw/publications/ontap/2010_tb/hydraulics_pressure_DWFSOM150.pdf
- Water Programs – Sacramento State. “Water Distribution System Operation and Maintenance” https://www.owp.csus.edu/courses/drinking-water/water-distribution-system-operation-and-maintenance.php

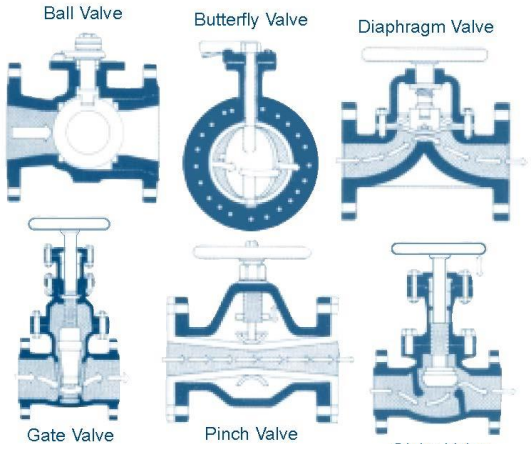
Water Valves

Valves can shut off, turn on, and otherwise regulate the flow of water, reduce pressure, provide air and vacuum relief, blow off or drain water from parts of the system, and prevent backflow.

Gate valves are the most common and are mainly used to isolate sections of mains to permit emergency repairs without interruption of service to large numbers of customers. Butterfly valves are more common in sizes larger than 12-inches in diameter. Globe valves are very efficient in either flow or pressure regulation. They are commonly used for isolation in small sizes and flow control in large sizes. Ball and plug valves are particularly adapted for isolation and are common in ¾-inch to 2 inches in size.

Check valves are automatic valves that open with forward flow and close against reverse flow. Pressure regulation, reducing and sustaining valves control water pressure by restricting flows. These valves are of the globe design and have a spring-loaded diaphragm that sets the size of the opening.

For more information, see the below sources.



Valve Diagrams (NECS, 2009)

Type	Advantages	Disadvantages
Gate Valve	• Low cost in small sizes • Low friction loss • Good service life • Ease of installation	• High cost in large sizes • Poor for throttling • Should not be used where frequent operation is necessary
Butterfly Valve	• Low cost in larger sizes for normal service pressures • Ease of operation	• Higher friction loss than gate valves • Often leaks because of seat damage • May cause problems when relining pipe
Globe Valve	• Simple construction • Dependable • Can be used for throttling • Good for pressure control	• High friction loss • Very heavy • Expensive in large sizes
Ball and Plug Valves	• Dependable • Very low friction loss • Slow shutoff characteristics • Ease of operation	• Expensive • Very heavy

Common Suppliers

National Rural Water Association Online Buyer's Guide - http://nrwa.officialbuyersguide.net/

Source

- Office of Water Programs CSU Sacramento, 2005, "Water Distribution System Operation and Maintenance" – Fifth Edition
- National Environmental Services Center (NECS) – Tech Brief. "Valves" http://www.nesc.wvu.edu/pdf/dw/publications/ontap/2009_tb/valves_DWFSOM21.pdf

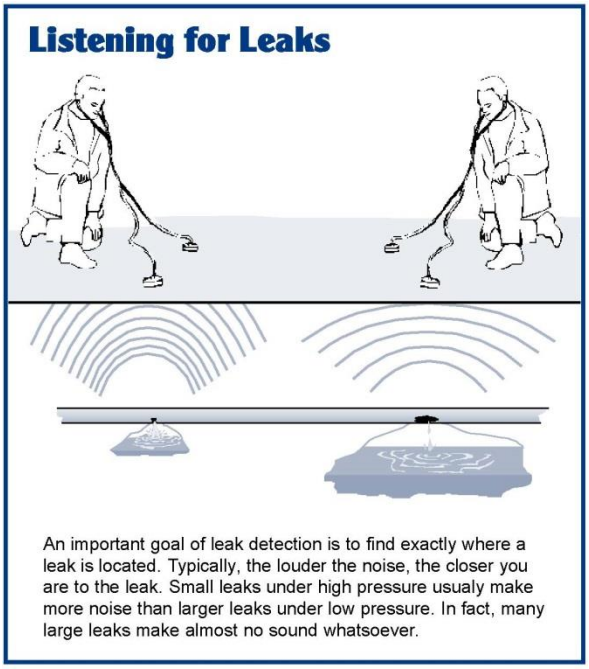
Other Links

- National Environmental Services Center – Tech Brief. "Valve Exercising" http://www.nesc.wvu.edu/pdf/dw/publications/ontap/2009_tb/valve_exercising_DWFSOM97.pdf
- Water Programs – Sacramento State. "Water Distribution System Operation and Maintenance" https://www.owp.csus.edu/courses/drinking-water/water-distribution-system-operation-and-maintenance.php

Leak Detection and Repairs

Leak detection programs can reduce the flow of leaks and often produce cost savings greater than the program itself. Leaks can be repaired when they are small and before serious failure occurs. Some factors that contribute to leakage include old and poorly constructed pipelines, inadequate corrosion protection, and poorly maintained valves.

The process of locating a leak is often not easy. Methods used to locate leaks include direct observation, sounding rods, and listening devices. The simplest listening device is a steel bar held against the pipe or valve. Patented leak detectors use audiphones to pick up the sound of escaping water. A leak correlator is a type of instrument that locates leaks by noise intensity and the time it takes for the leak sound to travel to a pair of microphones placed on fittings (fire hydrants or valves) on each side of a suspected leak. Leak correlators are fairly accurate in locating a leak. However, their use is limited in systems with low pressure, materials that absorb sound or have relatively few fittings.



An important goal of leak detection is to find exactly where a leak is located. Typically, the louder the noise, the closer you are to the leak. Small leaks under high pressure usualy make more noise than larger leaks under low pressure. In fact, many large leaks make almost no sound whatsoever.

Leak repair is the more costly step of the program. The simplest repairs for small leaks use repair clamps or collars which are short, cylindrical pieces of pipe which are bolted together or fastened around a pipe. These devices cover the break, or make a joint between two pipes. Larger leaks may require replacing one or more sections of pipe. Instead of repairing leaking mains, it may be preferable to replace the more leak prone and generally older pipes. The frequency of leaks in a given pipe and the relative costs to replace and repair should be evaluated to select a strategy.

Source

- Office of Water Programs CSU Sacramento – Fifth Edition, 2005, “Water Distribution System Operation and Maintenance”
- National Drinking Water Clearinghouse – Tech Brief, May 2001, “Leak Detection and Water Loss Control” http://www.nesc.wvu.edu/pdf/dw/publications/ontap/2009_tb/leak_detection_DWFSOM38.pdf

Other Links

- National Drinking Water Clearinghouse – Tech Brief, Spring 2004, “Repairing Distribution Line Breaks” http://www.nesc.wvu.edu/pdf/dw/publications/ontap/2009_tb/repairing_distribution_line_breaks_DWFSOM60.pdf
- National Environmental Services Center – Best Management Practices, Spring 2006 “Control Water Loss” http://www.nesc.wvu.edu/pdf/DW/conserve/water_loss_otsp06.pdf
- National Drinking Water Clearinghouse. “On the Trail of the Elusive Water Leak” http://www.nesc.wvu.edu/ndwc/articles/ot/SU03/Water_Leak.html
- Water Programs – Sacramento State. “Water Distribution System Operation and Maintenance” https://www.owp.csus.edu/courses/drinking-water/water-distribution-system-operation-and-maintenance.php