CHAPTER 5

DISTRIBUTION SYSTEM EQUIPMENT

5-1. Valves. The types of valves most frequently used in water distribution are gate, butterfly, ball, plug, globe, and check valves. Applications of the various types of valves and the standards to be used for these valves are given in table 5-1. All valves should have the direction to open shown on their operators.

a. Gate valves. Gate valves may have either a single solid wedge gate or double disc. Solid wedge gates are satisfactory in sizes up to 6 inches, but double disc gates should be used for larger sizes. Because of the excessive wear and leakage of the gates and seats which may result, gate valves should not be used where frequent operation is required. If gate valves are left open for long periods, debris may accumulate in the seats and prevent complete closure; but if left closed for long periods, deposits may prevent opening. Gate valves should be operated periodically to break loose any deposits which might have formed. Large gate valves should be geared to make operation easier. A typical double gate valve is shown in figure 5-1.

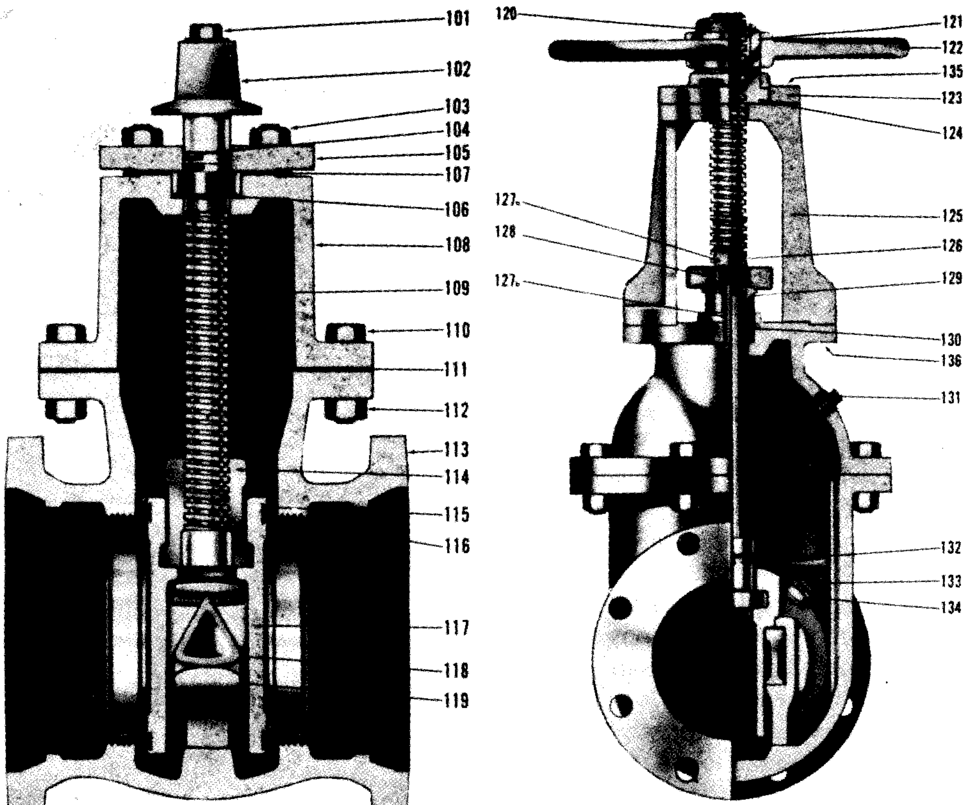
b. Butterfly valves. The advantage of butterfly valves include easy operation, small space requirement, low cost, minimum maintenance, low head loss, driptight shutoff, suitability for throttling, and reliability. A disadvantage is that main cleaning and lining equipment cannot be used in lines containing butterfly valves without removing the valves. Mechanical valve operators will be designed to restrict the rate of closure so that water hammer will not occur in the system in which the valve is installed. A typical butterfly valve is shown in figure 5-2.

c. Ball valves. Ball valves have the advantage of ease of operation, reliability, durability, and capability of withstanding high pressures, but are usually expensive. A typical small-diameter ball valve is shown in figure 5-2.

d. Plug valves. Lubricated and eccentric plug valves are the types of plug valves commonly used. Lubricated plug valves normally have a cylindrical

Table 5-1. Valve applications and standards.

Type	Applications	Sizes to be Used (diameter, inches)	Standard
Gate	Sectionalizing distribution mains. Isolating fire-hydrant branches.	3 or larger	AWWA C500, Standard for Gate Valves - 3 in. through 48 in. - For Water and Other Liquids.
Butterfly, rubber seated	Mains with water pressures less than 150 lb/in^2.	3 or larger	AWWA C504, Standard for Rubber-seated Butterfly Valves.
Ball	Applications involving throttling or frequent operation. Water service lines.	6 or less	AWWA C507, Standard for Ball Valves, Shaft - or Trunnion Mounted - 6 in. through 48 in. - For Water Pressures up to 300 psi.
Plug	Applications involving throttling or frequent operation. Water service lines.	6 or less	
Globe	Throttling operations. Water service lines.	2 or less	



Section of Mechanical Joint NRS Valve with O-Ring Packing

Cutaway of Flanged Valve with Outside Screw and Yoke

	Part	No.	Material
101	Cap Screw	1	Steel
102	Operating Nut	1	Cast Iron
103	O-Ring Plate Bolts & Nuts		Steel
104	O-Rings	2	Rubber
105	O-Ring Plate	1	Cast Iron
106	Low Torque Bearing	1	
107	Stuffing Box Gasket	1	
108	Cover	1	Cast Iron
109	Non-rising Stem	1	Bronze
110	Neck Flange Bolts		Steel—Rust-proofed
111	Neck Flange Gasket	1	Composition
112	Neck Flange Bolt Nuts		Steel
113	Body	1	Cast Iron
114	Gate Nut	1	Bronze
115	Gate Ring	2	Bronze
116	Case Ring	2	Bronze
117	Gate	2	Cast Iron
118	Wedge	2	Bronze
119	Hook	2	Cast Iron
120	Hold Down Nut	1	Bronze
121	Handwheel Key	1	Steel
122	Handwheel	1	Cast Iron
123	O.S.&Y. Retainer Plate	1	Cast Iron
124	O.S.&Y. Stem Nut	1	Bronze
125	O.S.&Y. Yoke	1	Cast Iron
126	Rising Stem	1	Stainless Steel
127a	Follower Nuts	2	Bronze
127b	Follower Studs	2	Steel—Rust-proofed
128	Follower Plate	1	Cast Iron
129	Follower Gland	1	Bronze
130	Packing		Braided Asbestos
131	Test Plug	1	Teflon-coated steel
132	Stem Nut Pin	1	Bronze
133	Pegs	4	Bronze or Nylon
134	Straps	2	Stainless
135	O.S.&Y. R.P. Cap Screws		Steel—Rust-proofed
136	O.S.&Y. Yoke Bolts & Nuts		Steel—Rust-proofed

Figure 5-1. Double disc gate valve.

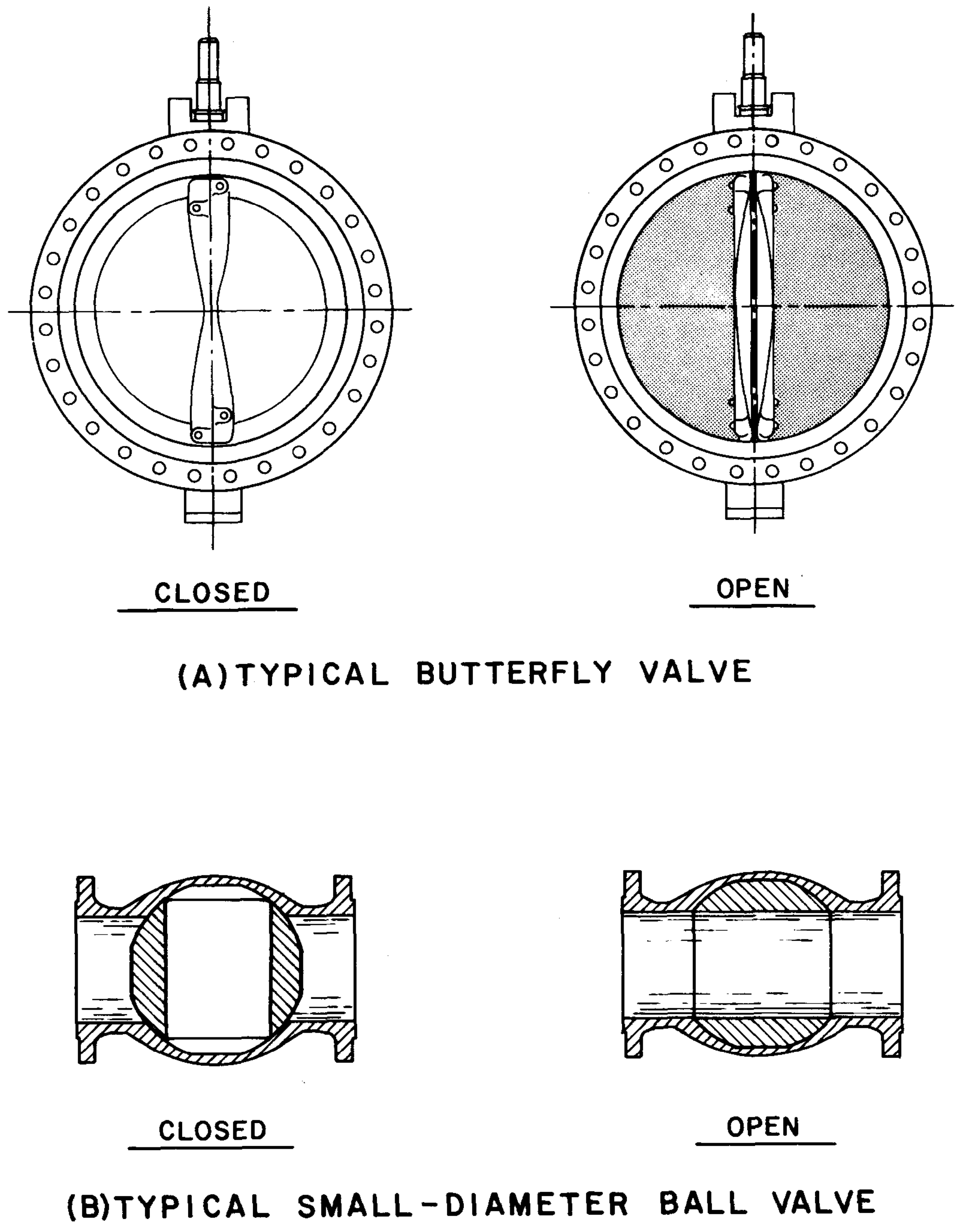


Figure 5-2. (A) Typical butterfly valve and (B) Typical small-diameter ball valve.

or tapered plug intersecting the flow with a rectangular port opening. Round ports can be obtained in the smaller sizes. Specially formulated greases are used both for lubrication and sealing of lubricated plug valves. When operated periodically, these valves are relatively easy to operate and provide a tight shutoff, but the plugs may freeze if not operated for a long period of time. Plug valves are especially good for high pressure applications. Eccentric plug valves are preferable to lubricated plug requirements; eccentric plug valves are also less prone to freeze. Ball and plug valves will not be used on buried pipelines, except when installed in a valve pit. The basic application for the eccentric plug valves are normally on small service lines.

e. Globe valves. Globe valves are particularly well suited to throttling operations and most plumbing fixtures are normally equipped with these valves. Small globe valves normally have rubberized discs and metal seats to provide driptight shutoff, but special discs and seats are available for more severe conditions; and may be used on water service lines 2 inches or less in diameter.

f. Check valves. Any valve used to prevent the reversal of flow is considered a check valve. Most check valves are equipped with plugs or hinged discs which close flow openings when flow is reversed. Rapid and complete valve closing is often ensured by the addition of special weights or springs to the plugs or discs. A newer type of check valve has spring-loaded, wafer-style, semicircular plates mounted on a vertical pivot through a flow port. The springs cause the plates to swing closed at the instant of flow reversal. This wafer-style check valve has the disadvantage of producing relatively high head losses and of showing excessive wear under some operating conditions.

g. Air release and vacuum relief valves. Air release valves are required to evacuate air from the main at high points in the line when it is filled with water, and to allow the discharge of air accumulated under pressure. Excess air allowed to accumulate at high points creates a resistance to flow, and an increase in pumping power requirements results. Vacuum relief valves are needed to permit air to enter a line when it is being emptied of water or subjected to vacuum. Special valves and vacuum relief valves should be installed at high points in the line or where a long line changes slope.

h. Valve location.

(1) *Shutoff valves.* The purpose of installing shutoff valves in water mains at various locations within the distribution system is to allow sections of the system to be taken out of service for repairs or maintenance without significantly curtailing service over large areas. Valves should be installed at intervals not greater than 5,000 feet in long supply lines, and 1,200 feet in main distribution loops or feeders. All branch mains connecting to feeder mains or feeder loops should be valved as closely to the feeders as practicable so that the branch mains can be taken out of service without interrupting the supply to other locations. In the areas of greatest water demand, or where the dependability of the distribution system is particularly important, maximum valve spacing of 500 feet may be appropriate. At intersections of distribution mains, the number of valves required will normally be one less than the number of radiating mains; the one valve will be omitted from the line which principally supplies flow to the intersection. Valves are not usually installed on branches serving fire hydrants on military installations. As far as practicable, shutoff valves should be installed in standardized locations (e.g., the northeast corner of intersections or a certain distance from the centerline of streets) so they can easily be found in emergencies. For large shutoff valves (approximately 30-inch diameter and larger), it may be necessary to surround the valve operator or entire valve with a vault to allow for repair or replacement. In important installations and for deep pipe cover, pipe entrance access manholes should be provided so that valve internal parts can be serviced. If valve vaults or access manholes are not provided, all buried valves, regardless of size, should be installed with special valve boxes over the operating nut in order to permit operation from ground level by the insertion of a special long wrench into the box.

(2) *Blowoff valves.* Blowoff valves or fire hydrants should be installed at the ends of dead-end mains to allow periodic flushing of the mains. Primary feeder mains and larger distribution mains should have a blowoff valve in each valved section which should be installed at low points in the mains where the flushing water can be readily discharged to natural drainage channels. Blowoff valves must be designed so that operation which will result in erosion or destruction of wildlife is not permitted. Special care must be taken to eliminate the possibility of contaminated water entering the distribution system through blowoff valves which have not been tightly closed.

5-2. Fire hydrants.

a. Types of fire hydrants.

(1) *Dry- and wet-barrel hydrants.* The most common types of fire hydrants are the dry- and wet-barrel varieties. They are similar in configuration

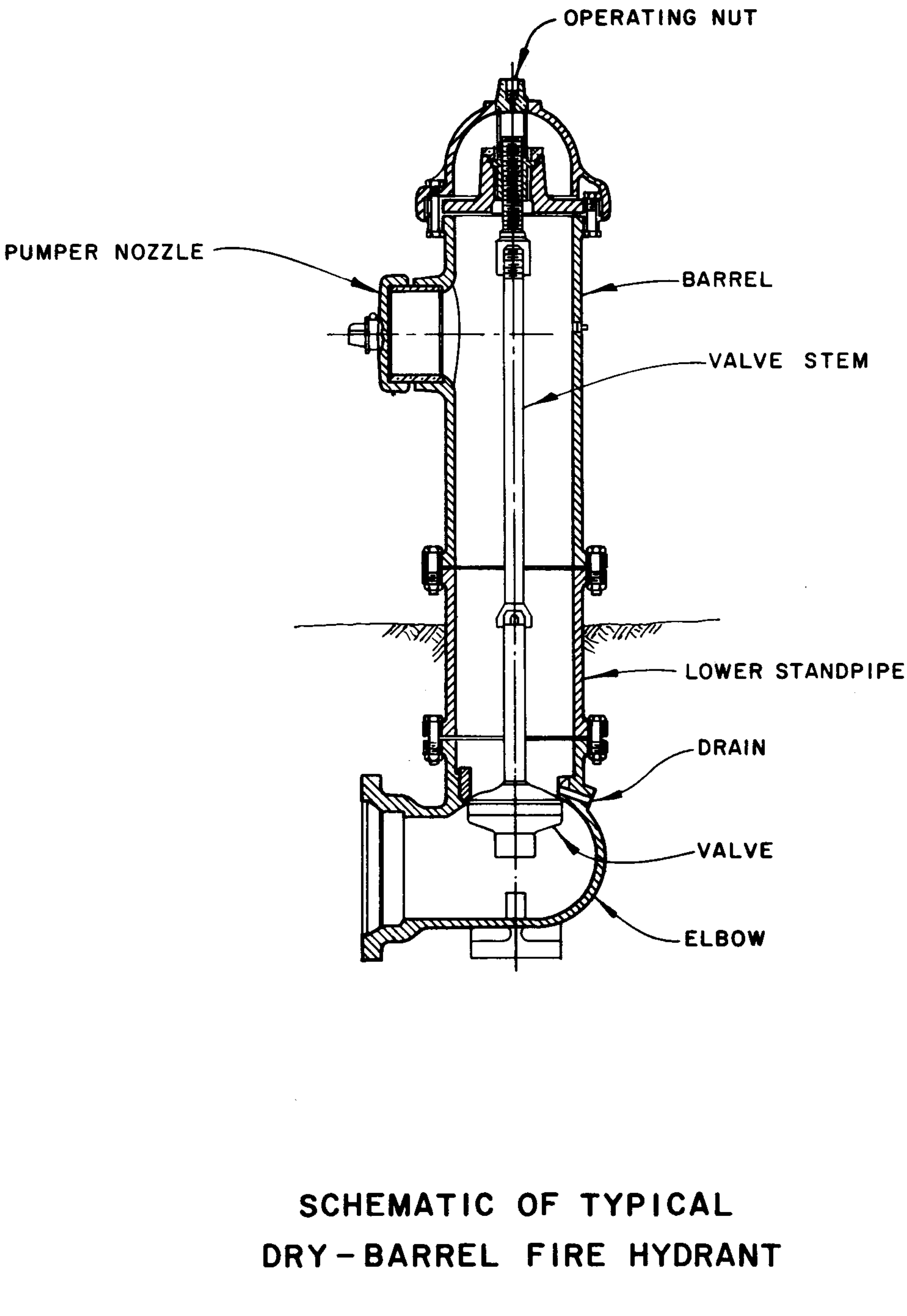


Figure 5-3. Schematic of typical dry-barrel fire hydrant.

and operation, but in the dry-barrel hydrant (AWWA C502), provision is made for draining water from the barrel after the hydrant is shut off. This is normally accomplished by gravity drainage through special drain outlets in the base or barrel of the fire hydrant. A dry-barrle hydrant is shown in figure 5-3. Wet-barrel hydrants (AWWA C503) can be used in areas where the temperature is always above freezing.

(2) *Safety hydrants.* Barrel-type hydrants extending aboveground are available in models which could be damaged by automobiles or trucks without disturbing the main valve. These are the safety or traffic fire hydrants and should be used near heavily traveled roads or intersections where adequate protection of the hydrant cannot be provided.

(3) *Flush-top hydrants.* In cases where the barrel-type aboveground hydrant would interfere with normal traffic, a flush-top hydrant can be utilized. The operating nut and hose nozzles in this type hydrant are located in a cast-iron box below ground level. The top of the box has a horizontal lid which is flush with the adjacent ground surface. However, flush-top hydrants are more difficult to locate than barrel-type hydrants, especially in areas subject to heavy snows, and once located are awkward to uncover and put into operation. Barrel-type hydrants are preferable to flush-top hydrants. Hydrants of all types should have the direction to open shown on their operators.

b. Hydrant nozzles. Nozzles on fire hydrants are either 2-1/2 or 4-1/2 inches in diameter. The 2-1/2 inch nozzle is for direct connection to fire hoses and the 4-1/2 inch nozzle is for use with mobile fire pumper units. Unless unusual conditions dictate otherwise, hydrants with two fire hose nozzles and one pumper nozzle should be used. The outlet nozzles on most hydrants are located at 90-degree angles to each other. The pumper outlet should normally face the street or intersection, and the two fire hose nozzles should face opposite directions, 90 degrees from the pumper nozzle. Hydrants with either more or less than three nozzles should be alined so that the nozzles are readily accessible from the street. Screw threads on hydrant nozzles should comply with the provisions of National Fire Protection Association (NFPA) 1963.

c. Hydrant spacing.

(1) *General.* Hydrant distributions will conform to the standards shown in table 5-2. Hydrant spacings must also conform to the guidelines given in AFM 88-10, Chapter 6 for Air Force applications and MIL-HDBK-1008 for Army applications.

Table 5-2. Hydrant distribution.

Required Fire Flow, gpm	Average Area per Hydrant, square feet
1,000 or less	160,000
1,500	150,000
2,000	140,000
2,500	130,000
3,000	120,000
3,500	110,000
4,000	100,000
4,500	95,000
5,000	90,000
5,500	85,000
6,000	80,000
6,500	75,000
7,000	70,000
7,500	65,000
8,000	60,000
8,500	57,500
9,000	55,000
10,000	50,000
11,000	45,000
12,000	40,000

(2) *Residential areas.* The preferred location for fire hydrants in residential areas is at street intersections. Where additional hydrants are required because of the above hydrant distributions, these additional hydrants will normally be located adjacent to streets approximately halfway between intersections. Each single or duplex family unit will have at least one hydrant within 300 feet and a second hydrant within 500 feet.

(3) *Airfields.* For airfield hangar areas, hydrants will be spaced approximately 300 feet apart, and where economically feasible will be connected to the base distribution system and not to the special system serving deluge sprinkler systems in the hangars. At Air Force double-cantilever hangar areas, hydrants will be connected only to the Base water distribution systen. For aircraft fueling, mass parking, servicing, and maintenance areas, the fire hydrants will be installed along the edge of aircraft

parking and servicing aprons. Hydrants will be spaced approximately 300 feet apart so that every part of the apron may be reached by approximately 500 feet of hose. Hydrants so located are not a hazard to moving aircraft, and no waiver of the provisions of AFR 86-5 is required. One or more hydrants will be located within 300 feet of all operational service points.

(4) *Individually sited buildings.* Where an adequately sized water main is available, or can be made available for an individually sited building such as a Reserve Center, two hydrants will be installed. However, one hydrant at the site is acceptable if the provision of a second hydrant would require extension of a water main beyond the point necessary to serve the domestic demands of the building.

(5) *Remote fuel storage areas.* Fuel storage facilities that are remotely located with relation to public or military installation water systems will generally not have fire hydrant protection. However, where the facility is of a critical nature or is of a high strategic or monetary value that would justify some degree of fire protection, appropriate recommendations will be furnished with necessary supporting information to HQDA (DAEN-ECE-G), WASH DC 20314-1000 or HQ USAF/LEEEU, Washington, D.C. 20332 for consideration.

d. Hydrant location.

(1) Proper clearance should be maintained between hydrants and poles, buildings, or other obstructions so that hose lines can be readily attached and extended. Generally, hydrants will be located at least 50 feet from the buildings protected and in no case will hydrants be located closer than 25 feet to a building, except where building walls are blank firewalls. Hydrants may be located adjacent to blank portions of substantial masonry walls where the chance of falling walls is remote.

(2) Street intersections are preferred location for fire hydrants because fire hoses can then be laid along any of the radiating streets. However, the likelihood of vehicular damage to hydrants is greatest at intersections, so the hydrants must be carefully located to reduce the possibility of damage. Hydrants should not be located less than 6 feet from the edge of a paved roadway surface, nor more than 7 feet. If hydrants are located more than 7 feet from the dege of the paved roadway surface and if the shoulders are such that the pumper cannot be placed within 7 feet of the hydrant, consideration may be given to stabilizing or surfacing a portion of wide shoulders adjacent to hydrants to permit the connection of the hydrant and pumper with a single 10-foot length of suction hose. In exceptional circumstances, it may not be practical to meet these criteria, and hydrants may be located to permit connection to the pumper using two lengths of suction hose (a distance not to exceed 16 feet).

(3) Hydrants should not be placed closer than 3 feet to any obstruction nor in front of any entranceways. The center of the lower outlet should not be less than 18 inches above the surrounding grade and the operating nut should not be more than 4 feet above the surrounding grade.

(4) In aircraft fueling, mass parking, servicing, and maintenance areas, the tops of hydrants will not be higher than 24 inches above the ground with the center of lowest outlet not less than 18 inches above the ground. The pumper nozzle will face the nearest roadway.

e. Hydrant installation. Many problems of hydrant operation and maintenance can be avoided if the hydrant is properly installed. All hydrants should be installed on firm footings such as stone slabs or concrete bases to prevent settling and strains on line joints. Separation of the pipe joints in the elbow beneath the hydrant is sometimes a problem because of forces created by the water pressure across the joint through the elbow. This problem can be alleviated by placing thrust blocks between the elbow and supporting undisturbed soil, or by tying the joint.

f. Hydrant markings. All hydrants at military installations will be marked in accordance with NFPA 291.

5-3. Water pipe materials.

a. Types of materials. Water distribution pipes are available in a variety of materials. Those most commonly used, and most suitable for use at military installations, are asbestos-cement, ductile iron, reinforced and prestressed concrete, steel, and plastic. All water mains and service lines should be designed for a minimum normal internal working pressure of 150 psig plus appropriate allowances for water hammer. External stresses due to earthfill and superimposed loadings will be calculated in accordance with the applicable standards of the American Water Works Association for each kind of pipe (app A). In areas classified as seismic zone 2 or higher, in accordance with TM 5-809-10/AFM 88-3, Chapter 13, pipes with flexible joints will be used. Asbestos-cement pipe, mechanical-joint cast-iron pipe, or rubber-gasket-joint pipe of various kinds (cast iron, steel, plastic, and reinforced concrete) may be used in these areas. The danger of earthquake damage can also be minimized if pipelines are laid in bedrock or coarse-grained sediments. Installation in fine-grained sediments such as clay and silt should be avoided in earthquake-prone areas if possible.

b. Selection of materials.

(1) In selecting the material to be used for a particular application, the following items should be considered:

(*a*) Ability to withstand maximum anticipated internal pressures and external loads or the most severe combination thereof.

(*b*) Flow resistance of the pipe, both in new condition and after the pipe has been in service for several years.

(*c*) Ease of installation. This involves the unit weight of the pipe, type of joints used, type of bedding required, and whether or not thrust blocking is required.

(*d*) Resistance to external and internal corrosion.

(*e*) Joint tightness.

(*f*) Durability.

(*g*) Ease of tapping for service connections.

(*h*) Cost.

(2) Information on pipe diameter, design, and coatings, linings and fittings for various types of pipe is given in table 5-3 below.

c. Description of materials.

(1) Asbestos-cement pipe.

(*a*) This pipe is usually unaffected by corrosive soil conditions, and is installed in many locations where unprotected cast-iron or steel pipe would suffer excessive corrosion. Standard lengths of asbestos-cement pipe are 13 feet for pipe 8 inches or larger in diameter, and either 10 or 13 feet for pipe 4 or 6 inches in diameter. The three classes of asbestos-cement pipe are: class 100, class 150, and class 200 for pipe 4 inches through 16 inches and classes 30, 35, 40, etc., for pipe 18 inches through 42 inches. These refer to the maximum anticipated internal working pressure, not including sudden surges, to which the pipe is to be subjected. A factor of safety of 4.0 has been used in the design and manufacture of these pipes. They should theoretically be capable of withstanding internal bursting pressures of at least 400 psi (class 100), 600 psi (class 150), and 800 psi (class 200). Techniques for evaluating both internal and external loads are given in AWWA C401, and C403. External loads include both the weight of the backfill supported by the pipe and the weight of superimposed loads, static or dynamic on the pipe. A factor of safety of 2.5 is used in designing for external loads.

(*b*) Asbestos-cement pipe is also grouped into two categories according to the percentage of uncombined calcium hydroxide in the pipe. Type I has no limit on the uncombined calcium hydroxide; type II has 1.0 percent or less. Inasmuch as the uncombined calcium hydroxide may be leached from the walls of a pipe, thereby reducing the strength of the pipe, type II pipe should be used whenever the sum of the pH, the logarithm (base 10) of the alkalinity (in mg/l as $CaCO_3$), and the logarithm (base 10) of the hardness (in mg/l as $CaCO_3$), and the water in the pipe is less than 12.0 but greater than 10.0. Type II will be used in all Army and Air Force construction.

(*c*) Installation of asbestos-cement pipe will be in accordance with the provisions of AWWA C603. Direct tapping of asbestos-cement mains is permitted for service connections of 1-inch diameter or smaller. With the use of special service clamps, tapping for service connections up to 2 inches in diameter is permitted.

Table 5-3. Pipe type comparison

Pipe Type	Maximum Diameter (Inches)	Pipe Type	Coatings, Linings And Fittings
Steel	96	M11	C200 series
Ductile Iron	48	C150	C105 C100 series
Concrete	144	M9	C300 series
Asbestos-Cement	16	C401	
	42	C403	C400 series
Glass Fiber Reinforced	144	C950	C950
Polyvinyl Chloride	12	C900	C900

(2) *Ductile-iron pipe.* Ductile-iron pipe of equivalent thickeness is stronger, tougher, and more flexible than the now obsolete gray cast-iron pipe. The prescribed method of determining the required thicknesses of ductile-iron pipe is given in AWWA C150 (ANSI A21.50). Ductile iron shall be used in situations where some pipe deflection may occur, such as in earthquake-prone areas or in soil conditions where settling of the pipe may occur. Ductile-iron pipes are frequently lined with coal-tar enamel or cement mortar to reduce corrosion of interior surfaces (para 7-3). Cleaning and lining of corroded ductile-iron pipe can substantially reduce the head losses in the pipe; pipeline cleaning without lining is not permitted.

(3) *Concrete pipe.* Concrete pipe is strong, durable, corrosion-resistant, and has a smooth interior which allows high flow velocities with minimal head losses. Without special equipment or expertise, concrete pipe is more difficult to tap than cast iron and it should not be used where multiple future tapping for building service may be required. Three types of concrete pipe commonly available are: noncylinder, nonprestressed concrete pipe; nonprestressed concrete cylinder pipe; and prestressed concrete cylinder pipe. Concrete cylinder pipe has a steel cylinder either outside the concrete or embedded in the concrete of the pipe (See AWWA C300, C301 and C302).

(a) Noncylinder, nonprestressed concrete pipe. This pipe has both longitudinal and circumferential reinforcing bars cast in the concrete. It is not as strong as prestressed concrete pipe and should be used only if internal working pressures are not anticipated to exceed 55 pounds per square inch. Information on design and manufacturing parameters for this pipe are contained in AWWA C302.

(b) Nonprestressed concrete cylinder pipe. This pipe is most commonly used in diameters of 24 to 144 inches and lengths of 12, 16, or 20 feet. It is suitable for use when working pressures are less than 260 pounds per square inch. Each section of pipe consists of a welded steel cylinder encased in concrete, with longitudinal and circumferential reinforcing bars in the outer portion of the concrete. This pipe will conform to the requirements of AWWA C300.

(c) Prestressed concrete cylinder pipe. There are two types of prestressed concrete cylinder pipe available. They are the lined-cylinder type with concrete cast inside the steel cylinder, wire wrapped under tension around the steel cylinder, and a concrete or mortar covering over the wire and cylinder; and the embedded-cylinder type with the steel cylinder encased in concrete, wire wrapped on the outer concrete surface, and the wire covered with a coating of cement or mortar. Both types are characterized by high strength and relatively lightweight as compared to other kinds of concrete pipe. The lined-cylinder type is used for pressures up to 250 pounds per square inch and the embedded-cylinder type for pressures up to 350 pounds per square inch. Diameters of the pipes range from 16 to 48 inches for the lined-cylinder type and from 24 to 144 inches for the embedded-cylinder type. The design and manufacturer of both types of prestressed concrete cylinder pipes is covered in AWWA C301.

(d) Concrete pipe joints. Operating experience has shown that rubber-gasketed bell-and-spigot joints provide a long-lasting, water-tight seal when proper installation procedures are followed. Subsequent coating of the joint with mortar ensures watertightness. Other types of joints are also available and may be used.

(4) *Steel pipe.* The properties of steel pipe favoring its use are high strength, and ability to yield or deflect under a load while still resisting the load, the capability of bending without breaking, and the ability to resist shock. Like cast iron, steel pipe is susceptible to corrosion if effective coatings and linings are not applied and maintained. Corrosion products do not adhere to steel pipe and are continually sloughed off, thus allowing further corrosion. By contrast, corrosion products adhere to cast-iron pipe and offer some protection against further corrosion. Steel pipe is generally available in diameters ranging to 144 inches and greater. Maximum allowable working pressures depend on pipe wall thicknesses and may be selected for the entire range of waterworks applications using AWWA Manual of Practice Number 11. In designing steel pipe to withstand internal pressures, a factor of safety of 1.0 is generally used; a factor of safety of 1.5 or 2.0 is recommended in designing for external loads. Steel pipe may be used for transmission, distribution and service lines with adequate protective coatings, and linings and cathodic protection as determined necessary by site conditions. The design and manufacture of steel pipe 6 inches and larger and cast-iron pipe is given in AWWA C101 and C200.

(5) *Plastic pipe.*

(*a*) Several different types of plastic have been used in the manufacture of water distribution pipes. The most commonly used plastics include ABS (polymers of acrylonitrile, butadiene, and styrene), polyethylene (PE), and polyvinyl chloride (PVC). Inasmuch as PVC pipe is presently the most suitable type of plastic pipe for water distribution, it is the only type covered herein.

(*b*) The advantages of PVC pipe are that it has a very low resistance to flow, it is somewhat flexible and can deflect under earth or superimposed loadings, it does not corrode from electrical or microbial action, and it is relatively lightweight and easy to install. Disadvantages are that it suffers a permanent loss of tensile strength with time, and that the tensile strength of the pipe at any time is decreased by temperature increases. PVC pipe also undergoes significant expansions and contractions with temperature changes, necessitating the use of gasket couplers.

(*c*) PVC pipe is used in sizes of 4 to 12 inches inside diameter. It is available in pressure classes of 100, 150, and 200 pounds per square inch, which correspond to the maximum anticipated internal working pressure for the pipe. A factor of safety of approximately 3.0 is used in the design of PVC pipe for sustained internal pressures; and a factor of safety of 4.0 is used for sudden pressure surges. However, due to the loss of tensile strength with time, these factors of safety decrease correspondingly. Pipe conforming to AWWA C900 with elastomeric gasket bell and spigot joints in 4-inch diameter through 12-inch diameter size, is acceptable for transmission, distribution, and service lines. Transmission, distribution, and service lines less than 4-inch diameter will require schedule 80 pipe with threaded joints or schedule 40, SRD26, 21, 17 or 13.5 pipe with elastomeric-gasket bell joints. The use of plastic pipe should normally be included as an option for contractors bidding on installation of new piping systems.

(*d*) In addition to the above, refer to AFM 88-15 for use of plastic pipe on Air Force facilities.

(6) *Insulating couplings.* If pipes of dissimilar metals must be jointed, a suitable insulating coupling should be used for the joint to prevent galvanic corrosion.