

Valve Training

Presenter: Tim Ballard

So many valves...

So little time!

Types of Valves

- Gate valves
- Butterfly valves
- Resilient wedge valves
- Horizontal sliding gate valves
- Plug valves
- Ball Valves
- Electronically activated valves
- Control Valves

Gate Valves – Double Disc

1. Most commonly used valve in water system prior to the introduction of resilient wedge valve.
2. Most common problem with these valves are providing a good seal as they become older.
3. Gate valves were designed for on-off
4. In comparison to other types of valves it is relatively inexpensive
5. Gate valve limitations are... they do not work well for throttling, are hard to operate against high pressure differentials.

All Valves



All Valves



All Valves



All Valves



All Valves



Valve Operation Troubleshooting



Valve Operation Troubleshooting



Valve Operation Troubleshooting



Valve Operation Troubleshooting



Valve Operation Troubleshooting



Gate Valves – Double Disc

6. Have a tendency to leak around stem this is very common and requires constant maintenance.
7. Tuberculation accumulates in the valve body and in the bottom of the valve.
8. When operating a gate valve when opening they will normally stop suddenly.
9. When closing, as the gates enter the valve faces...they become tighter and tighter
10. May leak from packing when valve is not fully opened.

Parts of a Gate Valve

Nut : **Red (right handed)**

Black (left handed)

Stem

Discs

Wedges and Spreaders

Body – Bonnet

Sealing, packing, O-rings

All Valves



All Valves







All Valves



Butterfly Valves

1. Seals and faces are more prone to wear because they are in the direct path of flow.
2. Its always recommended that when performing maintenance on a butterfly valve...to have a replacement readily available.
3. Butterfly valves work well where pressure differential in closing is going to be a problem.
4. When performing leak detection sounding around butterfly valves...due to their design is somewhat difficult.
5. Requires less exercising.

Butterfly Valves

6. Will stop suddenly in open or closed position.
7. Butterfly valves typically have a gear box. The number of turns vary with each manufacturer.
8. When performing a shutdown with a butterfly valve it is always a good idea to have some indicator that the valve is closed before applying any additional force on the valve.
9. How can you tell if you have a butterfly valve when it is buried?
10. The valve box will be off center line of the water main.

Butterfly Valves

<i>Size of Valve in Inches</i>	<i>Number of Turns to Open</i>
12	36
14	34
16	34
18	34
20	60
24	60
30	108
36	108
42	108
48	108

Resilient Wedge Valves

1. Spongy feeling when closing due to the sealing material.
2. Do not work at all for throttling purposes.
3. They will break
4. Easily to over close valve allowing water to still leak through.
5. Work well in systems that have a lot of sedimentation in their lines.
6. Should be noted that when opening and closing that valve is in full open or closed position.

Resilient Wedge Valves

<i>Size of Valve in Inches</i>	<i>Number of Turns to Open</i>
4	13 ½
6	19 ½
8	25 ½
10	31 ¾
12	37 ¾

Horizontal Sliding Gate Valves

1. Commonly used where bury depth is limited and on lines 14" and larger
2. Some have bypass valves built in to allow for easier operation when dealing with pressure differentials.
3. Normally installed in pits or vaults
4. Typically used in large diameter with high velocity and higher working pressures
5. To close this valve properly high velocity flows through the valve should be maintained to help clean debris out of the valve body.
6. Depending upon the manufacturer the number of turns varies with each gear box configuration used.

Plug Valves and Ball Valves

Typically used as suction lines valves
and not operated frequently.

Electronically Activated Valves

Typically open or closed...have electric motor
or in some cases water pressures which opens
and closes them.

All Valves

1. Before performing any repair or exercising, always try to start with valve in either the full open or full closed position.
2. If unable to determine position of valve, perform some type of testing to determine position of the valve.
3. If unable to operate valve and determine its status, be sure line associated with valve is depressurized before performing repairs.

All Valves

4. Mark operating system and body of valve together so that valve is reassembled in same position.
5. Pay particular attention when valve is operated for any unusual sounds.
6. Watch for valve tightening and becoming free during operation. Indicating some type of problem...bent stem, debris, slipping.

All Valves

7. Know the size and type of the valve.

Refer to maps and valve history.

8. On larger transmission mains smaller valves are sometimes used to save money.

(Know where those are)

All Valves

9. Distribution system valves be sure to inspect the valve box and valve operations nut.
10. Always – Always – count the number of turns both when opening and closing.
11. Water hammer – closing or opening valve too quickly will cause damage to the distribution system and to customers plumbing.

All Valves

13. When closing a valve during high flow situations the chance of water hammer increases dramatically.
14. Over closing or too many turns for a known valve size indicates problems.

All Valves



All Valves



Valve Operation Troubleshooting

- Hard to Turn
- Valve box misaligned
- Bent valve stem
- Debris in valve box
- Packing gland over tightened
- Debris in the valve internal mechanism

Valve Operation Troubleshooting

Start operating valve if it requires more than what is normal

Approximate	Torque Rating	New Valve
2" - 2 ½"	100 Ft Lbs.	
3" - 4"	200 Ft Lbs.	
6" - 12"	300 Ft Lbs.	
12" - 24"	400 Ft Lbs.	

Valve Operation Troubleshooting

If valve is older and you know your system has a lot of corrosion problems, operate valve carefully by closing a few turns, then open, then close again

Valve Operation Troubleshooting

One thing that helps when operating valves like this...is having enough downstream flow to clean out debris as you operate.

Always be prepared to back up any valve that you are performing maintenance on or is giving you problems when operating.

Upon determine that repairs are necessary, extreme care should be taken to assure proper parts and equipment are on hand to make repairs.

Customers have been notified...
a test shut down should have already been done.

Valve Operation Troubleshooting

1. If installing a new valve, it should be checked for proper size, flange, all bolts and plugs are tight.
2. New valve should be operated full open to full closed
3. Check that seats are clean.
4. Check for any cracks in the case.
5. Valve should be closed during installation.

Valve Operation Troubleshooting

When replacing valve packing, open valve to full open position and apply additional torque. Most valves will seal off the stuffing box to allow packing replacement

With today's available packing...Teflon would be the packing of choice. Teflon packing does not dry out as quickly as old graphite packing. Refer to manufacturer's recommendations for packing replacement.

Valve Replacement

Do not use gear passes or actuators or cylinders for lifting a valve. Use a valve strap on other appropriate device for lifting.

Be sure valves are properly supported. Do not use a valve as a final joint to correct any misalignment or spacing of pipe.

Valve Replacement

Always tighten flange bolts in a star pattern or diametrically opposite side of the flange until all bolts are tight and the joint gaskets have sufficient compression to prevent leakage at the test pressure. Refer to recommended torque pressure for flange bolts.

Valve Replacement

When installing the valve box confirm that it does not transmit traffic load directly to top of valve.

Be sure box is parallel and center to the valve stem.

Be sure valves are stored with valve opened and bottom of valve is on the ground

Valves with fiber board discs will still accumulate water in the body and possible freeze damage valve

Valve Stem Extensions

- Installed at time of installation
- Break Easily
- Have a valve key available to operate...make sure it is of suitable length
- Can cause valve nuts to deteriorate more quickly

Lock Out Tag Out

- Each utility should have a written procedure as to how they will handle a large shutdown involving several valves.
- It should include how these valves are marked and what method is used to prevent unauthorized opening of a valve once it has been closed.

Double Disc Valve # of Turns per Inch

<i>Size of Valve in Inches</i>	<i>Number of Turns to Open</i>	<i>Diameter of Stem</i>
4	15	1 1/8
6	21	1 1/4
8	27	1 3/8
10	33	1 1/2
12	39	1 1/2
16	52	1 7/8
18	58	2 1/8
20	64	2 1/8
24	76	2 1/2
30	63	2 3/4
36	75	3
42	88	3 1/2
48	100	4

Valve Report

Location		
Valve Number		
Valve Size		
Valve Opens	Left	Right
Number of Turns		
Date of Operation		
Depth of Valve		
Work Needed Code		

Valve Report

Location		
Valve Number		
Valve Size		
Valve Opens	Left	Right
Number of Turns		
Date of Operation		
Depth of Valve		
Work Needed Code		

Valve Report

Packing Leak	PLK
Operating Nut Broken	OPN BRK
Lid Broke	LD BRK
Clean Out	COT
Needs Located	NL
Needs Aligned	N ALIG
Valve Broke	V BRK OP____ CH____

Control Valves Training

1. Types of control valves

- Altitude valves
- Pressure Reducing
- Pressure Sustaining
- Pressure Relief Valves
- Globe Valve
- Pump Control Valves
- Butterfly Control Valves

Control Valves Training

2. Altitude Valve Use and Operation

- A. Used as water level control on water towers
- B. Some are considered to be non-throttling which means valve fully opens until level is obtained from pilot valve.
- C. Most all of these valves have multiple pilot valves that control various functions.
- D. Pilot valve that opens valve

Control Valves Training

- E. Pilot valve that opens valve
- F. In line Y strainer to prevent particles from interfering with operation.
- G. Valve position indicator
- H. 2-way flow

Control Valves Training

- I. One way flow altitude valve.
 1. Water is taken from reservoir from a separate line and used in the system
 2. Tank is then filled thru altitude valve altitude valve will then shut off. What tells the valve when to close when to open

Control Valves Training

- J. Pilot valve control operates on the differential in force between the water in the reservoir and the adjustable spring load on the valve.
- K. Altitude valves are most common in systems with multiple tanks
- L. By using altitude valves a water system can operate multiple tanks with various elevations thru one pump station

Pressures Reducing Valves

1. Pressure reducing valves operate automatically based on down stream pressure.
2. Valve automatically reduces inlet pressure to lower steady downstream pressure regardless of changing flow rates or varying inlet pressure.
3. The control system is very sensitive and is controlled by a single adjusting screw.
4. Many reducing valve problems are created by improper sizing and applications.

Pressures Reducing Valves

5. Where flow rates vary due to usage the need of multiple valves may be necessary set up in parallel. Larger valve works during high flows. Smaller valve works during low flows.
6. Determining need is difficult at times and through testing should be done to determine what is exactly needed.

Pressures Sustaining Valves

1. Pressure sustaining valves are installed in a line between an upper zone and lower area of heavy demand.
2. The valve acts to maintain desired upstream pressure to prevent robbing of the upper zone.

Pump Control Valve

1. Designed for installation on discharge side of pump
2. Eliminates pressure surges caused by starting and stopping of pumps
3. Pump starts against a closed valve
4. When the pump is started a solenoid valve is energized and the valve begins to open slowly pump continues increasing line pressure to full pumping head.

Pump Control Valve

When the pump is signaled to shut off the solenoid valve is de-engaged and valve begins to close gradually reducing flow while pump continues to run until valve is almost closed then it is signaled to shut off.

Each time a solenoid valve opens or closes, water is discharged from exhaust port. Exhaust tube must be free of back pressure. Air gap should be maintained between the exhaust tube and to drain

Air Relief/Vacuum Valves

Why do we need them?

Release air trapped in the line during filling

- Release air created in system during day-to-day pumping and operation.
- During draining or mainbreak air must be allowed to enter piping to displace the water being taken out.

Air Relief/Vacuum Valves

This is extremely important when elevation changes are created or after pumping systems.

Extremely important to be used with deep well vertical turbine pumps between check valve and pump to exhaust any air.

Air Relief/Vacuum Valves

There are a wide variety of relief valves to be used with different applications:

1. Air relief valves
2. Air/vacuum relief valves
3. Kinetic air/vacuum valves
4. Slow closing air/vacuum valves
5. Sewage specific air/vacuum valves
with back flushing attachments

Combination Air Valves

Why use combination air relief valves?

While air relief valves can exhaust small amounts of air during operation

They do not work well with large amounts of air and they do not work well at all in vacuum operation
neither air relief or air/vacuum valve can perform all these functions

Combination Air Valves

What do they do?

Combination air valves purge air from system at start up vent pockets of air during operation and prevent vacuum conditions during draining.

Globe Valves

Of all control valves the globe valve is most commonly used.

1. Rising stem
2. Design simplicity
3. Versatility of application
4. Ease of maintenance
5. Ability to handle a wide range of pressures
6. Disadvantage larger heavier and more expensive
7. All can be fitted with various actuator

Globe Valve Preventative Maintenance

1. Examine body for any signs of leaks
2. Check for any lubrication points
3. Check bolts for tightness
4. Be sure valve operates through entire cycle

Globe Valve Preventative Maintenance

Troubleshooting problems:

1. Leakage through valve seat build up of debris through time
2. Erratic stem movement
3. Over tightened stem packing
4. Debris on stem

Butterfly Control Valves

1. Been in existence since 1930's
2. Originally used as on/off block valve
3. 1970's design allowed for butterfly valve to be used for a control valve
4. Preferred in some applications over globe valve
5. Don't confuse on/off valves with high performance control valves $\frac{1}{4}$ turn

Preventative Maintenance

1. Inspect for any leaks at flanges or operation stem
2. Perform pressure testing on valve to determine its sealing abilities
3. Some leakage may occur depending upon specification for bubble tight requirements

Troubleshooting

1. Shaft has become worn erratic operation
2. Bearings where applicable are worn
3. Over tightening of packing seal erratic operation









































































