# 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

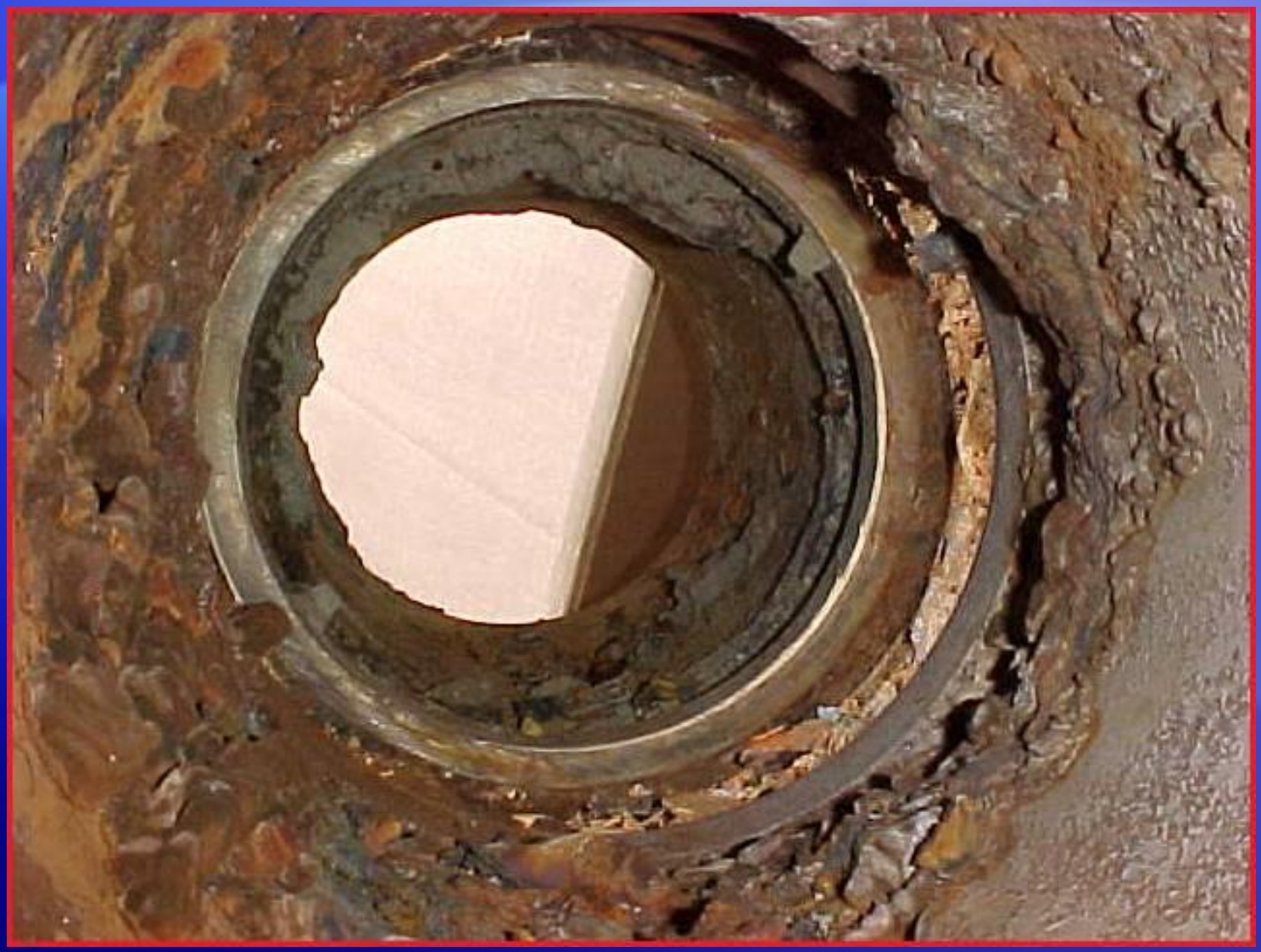
# All Valves

# All Valves

# All Valves

# Valve Operation Troubleshooting

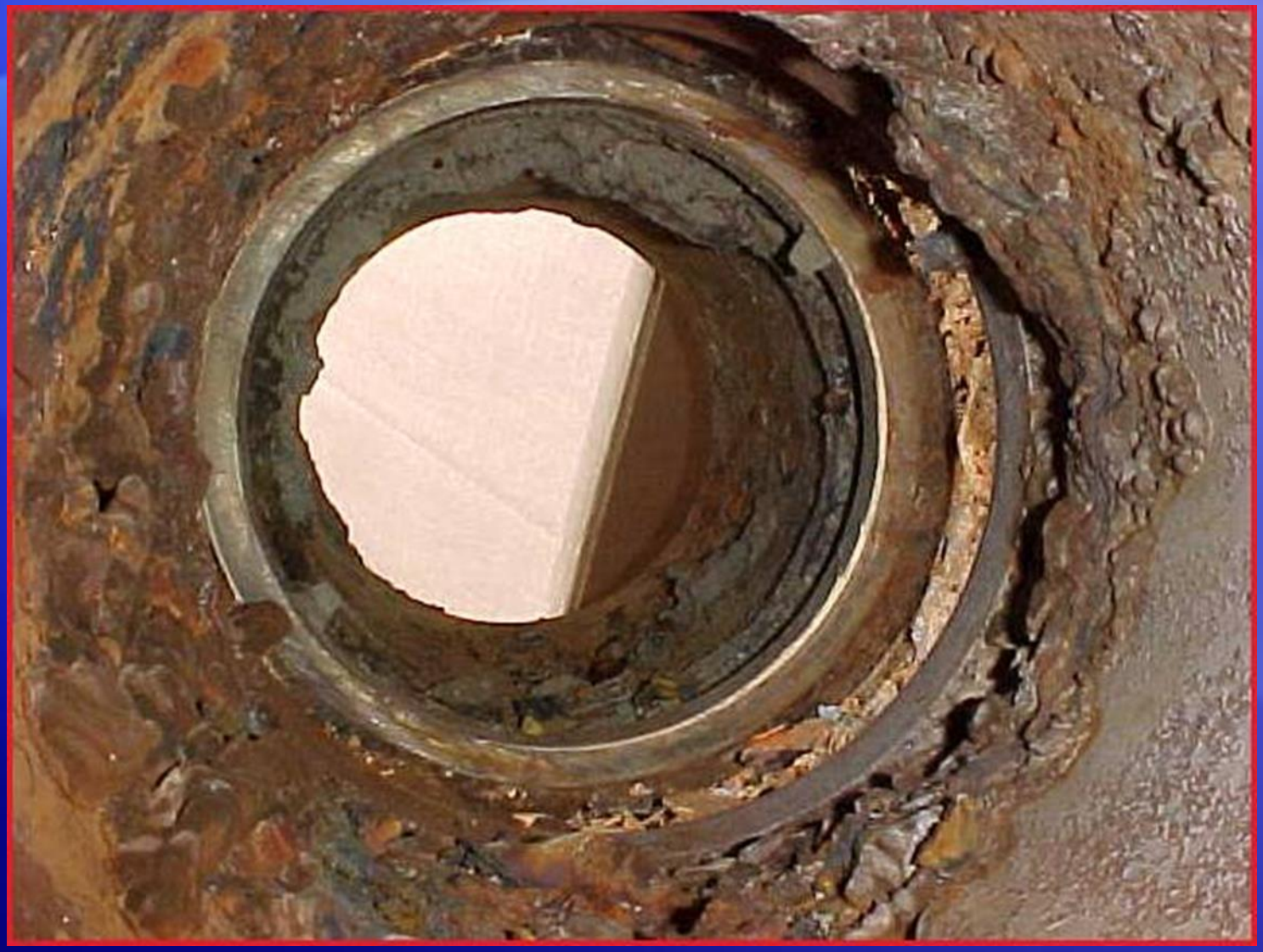
# Valve Operation Troubleshooting



# 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

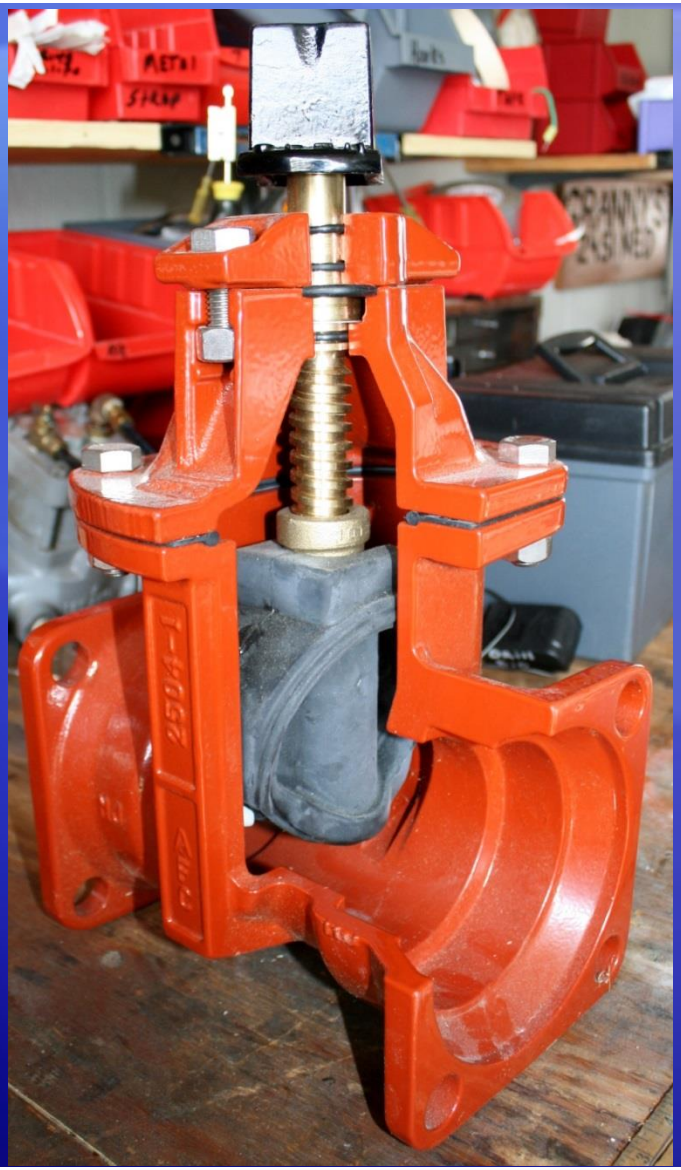
| *Size of Valve in Inches* | *Number of Turns to Open* |
|---|---|
| 12 | 36 |
| 14 | 34 |
| 16 | 34 |
| 18 | 34 |
| 20 | 60 |
| 24 | 60 |
| 30 | 108 |
| 36 | 108 |
| 42 | 108 |
| 48 | 108 |

# 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

# Resilient Wedge Valves

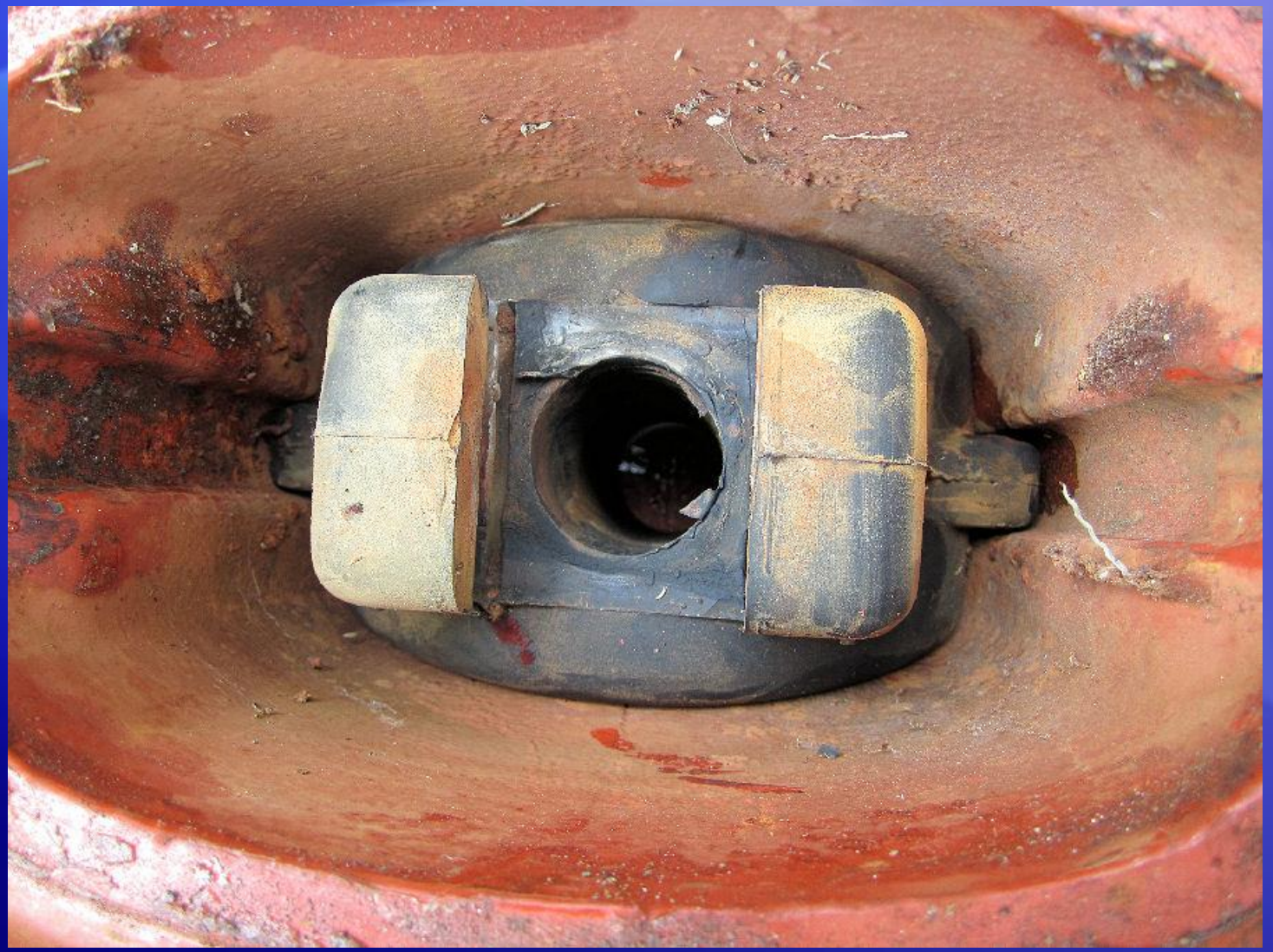


# Resilient Wedge Valves

# Resilient Wedge Valves

# Resilient Wedge Valves

# Resilient Wedge Valves




1993

# Resilient Wedge Valves

| *Size of Valve in Inches* | *Number of Turns to Open* |
|---|---|
| 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 todays 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

| *Size of Valve in Inches* | *Number of Turns to Open* | *Diameter of Stem* |
|---|---|---|
| 4 | 15 | 1 1/8 |
| 6 | 21 | 1 ¼ |
| 8 | 27 | 1 3/8 |
| 10 | 33 | 1 ½ |
| 12 | 39 | 1 1/2 |
| 16 | 52 | 1 7/8 |
| 18 | 58 | 2 1/8 |
| 20 | 64 | 2 1/8 |
| 24 | 76 | 2 ½ |
| 30 | 63 | 2 ¾ |
| 36 | 75 | 3 |
| 42 | 88 | 3 ½ |
| 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 ¼ 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

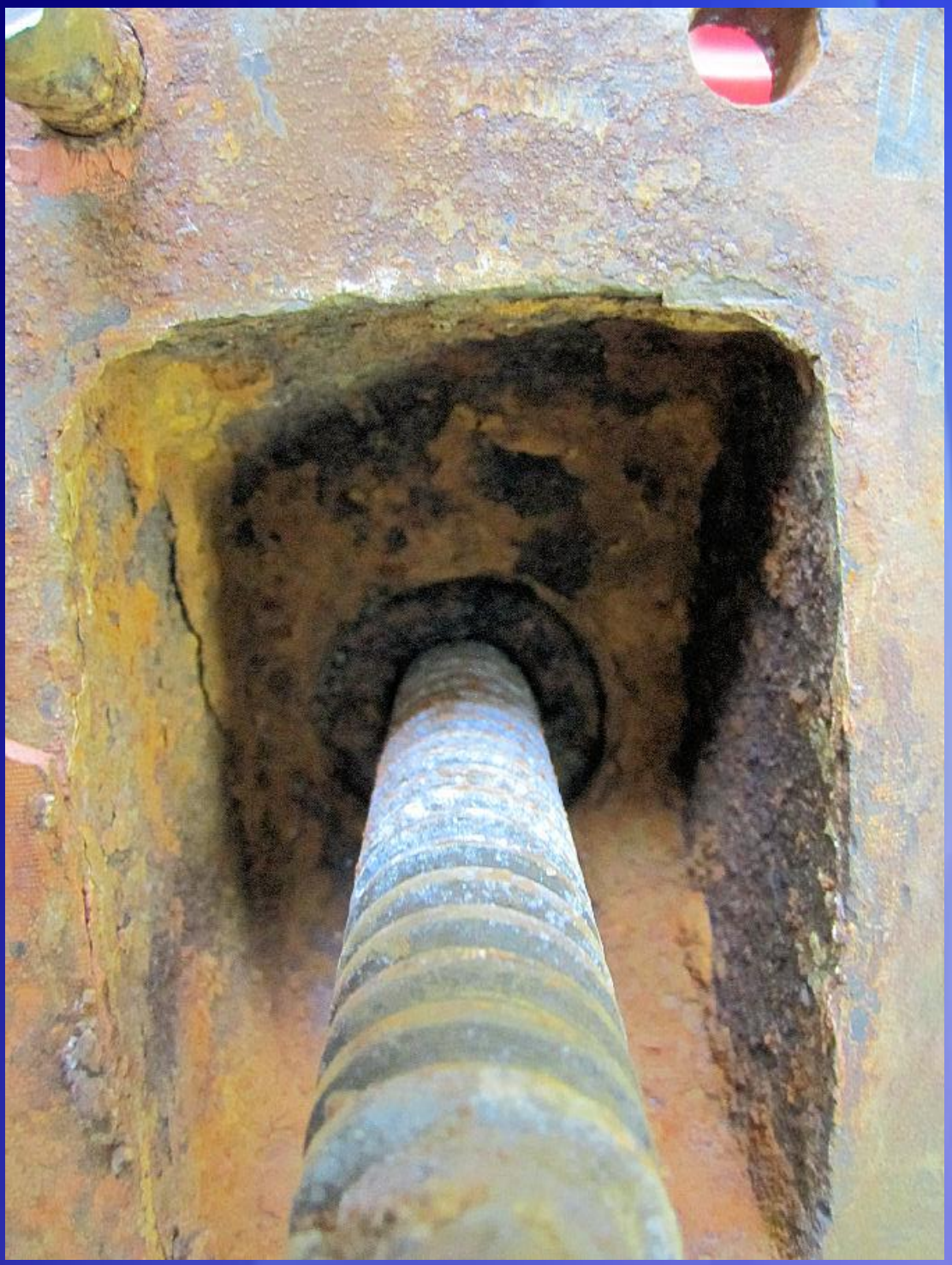
# Troubleshooting

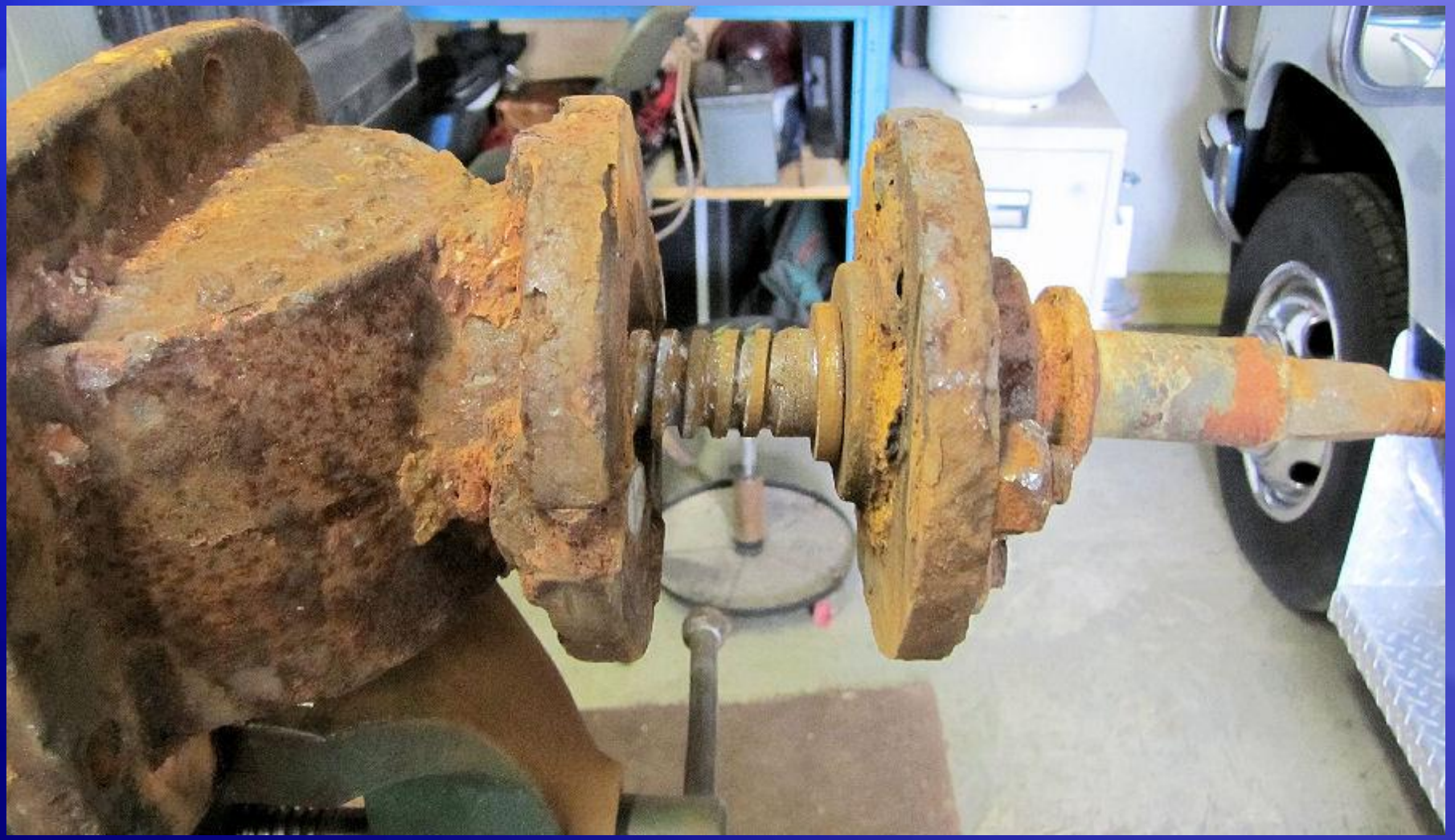
1. Shaft has become worn erratic operation
2. Bearings where applicable are worn
3. Over tightening of packing seal erratic operation

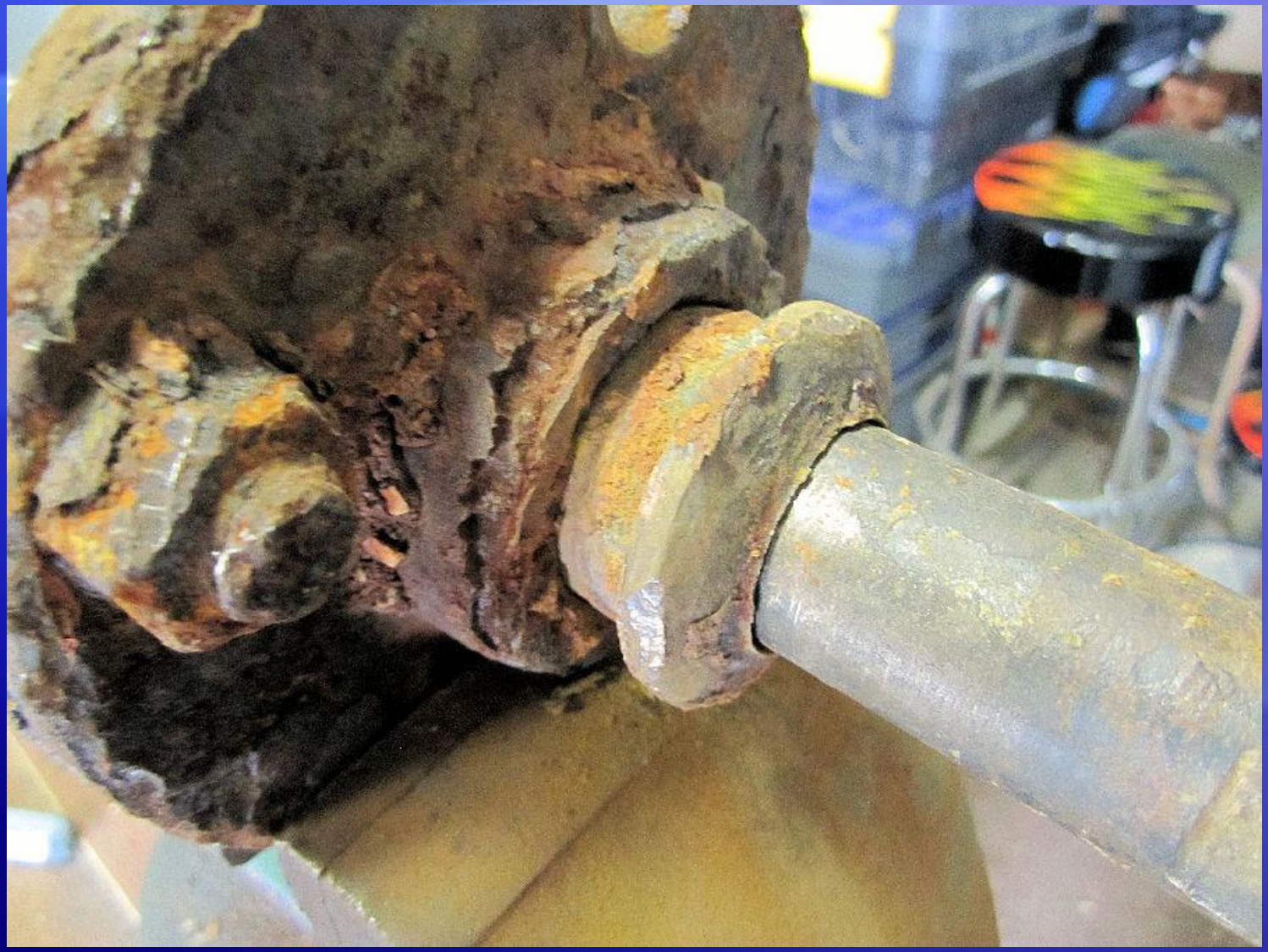

1988

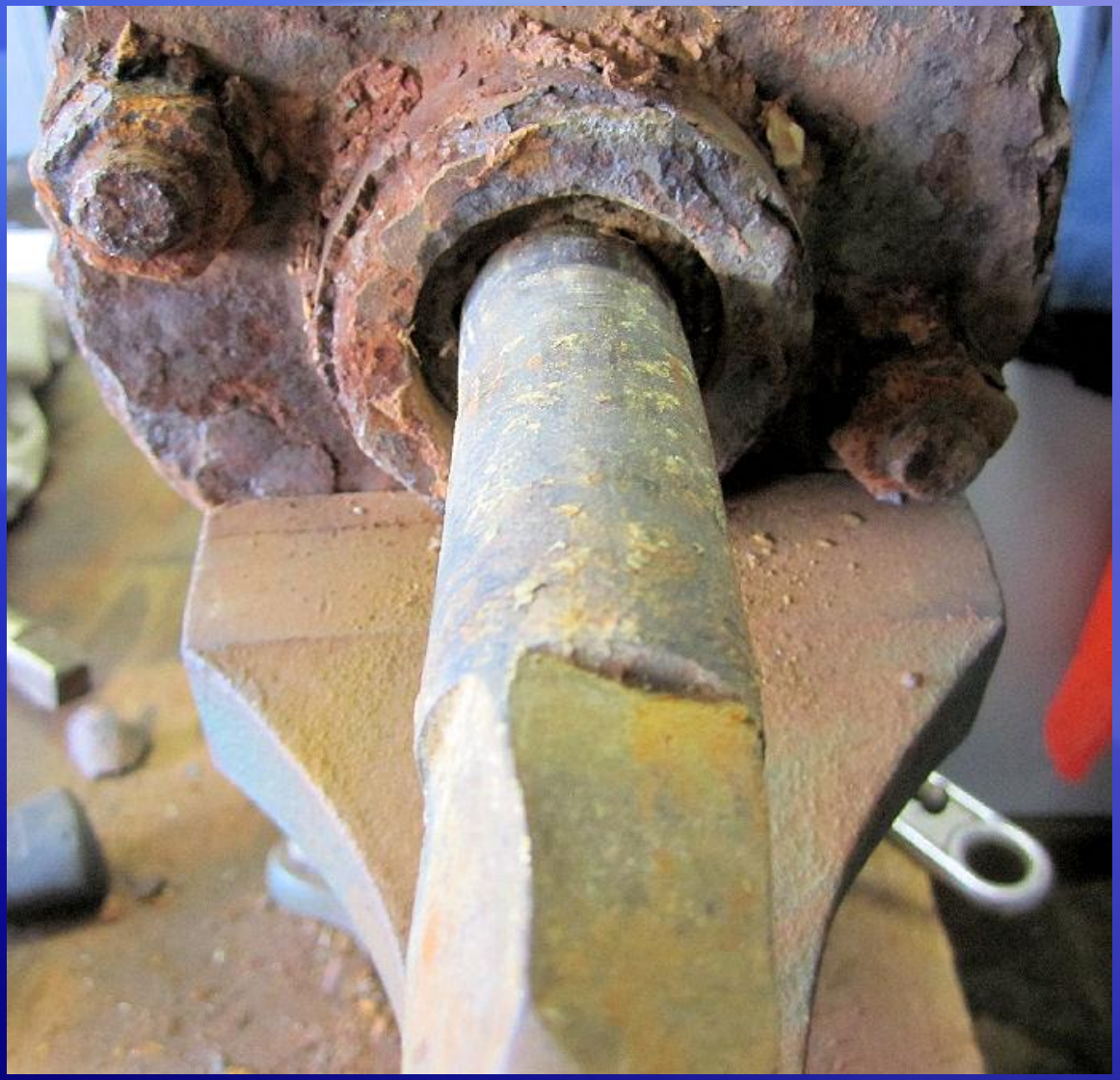

4
1988

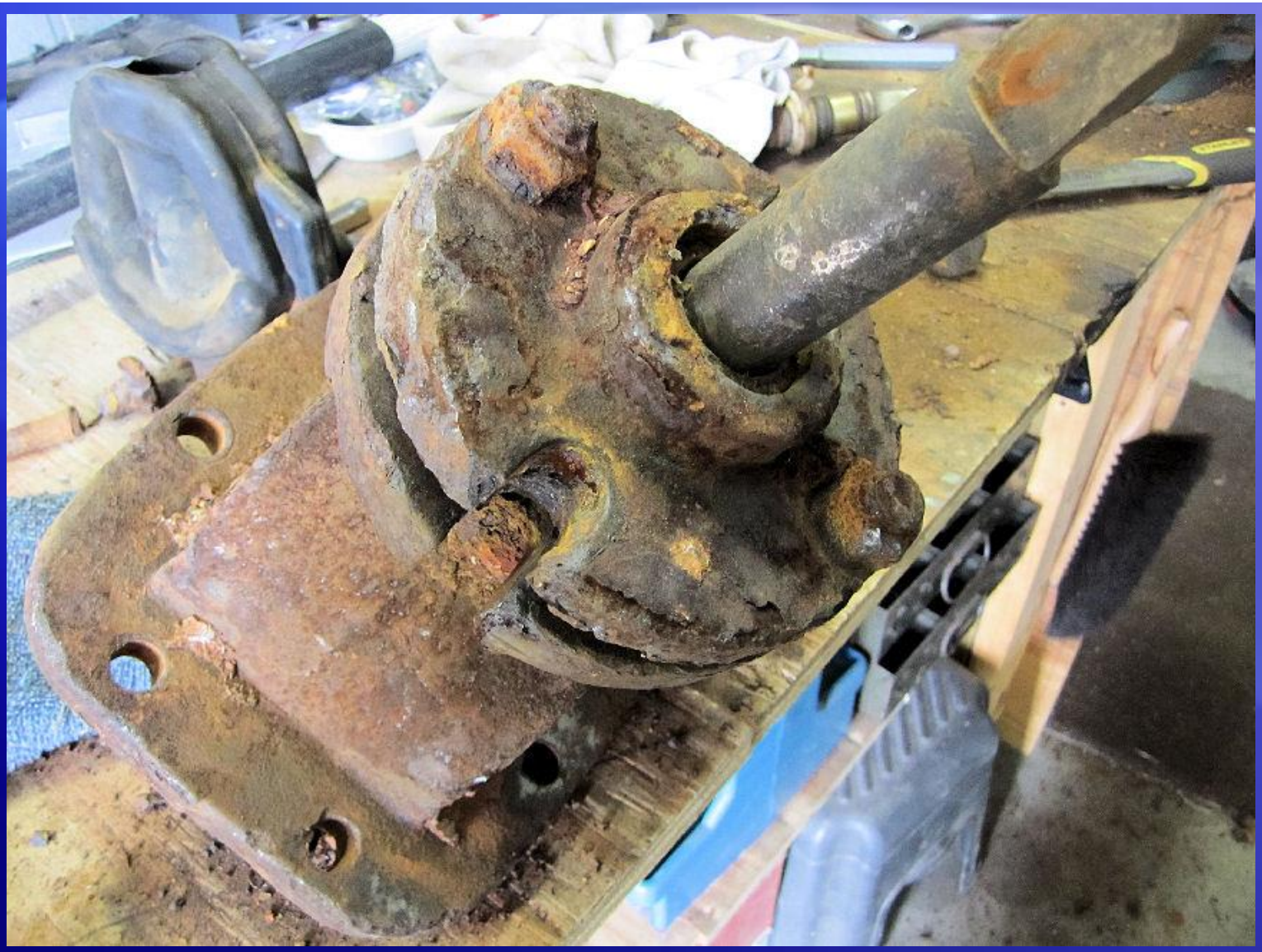

4

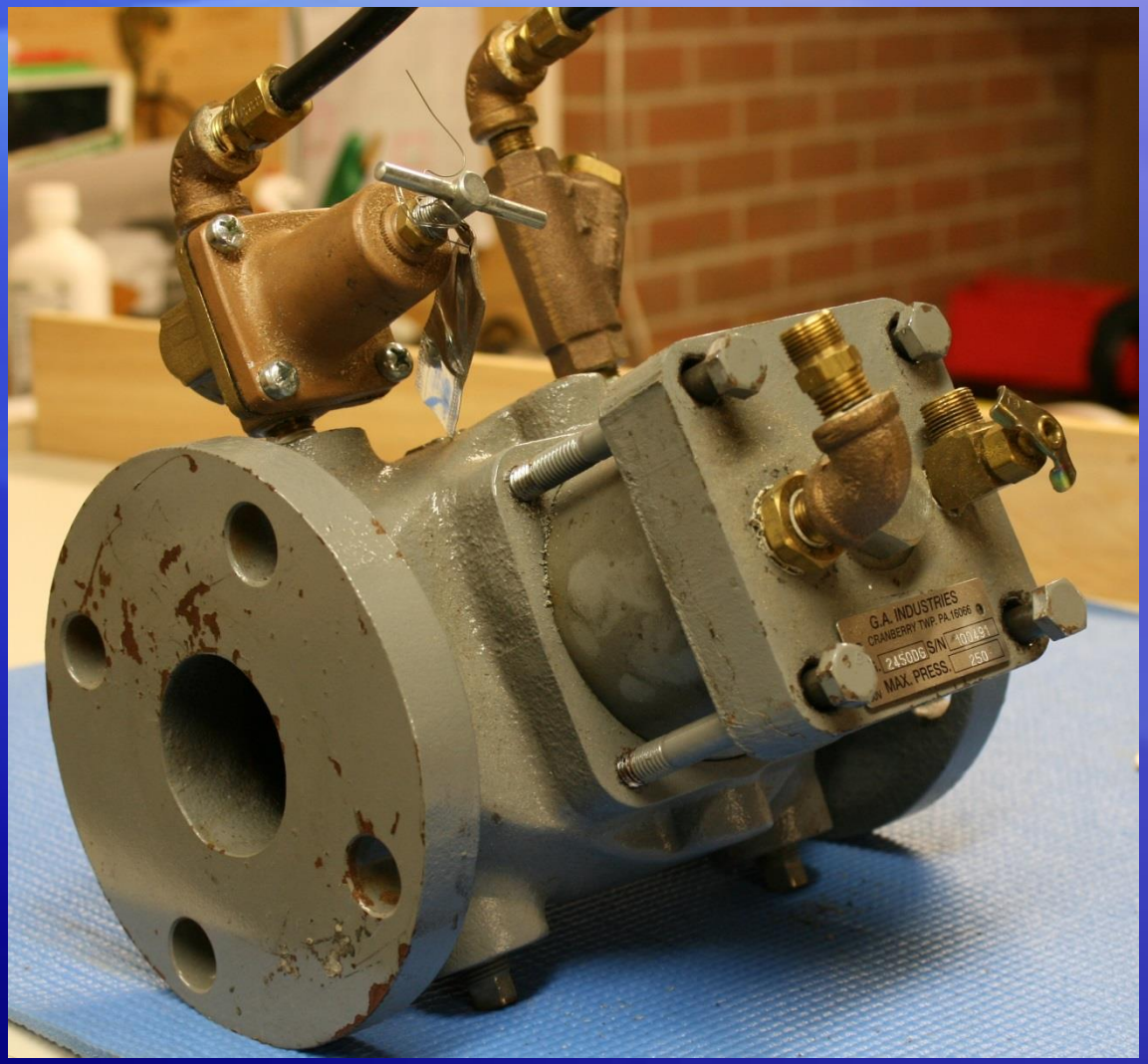


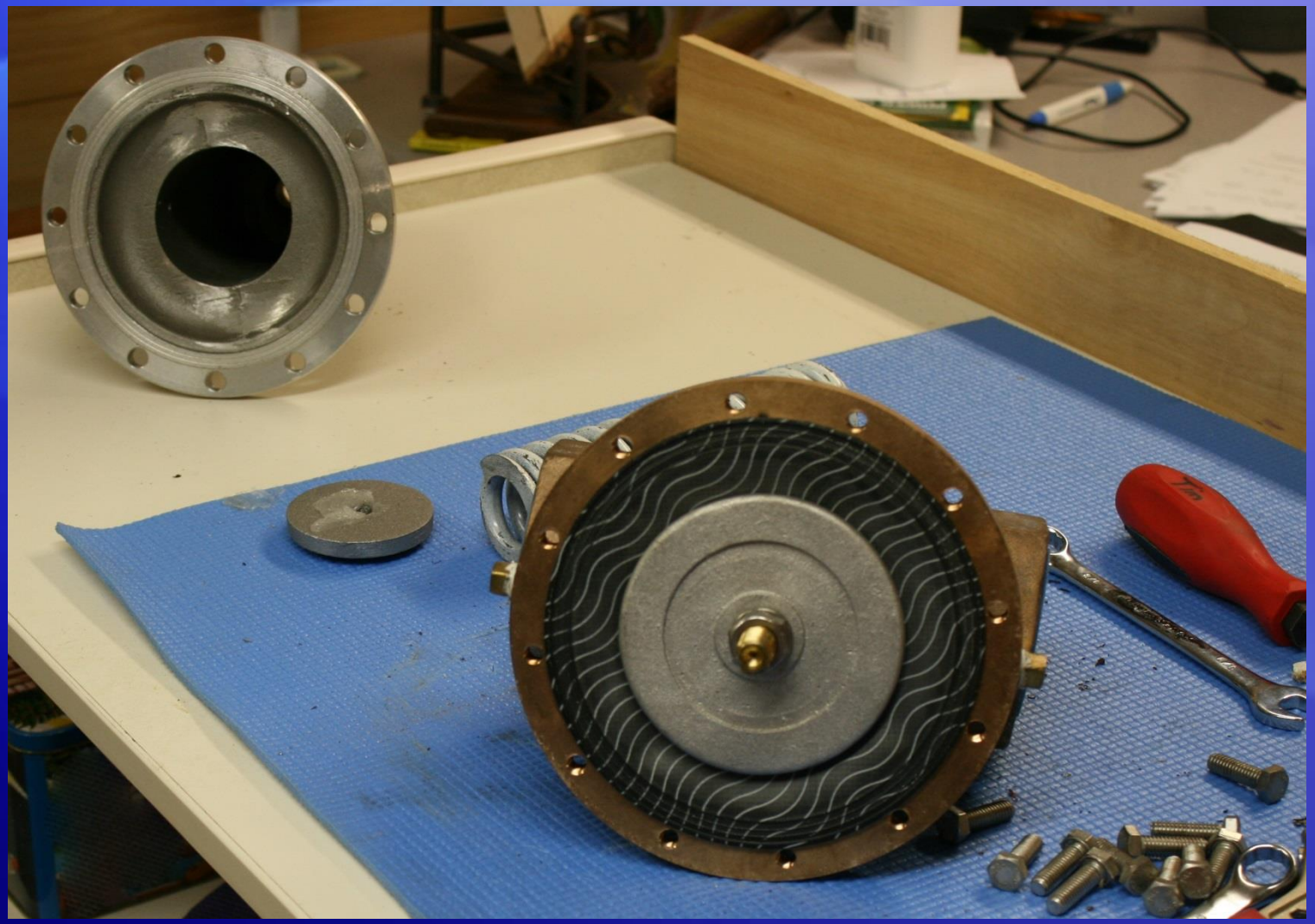


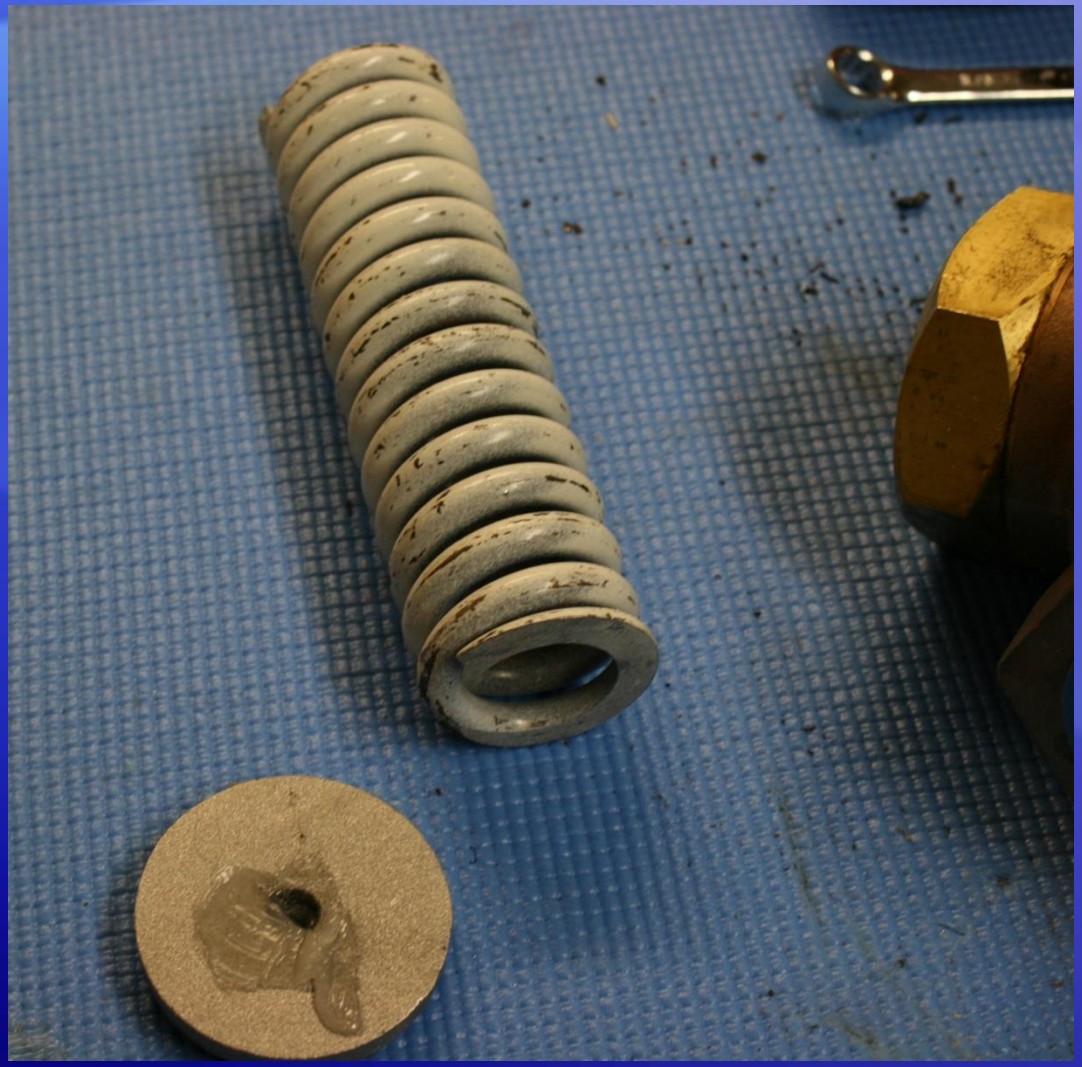




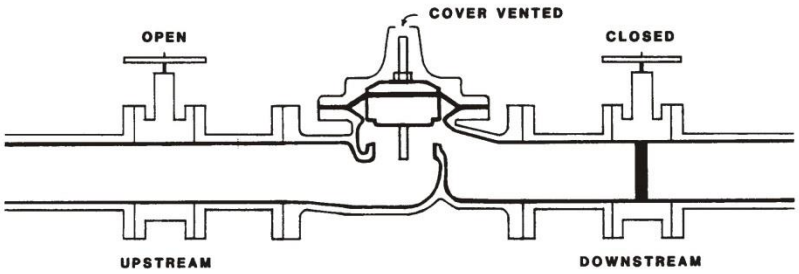



G.A. INDUSTRIES
CRANBERRY TWP. PA 16066
245006 S/N
MAX. PRESS. 250

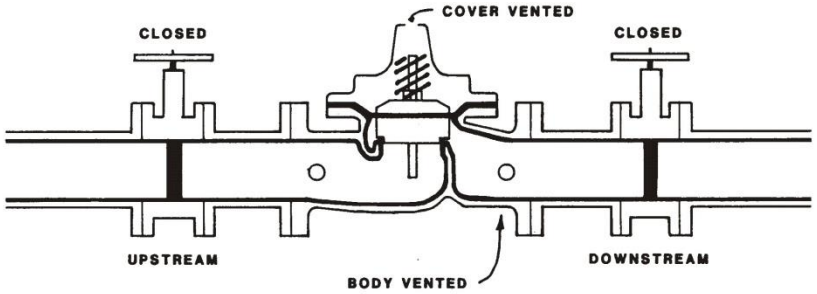




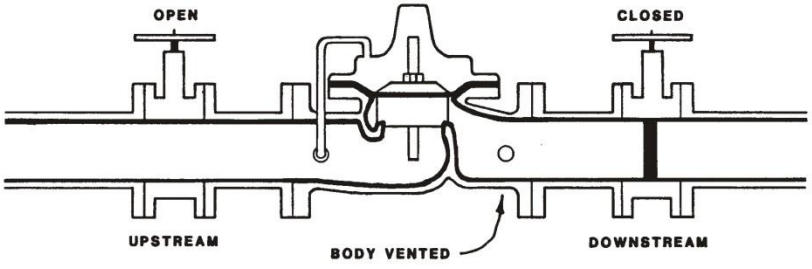
## DIAPHRAGM TEST




## STEM MOVEMENT TEST



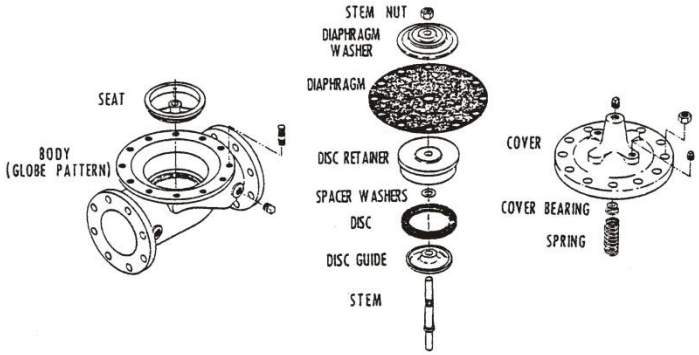

## DISC AND SEAT TEST

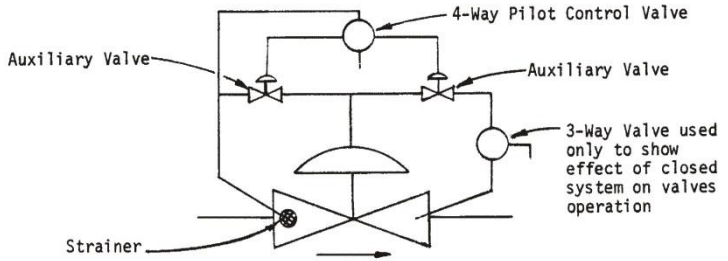


CLA-VAL CO.

# HYTROL

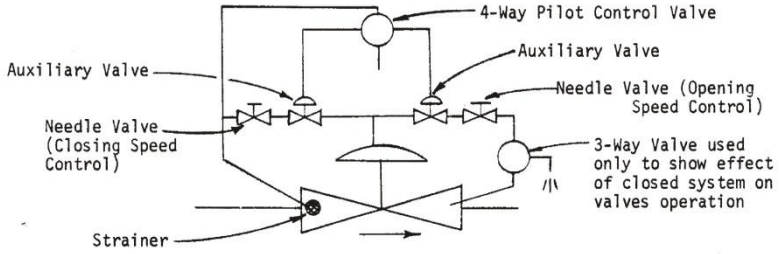
## THREE SIMPLE ASSEMBLIES






Operating Principle — The principle of auxiliary valve operation is to increase the capacity of the control system so fluid will flow into and out of the cover chamber more rapidly. The larger the auxiliary, the more capacity, and, therefore, the faster the operation. The size of auxiliary valve is limited only by the physical possibilities of getting them mounted on the main valve, but for the most part a 3/8" size is sufficiently large.

Speed Control — Control of the operating speed is more essential when using auxiliary valves because of the distinct possibility of too fast a closure with a resultant water hammer. For this reason, a closing speed control is probably of greater importance than the opening speed control. The diagram, however, illustrates both controls.

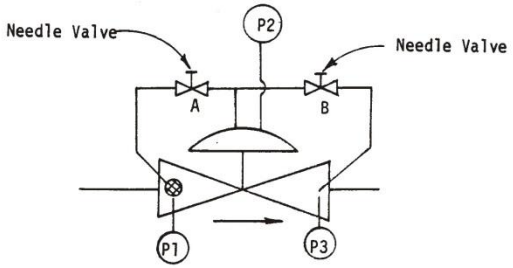



The use of a strainer in the inlet connection as shown is more important than ever when installing needle valves for opening and closing speed control because of the possibility of clogging these valves when they are throttled down quite severely.

**Flow Direction** The direction of flow through the Clayton 81 Check Valve is normally "over-the-disc". This is contrary to the general rule of flow "under-the-disc". Check Valves are arranged this way so a reversal of pressure will close the valve against the reverse flow, and thereby tend to reduce the slam. It is for this reason that a number of years ago the term "no-slam" was given to this check valve.

**Speed Control** The main valve of the Clayton 81 Check Valve lies in the ability to control the operating speed hydraulically with the installation of opening and closing speed controls. These controls simply permit a metering of the fluid into or out of the cover chamber with the consequent control of the speed of operation. This is very desirable, especially on applications where the start-up of a pump throws a surge on the line.

**Demonstration** Equip a demonstration valve with control lines from the inlet into the cover with a needle valve in it, and another line from the cover to the outlet with a needle valve in it also. See diagram below.




1. Check valve operation. Close valve "B" and open valve "A". Apply pressure at $P_1$ and note that no flow occurs. Open "B" and throttle "A" until valve opens and flow begins. Close "B" and observe the valve close slowly. Note difference in closing time for various settings of valve "A". This is a method of demonstrating a check valve operation when it isn't possible hydraulically to apply a higher pressure to the normal outlet of the demonstrator valve.

CLA-VAL TRAINING PROGRAM

"Learning with a Purpose"

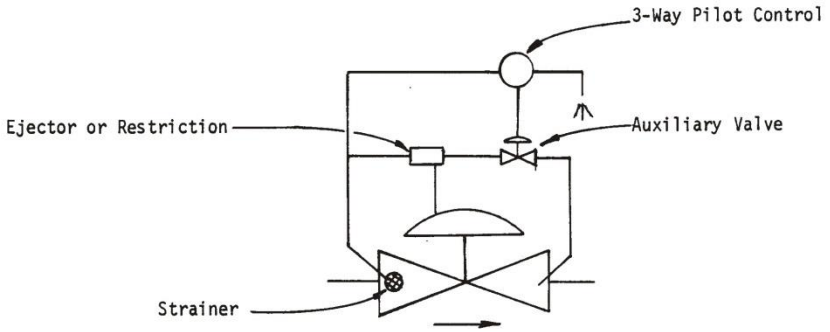
---------- SERVICE TRAINING COURSE ----------

# unit 5 - clayton no. 100 hytrol

## auxiliary control valves

Purpose Auxiliary control valves are used in conjunction with other control system pilot valves to increase the operating speed of CLAYTON VALVES. For the most part, these auxiliary valves are simply 3/8" 100 Hytrol Valves, but there are occasions where extremely fast operation is desired, in which auxiliary valves as large as 1" Hytrols are used. There are two different methods of achieving this auxiliary operation:

1. Ejector method. In this method only one auxiliary valve is used in series with an ejector or similar restriction as shown in the diagram. In this method, a 3-way pilot control valve is needed for operation.



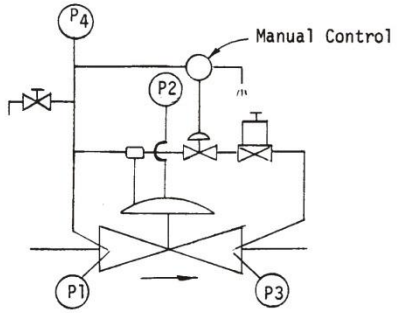

2. Two valve method. Two auxiliary valves connected as shown and operated by a 4-way pilot control valve are frequently used. This is typical of altitude valve operation.

Demonstration (continued)

1. Pressure reduction. Demonstrate the ability of the valve to maintain a constant downstream pressure regardless of fluctuating demand or changing inlet pressure.

2. Remote shutoff. Demonstrate the ability of the remote control pilot valve to either start or stop flow through the regulator whenever desired.

3. Low pressure operation. Determine by experiment how low the supply pressure to the remote control could drop and still have control of the valve. To do this requires the installation of a fourth pressure gauge at the remote control supply point and a by-pass valve to permit the lowering of this supply pressure without affecting the main valve supply.



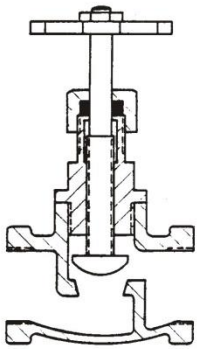

## special purpose valves

Definition

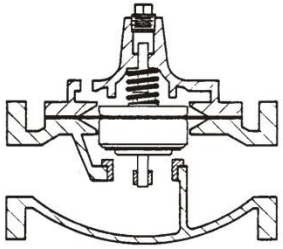
There are some valves in the CLAYTON VALVE line which do not fit into any of the three foregoing categories. To these have been given the designation of "special purpose valves" just for the classification used in this course. This term is not in general use in the Cla-Val Co. literature. There are several such valves, but the one which should be covered here is the Clayton 81 Check Valve.

Check Valve

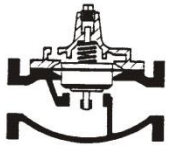
The most common of these special purpose valves is the simple Clayton 81 Check Valve. This valve is a Clayton 100 Hytrol Valve with a tube line connected from the outlet to the cover. It is obvious that, under a reversal of pressure (that is, when the outlet pressure is higher than the inlet pressure), the application of the outlet pressure to the cover will cause the valve to close in just the same way that any Hytrol Valve will close when the pressure in the cover is equal to pressure at the seat.



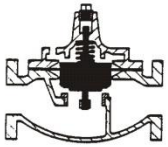
# CLA-VAL Automatic CONTROL VALVES



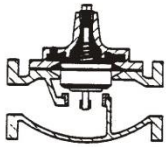
***FEATURE:***



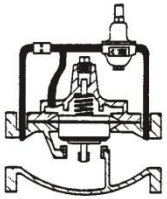
**MODIFIED GLOBE DESIGN**



**DIAPHRAGM ACTUATED**



**HYDRAULICALLY OPERATED**



**PILOT CONTROLLED**