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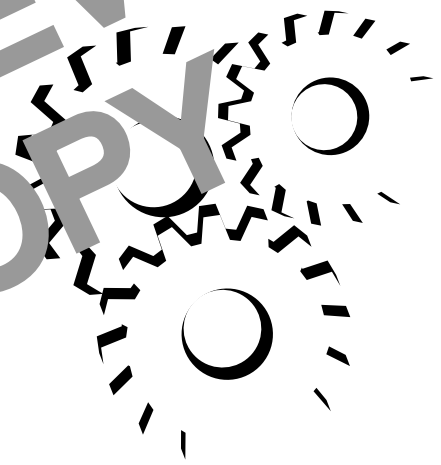
INSTALLING AND MAINTAINING VALVES AND PIPING SYSTEM PROTECTION

Lesson One

Valve Maintenance



TPC Training Systems

34701

Lesson

1 Valve Maintenance

TOPICS

Valve Materials
Threaded Connections
Welded and Brazed Connections
Flanged Connections
Valve Installation
Repairing Gate Valves
Repairing Globe and Angle Valves
Repairing Ball Valves
Maintaining Plug Valves
Maintaining Check Valves
General Maintenance

OBJECTIVES

After studying this Lesson, you should be able to…

- Discuss the factors that affect the selection of valve materials.
- Describe the various methods of connecting valves to piping.
- Identify the various types of common valves and the operating characteristics of each.
- Explain general maintenance and repair procedures for different types of valves.

KEY TECHNICAL TERMS

Valve 1.01 a device which controls the flow of fluid in a piping system

Check valve 1.60 a valve which allows fluid to flow in one direction only

Valves are an essential part of industrial piping systems. They are the devices which control the flow of fluid in the system. In order to function correctly, the valves must be properly designed, and made of a material suited to the application. They must also be installed and maintained correctly.

Lesson One describes six different, commonly used types of valves, and explains which materials are best suited for various applications. It also details valve installation and maintenance for common valve problems.

When you work with valves in your plant, remember this information and use it to select the appropriate valve for your application. Then, using the procedures described in this Lesson, install the valves and maintain them according to the maintenance schedule followed in your plant.

Valve Materials

1.01 A *valve* is a device which controls the flow of fluid in a piping system. Many different materials are used in the construction of valves. The choice of materials is determined by the following factors:

- the operating pressure and temperature
- the type of fluid to be carried
- the corrosive nature of the fluid
- the amount of shock or vibration
- the method of installation.

1.02 Bronze valves are used in applications of moderate temperature and pressure, and where small sizes are required. Bronze valves have pressure and temperature ratings of up to 300 psi at 550°F for steam service. Cold temperatures allow a maximum of about 1000 psi. Common valve sizes range from 1/4 in. to 3 in. Larger sizes are available for specific applications.

1.03 Cast iron valves for steam service are rated at up to 250 psi at a maximum of 450°F. The metallurgy can be changed for applications requiring heavier metal sections. Malleable iron valves are used where shock, expansion, and contraction in the system require the use of a tough, stiff material. Special cast iron valves are used where corrosion is a problem.

1.04 Steel valves are used where service requirements, including pressure, temperature, and shock or vibration, exceed what bronze or cast iron valves can handle. Pressure ratings have been established for 150-, 300-, 400-, 600-, 900-, 1500-, and 2500-lb steel valves. Steel valves may be of cast, forged, or alloyed steels. Stainless steel is used where great corrosion resistance is needed.

1.05 Steam ratings serve as one basis for describing pressure and temperature ratings of valves. Valves used at operating temperatures below the steam rating can be used at higher pressures. Increasing the operating temperature will normally result in a decreased pressure rating.

1.06 Valves are also rated according to the cold service rating. This rating is usually identified by the letters W.O.G., which indicate cold water, oil, or gas, with no shock conditions.

1.07 Valve types and applications are identified by abbreviations. Table 1-1 on the following page lists some of the more common abbreviations you should know.

1.08 The seat and disk inside a valve do the work of controlling the fluid flow. The contact between the two parts regulates or stops the flow. This is why the valve materials must be correct for the operation. Check the valve manufacturer's data before you choose the valve material for a particular application. Contact the manufacturer if you have any questions.

1.09 The seating surfaces of bronze and iron valves are usually made of the same material as the valve body. Special disks made of a nonmetallic composition material can be used for tighter sealing where it

Table 1-1. Common valve terminology abbreviations

W.O.G.	Water Oil Gas	**T.D.**	Teflon® Disk
C.W.P.	Cold Working Pressure	**F.F.**	Flat Face
W.S.P.	Working Steam Pressure	**R.F.**	Raised Face
"LPG"	Liquefied Petroleum gas	**L.M.F.**	Large Male and Female
T.E.	Threaded End	**S.M.F.**	Small Male and Female
F.E.	Flanged End	**L.F.**	Large Female
B.W.E.	Butt Welding End	**S.F.**	Small Female
S.W.E.	Socket Welding End	**L.M.**	Large Male
S.J.	Solder Joint	**S.M.**	Small Male
S.B.	Silver Braze	**L.T.G.**	Large Tongue and Groove
S.I.B.	Screwed Bonnet	**S.T.G.**	Small Tongue and Groove
U.B.	Union Bonnet	**L.T.**	Large Tongue
B.B.	Bolted Bonnet	**S.T.**	Small Tongue
O.S.Y.	Outside Screw and Yoke	**L.G.**	Large Groove
I.S.R.S.	Inside Screw Rising Stem	**S.G.**	Small Groove
I.S.N.R.S.	Inside Screw Non-Rising Stem	**R.T.J.**	Ring Joint
N.R.S.	Non-Rising Stem	**Int. S.**	Integral Seat
R.S.	Rising Stem	**Ren. S.**	Renewable Seat
S.W.	Solid Wedge	**I.P.S.**	Iron Pipe Size
D.W.	Double Wedge	**P.S.I.**	Pounds per square inch
D.D.	Double Disk		

is difficult to hold a tight seal. Seating materials may be lined or coated for special applications.

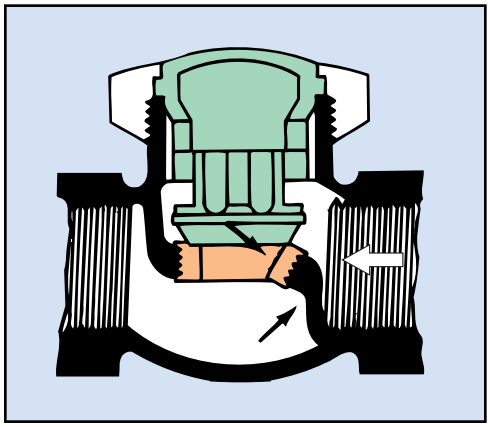
Threaded Connections

1.10 Threaded joints are often used to connect the valve to the pipe where the valve is removed frequently for service or repair. The use of extra unions or other fittings eliminates the need to dismantle long lengths of pipe next to the valve.

1.11 Threaded valve ends have female ends made to American Standard Pipe Threads, ANSI B21. A threaded connection is usually less costly than other types of connections because less finishing work and valve body material are required. Threads on connecting pipes must be within allowable tolerances.

1.12 You should remember two points when making threaded connections. Do not cut the threads too small in diameter, and do not use excessive force when you tighten the joint. Either situation can cause the end of the pipe to go too far into the valve body. A pipe that fits too far into the valve body can hit the internal parts of the valve and cause damage. When this happens, the damage prevents the moving parts of the valve from moving or seating properly, as shown in Fig. 1-1. Undersized threads can make it hard to achieve a tight, leak-free connection.

Fig. 1-1. Damage from pipe run in too far



1.13 Before you install a threaded valve, make sure the pipe and valve threads are clean and straight. Clean both the male and female threads with a wire brush, then wipe them with a clean rag. A final cleaning and straightening of the threads can be done with a tap or a die.

1.14 You can use pipe thread compound to make the joint go together more easily, but apply it only to the male threads. By doing this you prevent the compound from entering the pipe or valve where the fluid will flow. You also avoid contamination or

buildup and possible damage to the valve's working parts.

1.15 Start the joint by hand to avoid causing damage to the threads if they do not start properly. Then use a wrench with flat jaws, such as a hex or monkey wrench. Do not use a pipe wrench. Use the wrench only on the pipe side of the valve, never on the valve body. If you apply the wrench to the valve body, it could distort the working parts of the valve.

Welded and Brazed Connections

1.16 Welded connections are used in high-pressure, high-temperature applications where frequent valve removal is not required. The connection can be butt- or socket-welded. Make sure the valve is open as you weld. Remove any disks that could be damaged by heat. Threaded connections must be handtight to avoid distortion.

1.17 **Butt-welded connections**. Before you can butt weld, you must prepare the pipe ends to match the valve. The pipe and valve ends must be free of burrs, dirt, rust, oil, and grease. Then, the pipe and valve must be aligned, leaving the proper root opening. You can use fixtures to hold the pipe and valve in alignment, then tack weld to hold the pieces together after they are aligned. Figure 1-2A shows a butt weld.

1.18 Make the weld, using the procedures and precautions you have already learned. Remember that the first pass is critical. It must completely penetrate the material and be smooth on the inside of the pipe. Inspect each pass for cracks and porosity before applying the next pass.

1.19 **Socket-welded connections**. Before welding, leave a small space between the end of the pipe and the bottom of the socket in the valve, as shown in Fig. 1-2B. Again, the pipe and the valve must be supported as the weld is being made.

1.20 Bronze valves can be silver-brazed or soldered. The pipe or tube end must be cut square, the diameter round, free of burrs, and clean. Clean both the pipe and valve socket with steel wool or emery cloth to remove any oxidation that would prevent a good bond.

1.21 Use solder flux or silver-braze flux on the outside of the pipe or tube and inside the socket. Put the pipe into the socket until it bottoms on the shoulder. Rotate the pipe to spread the flux around. Figure 1-3 shows typical valve end connections for soldering or brazing.

1.22 Before you solder, check that the valve is open, that threaded connections are handtight, and that disks that could be damaged by heat have been removed. Use a suitable heat source—gas, for example—to heat the pipe or tubing uniformly to the valve connection. The material is hot enough when the brazing or solder material begins to melt. Put a uniform amount of material around the joint between the pipe or tubing and the valve.

1.23 The solder or brazing material should flow into the socket to obtain a tight joint. Try to keep the flame off the valve body. Excessive heat can distort and damage the valve.

Fig. 1-2. Welded connections

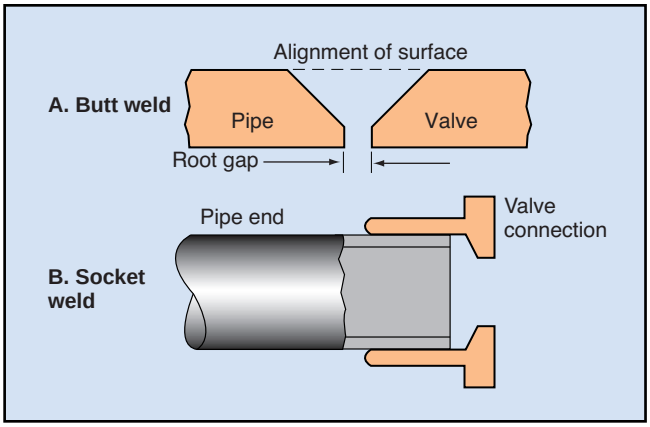
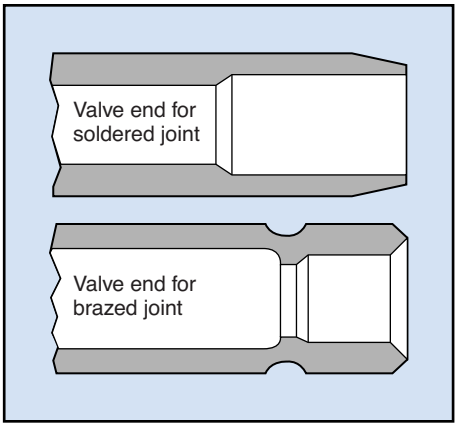


Fig. 1-3. Valve ends for soldering and brazing



Flanged Connections

1.24 Flanged connections are another way to connect pipes to valves. Flanges make tight joints that are relatively strong. Also, the valve can be removed for repair or replacement. Valve flanges are available in the same types and sizes as those used to connect pipe ends and pipes to fittings. Always use the same type of flange on the pipe end as you use on the valve. Figure 1-4 shows the most common flanged connections and how they fit together.

1.25 Tighten flanged-connection bolts evenly to ensure proper gasket compression and sealing. Tighten the bolts in an alternating pattern, always moving from one bolt to the one 180° away. Each bolt should be tightened in sequence so that pressure is uniform over the entire gasket.

Valve Installation

1.26 Prior to installation, valves must be kept wrapped and stored in a safe place. Do not stack valves on top of each other, or in a location where they could fall. The seat, disk, stem, or other parts can be damaged if a valve is dropped or hit. Wrapping the valve keeps dirt and other foreign material out of the working parts.

1.27 Although the valve has been wrapped, you must clean it before installation. Use water or compressed air to remove any particles. Clean threads, flange faces, and weld ends thoroughly to prevent sealing problems when the valve is connected to the pipe.

1.28 The valve should not carry any load from the pipes. Support the pipes on each side of the valve with hangers or stands. Be sure the pipes and valves are aligned correctly and that the valve is installed in the correct position.

1.29 The direction of flow determines which side is the inlet and which is the outlet, as in a check valve. Some valves require the flow and pressure to be above or below the disk, depending on the system design. General practice is always to have the stem pointing up. This reduces problems with trapping water or sediment in the bonnet.

Repairing Gate Valves

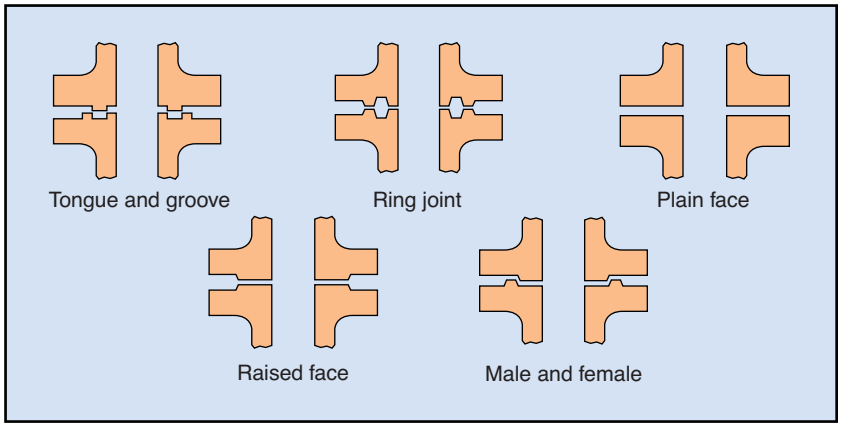
1.30 Figure 1-5 shows an exploded view of a gate valve with a one-piece yoke and bonnet. The steps for repairing this valve are typical of other designs, but you should always follow the manufacturer's instructions for the repair of any valve.

1.31 A common problem with gate valves is leakage around the stuffing box when the valve is partially open, although there is no leakage when the valve is fully open or fully closed. The first step is to adjust or replace the packing.

1.32 To adjust the packing, turn the gland bolt nuts in a clockwise direction. Tighten one nut about one-quarter turn, then tighten the other nuts the same amount. Repeat this until the leak stops. If this adjustment does not stop the leak, you must replace the packing.

1.33 Packing replacement must be done with the valve fully open or fully closed. The recommended position is fully open, which takes the pressure off the

Fig. 1-4. Valve-to-pipe flanged connections



packing. The safest way to proceed is to remove all pressure from the line.

1.34 First remove the gland bolt nuts. Lift the packing gland and gland flange out of the stuffing box. Use packing hooks to pull the packing out of the box. Install new packing, then replace the packing gland and flange over the bolts. Tighten the gland bolt nuts alternately and evenly until they are snug. Do not overtighten the nuts.

1.35 Leakage can also occur across the valve seat. When this happens, you must replace the disk and possibly the seat, if it is a replaceable type. Be sure there is no pressure in the line. Turn the handwheel to the open position and remove the bonnet nuts. Carefully lift the valve assembly out of the valve body. Turn the handwheel clockwise to move the stem downward.

1.36 Remove the disk from the valve stem. You will find the stem is not rigidly fastened to the disk. This is always done to prevent any stress on the stem that could be caused by line pressure on the disk. Otherwise, the stem could be bent.

1.37 Inspect the disk seating surfaces. If the disk cannot be ground and lapped you will have to replace it. Integral seats must be lapped. Replaceable seat rings, shown in Fig. 1-6, can be removed and replaced. The valve should be reassembled by reversing the procedure. A new gasket must be installed whenever the bonnet is separated from the body.

1.38 A new stem may be needed if damage occurs to the threads. All pressure must be removed from the valve before you replace the stem. Remove the bonnet and valve assembly from the body. Next, remove the handwheel nut and the handwheel. Run the stem down until it is clear of the yoke sleeve. Remove the disk, replace the stem, and reassemble it into the bonnet.

1.39 Many variations exist in gate valve design. Follow the detailed instructions for the particular valve you are repairing. Always replace the packing and use a new body-to-bonnet gasket after installing a new stem.

The Programmed Exercises on the next page will tell you how well you understand the material you have just read. Before starting the exercises, remove the REVEAL KEY from the back of your Book. Read the instructions printed on the Reveal Key. Follow these instructions as you work through the Programmed Exercises.

Fig. 1-5. Gate valve

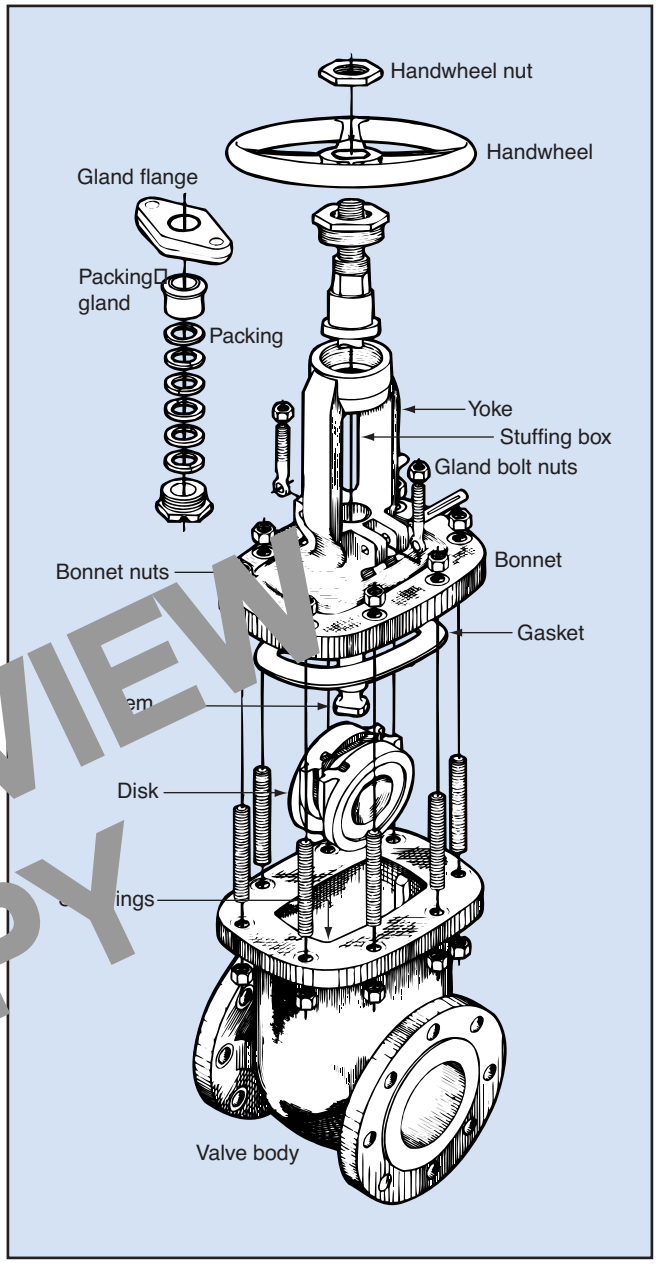
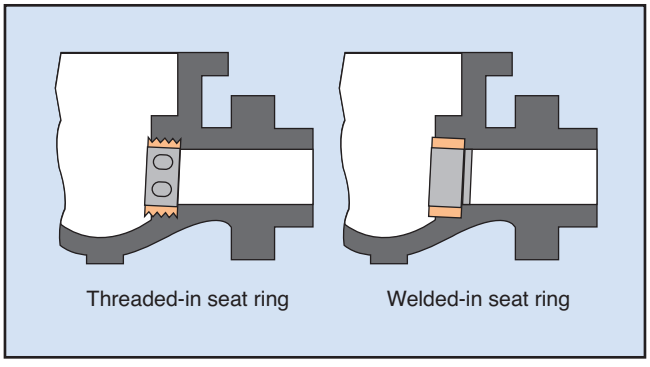


Fig. 1-6. Gate valve seat rings



1-1. Devices which control the flow of fluid in a piping system are called _____.	1-1. VALVES Ref: 1.01
1-2. Steam ratings determine both the _____ and _____ limits of valves.	1-2. TEMPERATURE; PRESSURE Ref: 1.05
1-3. It is common for applications in which valves must be removed frequently to use _____ joints.	1-3. THREADED Ref: 1.10
1-4. When may a wrench be applied to the body of a valve?	1-4. NEVER Ref: 1.15
1-5. Name the two common types of valve-to-pipe welded connections.	1-5. BUTT WELD; SOCKET WELD Ref: 1.16
1-6. Tongue and groove is a type of _____ connection.	1-6. FLANGED Ref: Fig. 1-4
1-7. Prior to installation, a valve should be cleaned with water or _____.	1-7. COMPRESSED AIR Ref: 1.27
1-8. As a general rule, a valve should be installed with the stem pointing _____.	1-8. UP Ref: 1.29

Repairing Globe and Angle Valves

1.40 All globe and angle valves are similar in design and construction. However, the inlet of an angle valve is at a 90° angle to the outlet. The inlet and outlet of a globe valve are in line. Maintenance and repair procedures are the same for either type.

1.41 Figure 1-7 shows a union bonnet globe valve with a one-piece metal disk. This design is often used in piping systems having low pressures and temperatures. The contact surface between the disk and the seat is narrow. As a result, uneven material buildup on the seat or disk can prevent tight sealing. As with the gate valve, leaks around the stuffing box indicate the need to adjust or replace the packing.

1.42 The first step is to tighten the packing nut. The valve should be partially open and the system under pressure. If leakage continues, you must replace the packing. Remove the handwheel nut and handwheel. Loosen the packing nut and lift it off the valve. Slide the packing gland up and off the stem. Then remove the old packing and install the correct type of new packing.

1.43 Replace the packing gland and packing nut. Tighten the packing nut until it is snug, but not tight. Replace the handwheel and the handwheel nut.

1.44 Leakage around the valve seat requires disk and/or seat replacement or refinishing. First, remove the union bonnet ring and lift the valve assembly out of the valve body. Turn the handwheel clockwise to move the stem down. Then remove the disk and replace it with a new disk of the same size.

1.45 You will notice that the fit between stem and disk is close. This is necessary because the stem guides the disk into the seat. No side movement is allowable, as it could cause the disk to seat unevenly. Also, once seated, the disk must not turn on the seat. The stem-to-disk connection should allow the stem to turn in the disk but not allow the disk to move sideways on the stem.

1.46 Seats can be held in place by threads, by being pressed into place, or by being welded. Threaded seat rings can be removed with a seat ring wrench, and new rings installed. The seat can also be integral with the valve body and machined to the proper size.

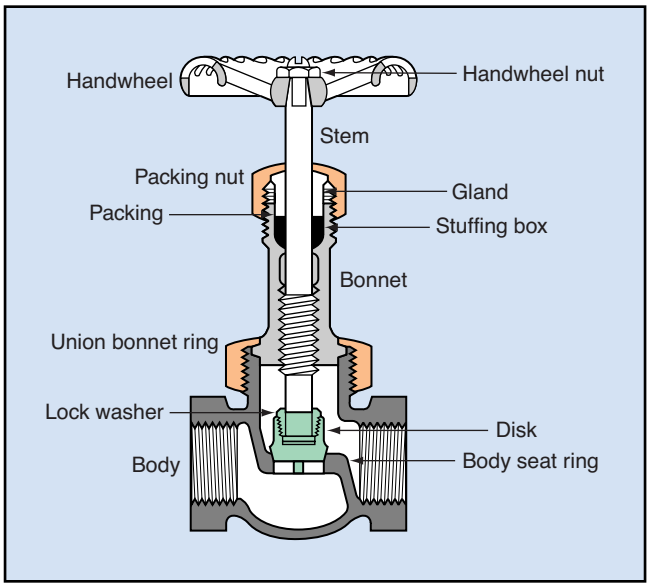
1.47 Most globe valve seats can be ground in place. This can be done on some types by removing the bonnet ring and lifting out the valve assembly. Place a pin in the disk holder to keep the disk from turning when the stem is rotated. Put grinding compound on the disk seating surface and replace the valve assembly. Handtighten the union bonnet ring, then back it off one turn. This will help ensure that the stem is vertical and the disk and seat are aligned.

1.48 Next, turn the stem until the disk and seat make contact. Rotate the stem in opposite directions to grind the seat. Do not overgrind. Remove the union bonnet ring and bonnet. Lift out the valve assembly and thoroughly clean the disk and seat. Oil the threads of the union bonnet ring. When you are done cleaning and oiling, reassemble the valve.

1.49 The stem may not move freely if the stem threads are damaged. When this happens you must replace the stem. First remove the handwheel nut and the handwheel. Remove the union bonnet ring and run the stem down until the threads clear the bonnet. Remove the packing nut and the packing gland. Pull the stem out of the bonnet and stuffing box.

1.50 Remove the disk parts. If they are in good condition, place them on the new stem. Remove the old packing from the stuffing box, then thread the new stem up through the bonnet and stuffing box. Put

Fig. 1-7. Globe valve



in new packing. Replace the gland and packing nut. Finally, tighten the packing nut until it is snug, then replace the handwheel and handwheel nut.

Repairing Ball Valves

1.51 Common types of ball valves require removal of the pipe from one end, as shown in Fig. 1-8. You can replace the ball or seats by removing the pipe from the end of the valve which has the threaded coupling. After you have removed the pipe, remove the coupling. Then remove the nut on the lever, and the lever itself. Back off the packing nut, and remove the follower, packing, and packing washer. Lift the stem out of the valve body.

1.52 The ball and seats can be pulled out of the body of the valve. Inspect the ball and replace it if too much wear is apparent. Install a new back-side seal into the valve body. Be sure it seats properly. Slide the ball into place and make sure the slot for the stem is aligned. Install the second seat and screw the threaded coupling into place.

1.53 Put the stem down through the top of the valve into the slot on the top of the ball. Put the thrust and packing washers into place. Repack the valve and install the follower and packing nut.

1.54 Place the handle over the stem in the proper position and tighten down the handle nut. The ball and handle should be positioned so that, when the handle is in line with the pipe, the ball opening is also in line with the pipe. It is a good idea to check the action by opening and closing the valve a few times. It should be firm but not too tight.

Maintaining Plug Valves

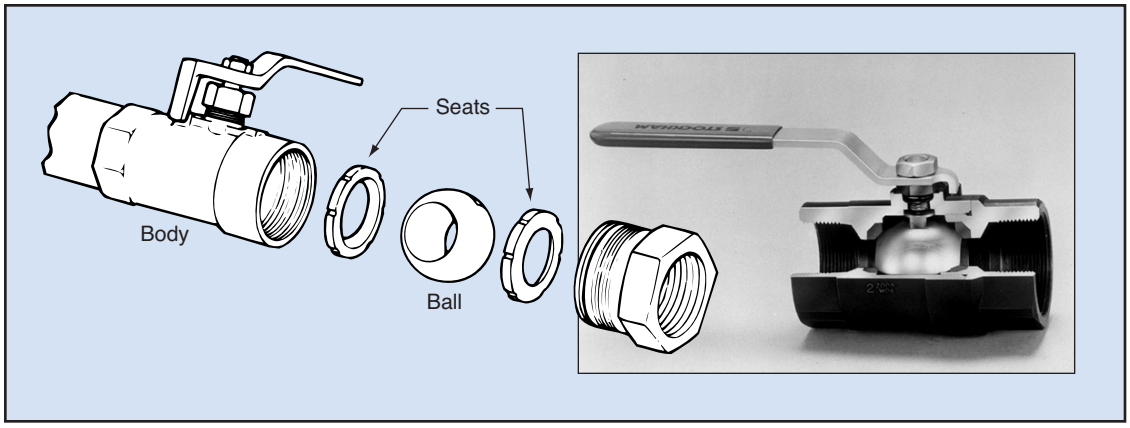
1.55 Lubrication is an essential part of plug valve maintenance. Figure 1-9 shows various types of lubricated plug valves. The channels on the plug allow lubricant to be forced from the top, through the plug body, and into the area between the plug and valve body. The pressure lifts the plug, making it easier to turn. The pressure of the lubricant is higher than the line pressure, which prevents material from getting between the plug and the valve body. The lubricant also helps maintain a seal around the plug and protects the surfaces from wear.

1.56 Plug valves require a special lubricant, which resembles a plastic sealant. The lubricant must be able to hold a film between the surfaces, and resist corrosion and action of the fluid. Common lubricating materials include fluorinated plastics and molybdenum disulfide.

1.57 If the valve becomes difficult to open and close, the problem may be caused by a lack of lubricant. Follow the manufacturer's recommendations for the type of lubricant to use and how to install it. If lubricating the valve does not help, loosen the gland slightly and relubricate. When the valve again works freely, retighten the gland. If these steps do not free the valve, you must disassemble it, clean it thoroughly, and then reassemble and relubricate it.

1.58 Leakage across the valve can be caused by too loose a gland or by misalignment of the plug with the body. Lubricate the valve and watch for the back pressure that should build up. A lack of back pressure can

Fig. 1-8. Ball valve repair



indicate that the plug is out of alignment. The lubricant will go into the pipe line if alignment is incorrect.

1.59 Open and close the valve repeatedly as you tighten the gland. This will force out any extra lubricant which might be causing the misalignment. Disassembly, cleaning, and repair may be required if the problems persist.

Maintaining Check Valves

1.60 *Check valves* allow fluid to flow in one direction only. There are three types of check valves—swing, horizontal lift, and vertical lift. Swing check valves can be installed in any position as long as the line pressure is under the disk.

1.61 Horizontal lift check valves must be mounted in a horizontal position. Pressure must be on the bottom of the disk to raise it and open the valve for fluid flow.

1.62 Vertical lift check valves are used only for vertical upflow. The inlet side of the valve must be on the bottom to allow the fluid pressure to open the valve.

1.63 Figure 1-10 on page 14 shows the parts of a swing check valve. Seat leakage is a common problem in this type of check valve. Cleaning the valve seats or replacing the disk usually solves the problem. The first step to replacing the disk is to remove the cap. Remove the hinge pin plug or both plugs if the valve has two. Remove the hinge pin and take out the disk assembly.

1.64 A one-piece disk is replaced by removing the pin disk nut and washer, then positioning the new disk. Next, tighten the disk nut on the washer and install the pin. If you are replacing a composite disk, remove the disk locknut, install the new disk and tighten the disk locknut. Inspect and clean the valve body and seat. If the seat is damaged beyond repair, replace the valve.

Fig. 1-9. Lubricated plug valves

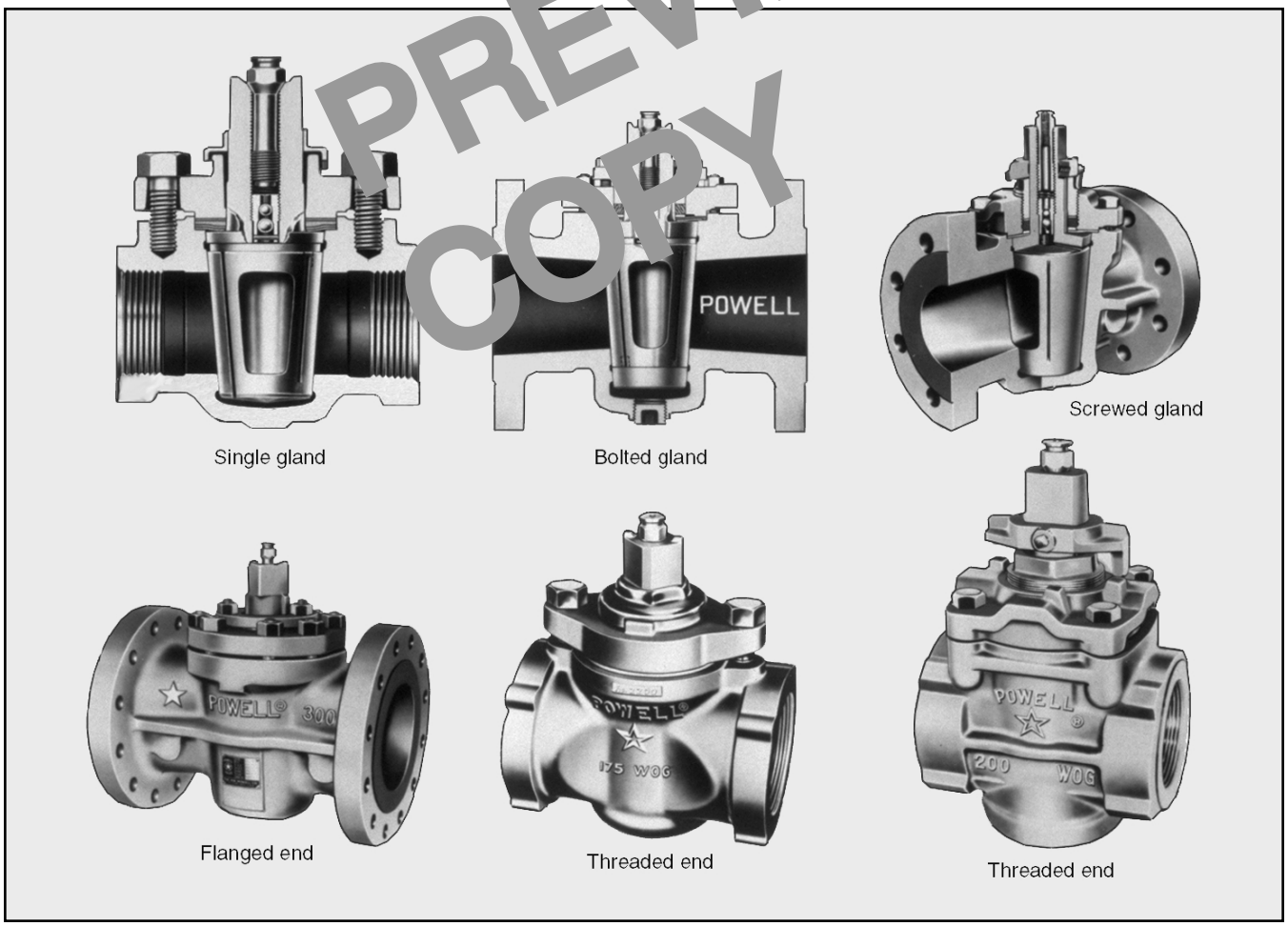


Fig. 1-10. Swing check valve

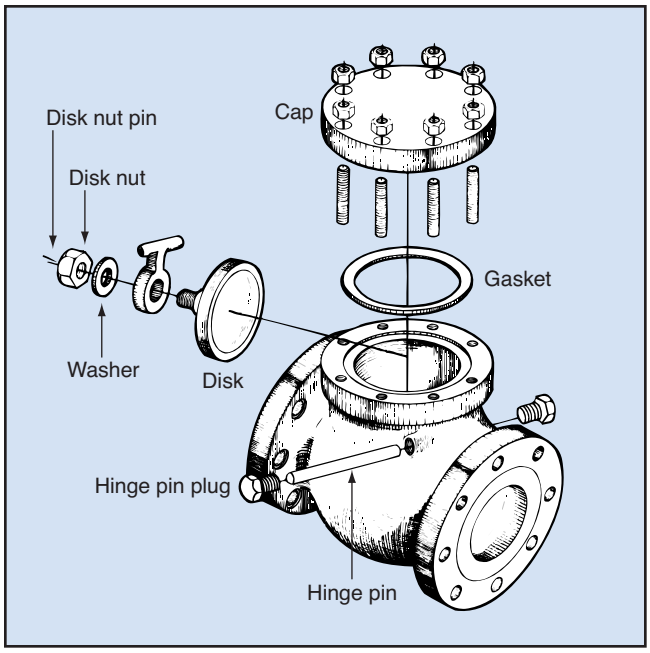
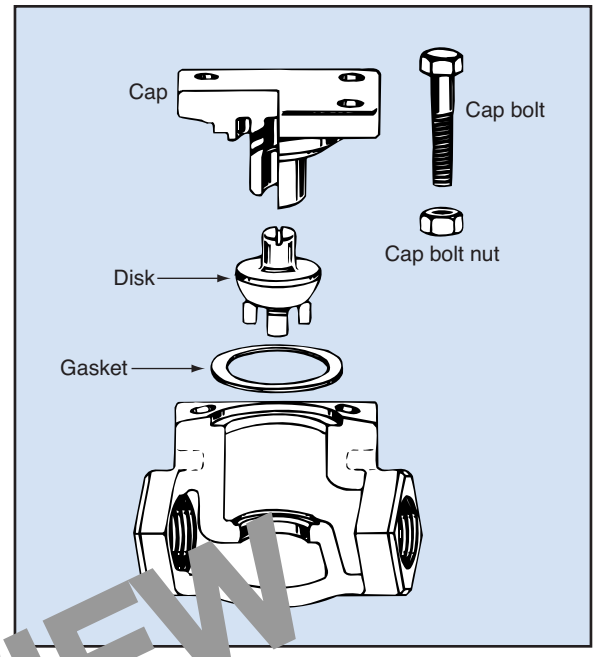


Fig. 1-11. Horizontal lift check valve



1.65 Install the repaired disk assembly into the valve body. Put the hinge pin into position and tighten the hinge pin plug(s). Bolt the cap back onto the valve body with a new gasket.

1.66 Figure 1-11 shows a horizontal lift check valve. In order to repair seat leakage, you must first remove the cap bolts and the cap. Then, lift the cap off and remove the disk. Check the seat and grind it with a seating tool. Install a new disk, a new gasket, and the cap, then tighten all the cap bolts.

Table 1-2. Torque values for bolted bonnet threaded members for flanged bonnet joint bolting

Torque values	
Nominal diameter (in.)	**Torque (ft-lb)**
1/2	30
9/16	45
5/8	60
3/4	110
7/8	170
1	260
1 1/8	375
1 1/4	525
1 3/8	715
1 1/2	925

General Maintenance

1.67 A leak is usually the first indication of a valve problem. This can often be fixed very simply. The first step is to open and close the valve repeatedly to wipe off the stem seating surfaces. Check to see if the leak still appears around the stem after you have done this several times.

1.68 If the leak persists, tighten the bolts on the packing gland or packing nut. Be sure you tighten the bolts alternately in several steps. You should tighten a packing nut in small steps until the leak stops. If the leak does not stop, you will have to repack the valve.

1.69 Leakage around flanged end connections or the bonnet can sometimes be stopped by tightening the bolts. Table 1-2 lists recommended values of torque to be applied to bonnet valve bolts. Install a new gasket if tightening the bolts does not stop the leak.

1.70 Movement and rotation of the valve stem can cause the packing around a stem to wear. You should oil the stem at regular intervals. Oiling reduces friction between the stem and packing and helps the

valve operate more smoothly. You should also oil any exposed threads on the stem.

1.71 Hangers that support valves should be inspected frequently. Sag in the pipeline can put stress on the pipe-to-valve connection and cause leaks, especially at flanged joints.

1.72 Most valves can be disassembled and inspected without removing them from the pipeline. Critical valves and those with a history of problems should be inspected internally. Depressurize the line before you dismantle any valve.

1-9. The inlet of an angle valve is at a(n) _____ angle to the outlet.	1-9. 90° Ref: 1.40
1-10. When leakage occurs around the stuffing box of a globe valve, the first thing you should do is _____.	1-10. TIGHTEN THE PACKING NUT Ref: 1.42
1-11. If the stem of a globe valve does not move freely, one probable cause is _____.	1-11. DAMAGED THREADS Ref: 1.49
1-12. In order to replace a ball valve, you should remove the pipe from the end of the valve which has the _____.	1-12. THREADED COUPLING Ref: 1.51
1-13. What type of valve requires a special corrosion-resistant lubricant?	1-13. PLUG VALVE Ref: 1.56
1-14. Name the three types of check valves.	1-14. SWING; HORIZONTAL LIFT; VERTICAL LIFT Ref: 1.60
1-15. Which type of check valve can be installed in any position as long as the line pressure is under the disk?	1-15. SWING CHECK VALVE Ref: 1.60
1-16. The first sign of a valve problem is usually a(n) _____.	1-16. LEAK Ref: 1.67

Answer the following questions by marking an "X" in the box next to the best answer.

1-1. Cast iron valves for steam service are rated at a maximum temperature of _____ °F.

- ☐ a. 250
- ☐ b. 450
- ☐ c. 550
- ☐ d. 1000

1-2. The letters W.O.G. usually refer to a valve's _____rating.

- ☐ a. pressure
- ☐ b. steam
- ☐ c. insulation
- ☐ d. cold service

1-3. Threaded valve-to-pipe connections are generally used in applications where

- ☐ a. valve removal and maintenance is frequent
- ☐ b. a tight seal is not required
- ☐ c. dirt is a problem
- ☐ d. high pressures and temperatures are present

1-4. The correct way to tighten a threaded joint is to apply a flat-jawed wrench to the _____ of the valve.

- ☐ a. body
- ☐ b. stem
- ☐ c. pipe side
- ☐ d. handwheel

1-5. Before making a soldered connection, you should do all of the following except

- ☐ a. close the valve
- ☐ b. handtighten the threaded connection
- ☐ c. remove the disks
- ☐ d. heat the pipe or tubing

1-6. The inlet and outlet of a globe valve are

- ☐ a. at a 45° angle to each other
- ☐ b. at a 90° angle to each other
- ☐ c. in a straight line with each other
- ☐ d. one and the same

1-7. One indication that the plug and the body of a plug valve are misaligned is

- ☐ a. contamination of the fluid
- ☐ b. damaged stem threads
- ☐ c. a loose gland
- ☐ d. a lack of back pressure

1-8. Each of the following describes a type of check valve except

- ☐ a. vertical lift
- ☐ b. plug
- ☐ c. horizontal lift
- ☐ d. swing

1-9. A vertical lift check valve must be installed with the _____ on the bottom.

- ☐ a. inlet side
- ☐ b. outlet side
- ☐ c. joint
- ☐ d. handwheel

1-10. Which of the following is normally the first sign of a valve problem?

- ☐ a. Overheating
- ☐ b. Noise
- ☐ c. Leakage
- ☐ d. Vibration

SUMMARY

Valves control fluid flow in piping systems. Valves are commonly constructed of bronze, cast iron, and steel. The choice of the best valve material for a particular application depends on the operating pressure and temperature, the type of fluid to be carried, the amount of shock or vibration in the line, and the method of installation.

The joints that connect valves and piping may be threaded, welded, brazed, soldered, or flanged. Threaded valves are used where frequent service is necessary. Welded connections are indicated for high-pressure, high-temperature applications, where valve removal is infrequent. Flanged connections permit valve removal and make moderately strong joints.

Despite their weight, valves are easily damaged. They should be stored wrapped and laid flat. You should clean each valve prior to installation, and be careful, when you make the valve/pipe connection, not to insert the pipe end too far into the valve. Make sure you depressurize the line before you dismantle any valve for inspection or service.

Answers to Self-Check Quiz

1-1. b. 450. Ref: 1.03

1-2. d. Cold service. Ref: 1.06

1-3. a. Valve removal and maintenance is frequent. Ref: 1.10

1-4. c. Pipe side. Ref: 1.15

1-5. a. Close the valve. Ref: 1.22

1-6. c. In a straight line with each other. Ref: 1.40

1-7. d. A lack of back pressure. Ref: 1.58

1-8. b. Plug. Ref: 1.60

1-9. a. Inlet side. Ref: 1.62

1-10. c. Leakage. Ref: 1.67

Contributions from the following sources are appreciated:

Figure 1-5.	Crane Co.
Figure 1-8.	Stockham Valves and Fittings
Figure 1-9.	The Wm. Powell Company
Figure 1-10.	Crane Co.
Figure 1-11.	The Wm. Powell Company
Table 1-1.	The Wm. Powell Company
Table 1-2.	Crane Co.