

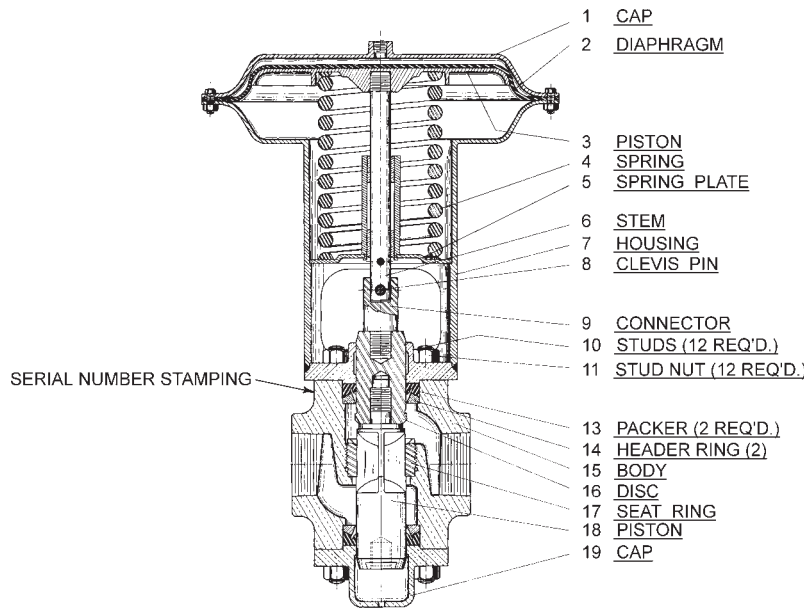


SERVICE INSTRUCTIONS FOR VALV-TROL BALANCED VALVES

These instructions are written for Valv-Trol balanced 2-way valves, in sizes from 3/4" through 4", with all body constructions, including standard bronze bodies or steel bodies. These procedures are also applicable to our balanced 3-way valves, which have two discs and two seat rings for each valve.

For those who want assistance, or prefer to have the valves professionally serviced, **Valv-Trol offers complete valve repair or reconditioning to new standards.** These services are done on a time and material basis, and usually offer significant savings over new valve prices.

Valv-Trol valves can be repaired without removal from the piping, or while mounted in a bench vise. Care should be taken to not distort the valve body in the vise. Grip the valve body in line with the ports, or screw a length of pipe into the port and hold the pipe in a vise.



TYPICAL NORMALLY OPEN (N.O.) 2-WAY VALVE SHOWN



PROPER MOUNTING IN A VISE

SERVICING THE DIAPHRAGM

1. Remove nuts and screws around the diaphragm top cap. Lift off cap and diaphragm and inspect for wear.
2. To replace diaphragm, place top cap upside down on a bench. Place a new diaphragm, which may be flat or molded, on the cap.
3. With a molded diaphragm, insert screws up through holes in top cap and through the diaphragm. Place cap and diaphragm back on housing and replace nuts and tighten for an air tight seal. Over tightening may distort the cap and cause extra leakage.
4. With a flat diaphragm, insert the screws up through holes in cap and diaphragm. Insert one at a time working your way around the diaphragm. (On some sizes it may help to skip some screws and then go back to fill in the blanks.) The diaphragm may appear to be too large, but leave the extra material buckled up between the screws. The diaphragm will end up bulged upward at the middle. Once all screws are through, push the diaphragm down into the cap. It is normal for some buckling to occur, but this will soon go away in operation, and the diaphragm will mold to the proper shape. Place cap and diaphragm back on housing and start the nuts on the screws. It may be helpful to use a C-clamp to draw the housing down enough to start the screws. Tighten all screws for an air tight seal. Over tightening may distort the cap and cause extra leakage.
5. After reinstalling actuator assembly operate valve several times to check for leaks and form the diaphragm. Remember that air pressures over 35 PSI will only reduce the life of the diaphragm and other components.



FLAT DIAPHRAGM INSTALLATION



C-CLAMPS HELP DRAW DOWN THE HOUSING

SERVICING THE PACKERS

1. Remove the clevis pin by applying low pressure air (10-15psi) to the diaphragm chamber to partially stroke the valve. With spring tension now relieved and the cotter pin removed, the clevis pin can be easily pulled out. Remove the nuts or cap screws holding the housing assembly to the body. **CAUTION DO NOT PINCH FINGERS.**
2. Lift housing assembly straight off the body and set aside, being careful not to damage the machined bottom surfaces or inside diameter. The top packer is now exposed.
3. To expose the bottom packer, remove the nuts or cap screws holding the bottom cap.
4. Remove the bottom cap and set aside, being careful not to damage the machined surfaces or inside diameter. The bottom packer is now exposed.
5. If the valve has been removed from the piping, a blast of air from an air gun blown into the open ports may push the packers out. If this is not convenient, a packing hook or sharp instrument may be used to grab the packer and pull it out of the valve. **Be careful not to scratch the inside diameter of the body, or the surface of the piston or disc that moves in the packer.**

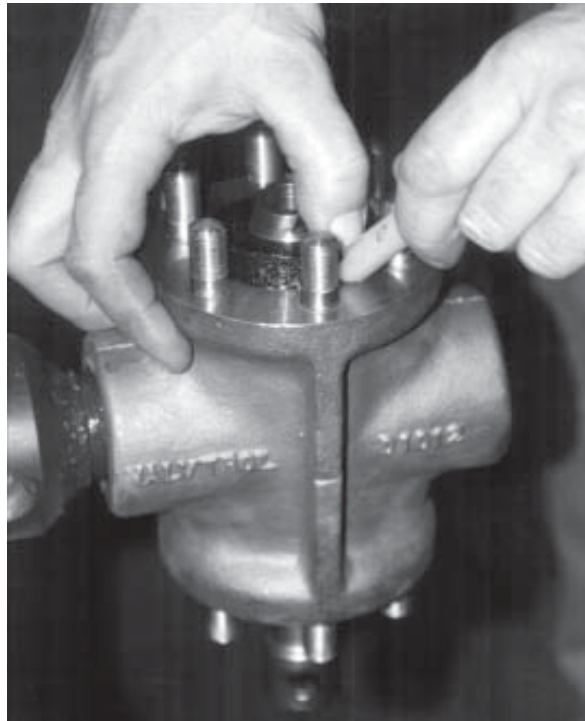


REMOVE AND INSTALL PIN WITH VALVE IN
MID STROKE



REMOVE HOUSING TO EXPOSE PACKER

6. Inspect machined surfaces for signs of roughness or nicks. A rough surface on the disc or piston will shorten the life of the new packers. Replace parts as necessary. A deep nick in the body may also cause the packer to leak. Sometimes, smoothing the nick with emery cloth will help.
7. Look at the header rings underneath the packers and replace if they are broken, badly nicked, or cracked. These rings do not compress the packers for a tighter seal. Their function is merely as a guard and support for the packers, which are energized by the fluid under pressure.
8. To replace packers, lubricate them with a good grease or oil compatible with the material, and place over the disc or piston and into the body with lips facing the pressure side or inside of the valve.
9. Carefully ease the outer lips into the body, being careful not to nick them. A dull instrument can be used to help push the lips into the body, if necessary.



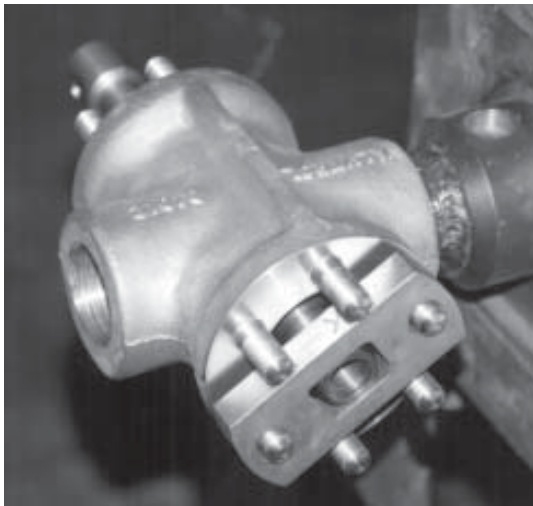
INSTALLING NEW PACKING

10. Once both packers are in place, prepare to reinstall the bottom cap and housing assembly. Check the machined surfaces of the bottom cap and housing for damage. Smooth any nicks or burrs, or replace as necessary.
11. Replace bottom cap and housing assembly, **reinstalling nuts only finger tight.**

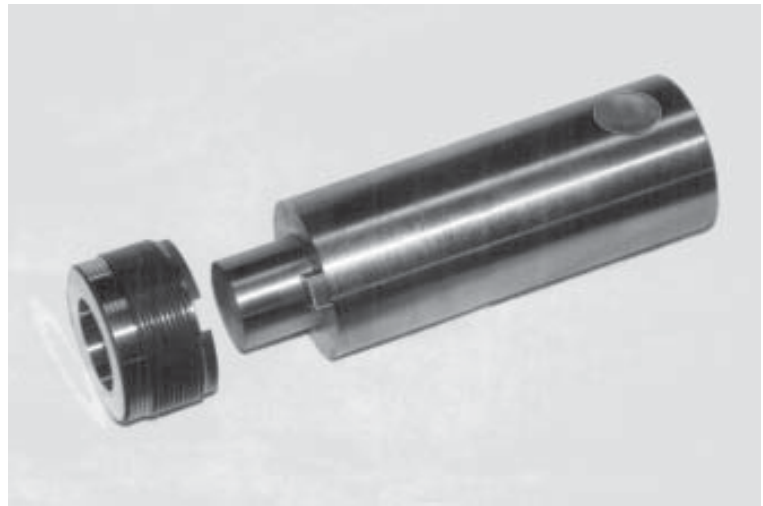
12. Apply low pressure air to the diaphragm chamber again to stroke the valve just enough to replace the clevis pin. **Caution: be careful not to pinch a finger when the stem assembly is moving.** Replace cotter pin.
13. Stroke the valve several times to make sure it shifts smoothly and is properly aligned, and then tighten nuts or cap screws on the bottom cap and housing assembly.
14. Your repair is now complete and the valve is ready to test and reinstall.

SERVICING THE VALVE SEATS

1. Remove housing assembly and bottom cap per instructions for servicing packers.
2. With packers still in place, remove the internal parts by unscrewing the piston from the disc. This is a right hand thread and should have been locked tightly. While it is possible to use an open end or adjustable wrench on each end of the disc/piston assembly, it may be more convenient to use a special disc wrench available from Valv-Trol. This wrench allows one end to be easily held by the studs or cap screws while you use a wrench on the other end.



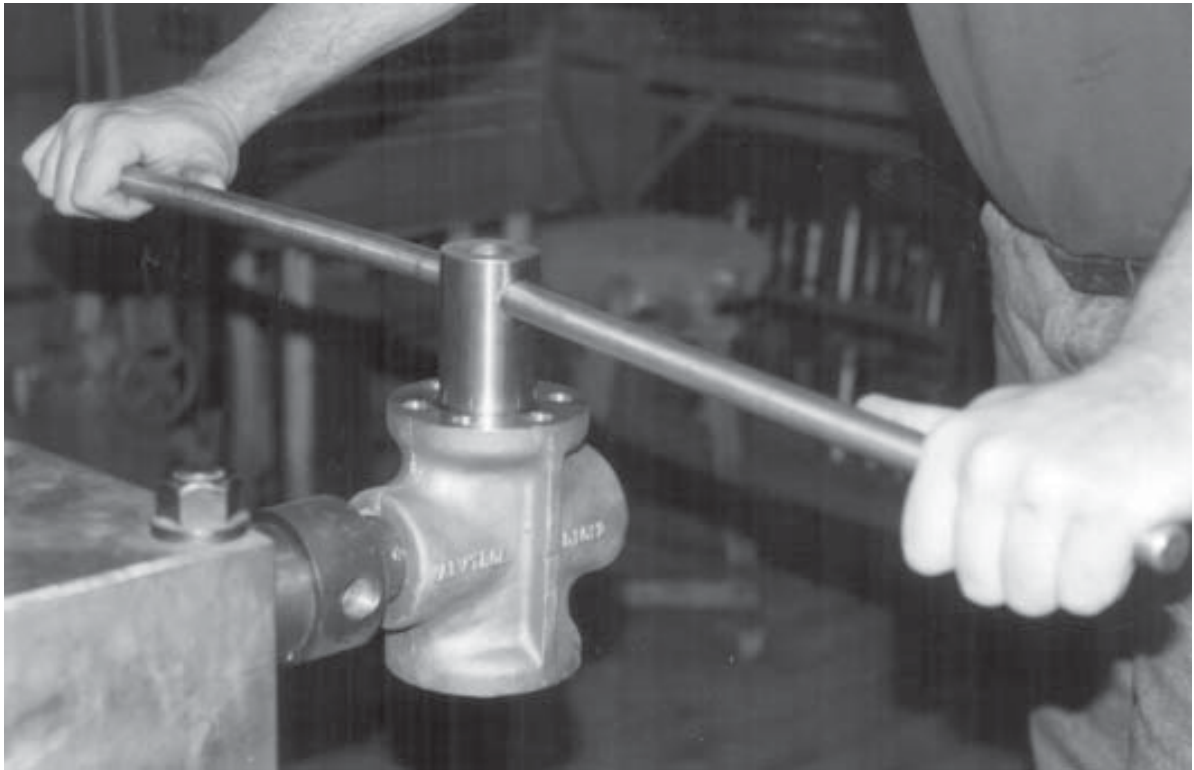
DISC WRENCH INSTALLED



SEAT RING AND SEAT WRENCH

3. Once the threads have disengaged, pull the piston and disc straight out of the body being careful not to nick any of the machined surfaces. The header ring and packer should pull out at this time also. Set aside the piston, disc, header rings, and packers for cleaning and inspection.
4. The seat ring is now the only part left to remove. If the seating surface appears to be in good condition, and if there is no evidence of leakage between the seat ring and the body, and if the seat ring is tight in the body, it may not need to be removed. If there is any question at all, it should be removed to check the machined surfaces.
5. To remove the seat ring, it is necessary to have a tool that will fit the milled slots in the seat ring and extend out of the body enough to receive a wrench or bar for turning. It is also desirable for the wrench to guide on the inside diameter of the seat ring, to help prevent slipping and damaging the seating surface. **A special seat wrench is available from Valv-Trol for each size seat ring we offer.**
6. The valve body must be held firmly to prevent rotation when removing or installing the seat ring.
7. Locate the wrench in the body and turn until the wrench lugs fall into the slots of the seat ring. Insert a 24" to 36" steel bar through the wrench hole, far enough to form a T-handle. Grab both ends of the bar and turn counter-clockwise. It may be necessary to use a longer bar if extra force is needed to break it loose.
8. Once the hardened seat ring is loose and unthreaded, pull it out of the body using care not to damage the machined body.
9. Now that the body assembly is completely apart, all parts should be cleaned thoroughly and inspected. Good machined surfaces and cleanliness are very important here for proper service life. There are basically seven machined surfaces that should be checked before reassembly. They are:
 - (a) The land or shoulder in the body that contacts the seat ring.
 - (b) The flat bottom of the seat ring.
 - (c) The angled seating surface of the seat ring.
 - (d) The angled or radiused seating surface of the disc.
 - (e) The outside diameter of the disc and piston.
 - (f) The inside diameter of the body where the packers seal (the stuffing box area).
 - (g) The ends of the discs, pistons, or spacers.

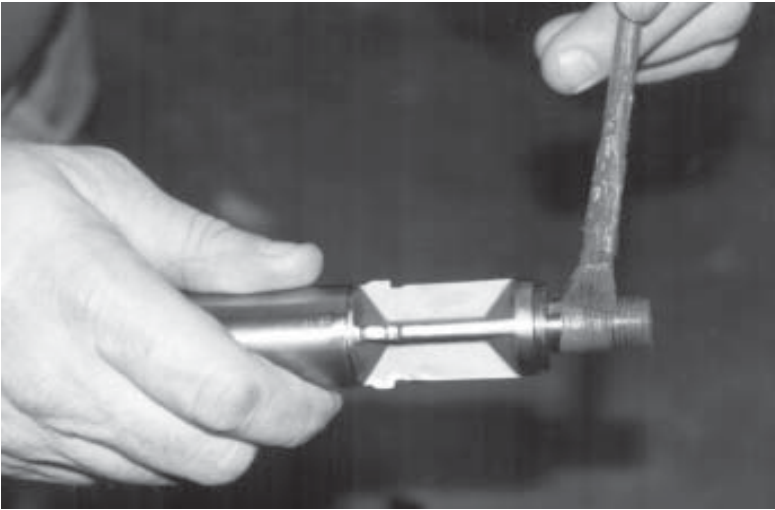
10. Any parts repairs or replacements should be done now. The seat rings and discs can generally be remachined several times if damage is not too severe. We do not recommend remachining in the field. Valv-Trol has the facilities to properly bring these parts back to serviceable condition. We also have the knowledge of how much machining can be done without sacrificing the performance or service life of the valve. **Valv-Trol offers this parts repair service at a very significant savings over new parts.**
11. Marks on the outside diameter of the disc and piston can usually be polished out with fine emery cloth. Any major nicks or grooves may reduce the life of the new packers significantly, so replacement of the disc or piston may be best. Nicks or grooves in the packer area of the body can sometimes be removed by hand with fine emery cloth. The shoulder where the seat ring contacts the body must be perfectly flat and clean to form the proper seal. We recommend running a clean finger around this land, to wipe off all dirt or lint just before replacing the seat ring.



PROPER USE OF SEAT WRENCH AND BAR

12. The seat ring can now be replaced. A lubricant is not needed, but if it is used on the threads, be sure not to allow any dirt or grit to be trapped between the mating surfaces. The seat ring should be tightened with the seat wrench and bar until it is locked tightly in the body. Pull evenly on both sides of the bar. It is nearly impossible to get the ring too tight or strip the threads on any but the smallest size (3/4") valves. A proper fit here should result in the seat ring "snapping" tight in the body. "Mushiness" during final tightening may indicate dirt or burrs on the land. **A tight seal here is important to long service life.**

13. The next step is to lap the disc and seat ring together for a perfect metal to metal seal. We recommend using a 240 grit or finer abrasive lapping compound. A water based compound will generally be easier to clean up after you are done, but an oil based compound will work also. Refer to the lapping instructions for the proper techniques.
14. Once the lapping is complete, the disc and piston can be inserted in each end of the body and threaded together. We recommend using a light coating of anti-seize compound on the male end of the piston (thread and pilot, but not the face), to reduce the chance of galling.



APPLY ANTI-SEIZE COMPOUND TO THREAD AND PILOT ONLY



INSERT DISC PISTON AND SCREW TOGETHER

15. Holding one end with the disc wrench, tighten the other end with a wrench until the disc and piston are firmly locked together. Use care to prevent turning the disc if it is in contact with the seat ring. **A little extra care here will prevent galling or otherwise damaging the freshly lapped seating surfaces.** "Mushiness" during final tightening may indicate dirt or burrs are preventing proper contact between parts. If so, disassemble and clean before reassembly.
16. Insert header rings and packers and reinstall the housing assembly and the bottom cap, per the instructions for servicing packers.
17. Your repair is now complete and the valve is ready to test and reinstall.

WHY LAP?

Since a metal to metal contact is used to shut-off the flow of liquid, it's only natural that the better the two metal parts contact each other the better the valve will shut-off. A leaking valve increases operating costs because it reduces the efficiency of the pumping system, and can cause a heat buildup that may cause other problems. Worse than that, a leak with some fluids, such as water, can erode or "wire draw" the seating surfaces enough to cause increased leakage. If left unattended, the process will continue until the valve is no longer usable. Any leaking valve should be serviced at the first sign of problems.

The best way to assure that the valve will shut-off tightly is to lap the disc to the seat ring with a fine abrasive compound. We have found a water based abrasive of 240 grit or finer works best on our valves. The water based compounds are generally easier to wash out after lapping, but an oil based compound will work well if cleaned out thoroughly. The following will take you through the lapping procedure we perform here at the factory, and recommend any time seats or discs are removed or changed. Valv-Trol now offers a convenient container of water based lapping compound under part number SK-305.

Before starting, it is important to realize that the seat ring should be tight in the body of the valve before lapping. You should also note that the seat ring has an angled seating surface that will be in contact with the disc. Most discs however will have a "spherical radius" that contacts the seat ring angle. You may picture this better by imagining a large hardened stainless steel ball resting on the seat ring (see illustration). The ball can be twisted or turned to any position, and yet stay in full contact with the seat ring angle. We use this same principle on our valve discs to allow the disc to contact the seat ring at any angle and still seal tightly. This unique concept allows the valve to seal on a very specific ring diameter so that the forces in the valve are "balanced" or pushing both directions evenly at the same time. This also allows you to lap the surfaces together without having to precisely guide the disc in the body. Knowing this, you may now begin the lapping procedure.

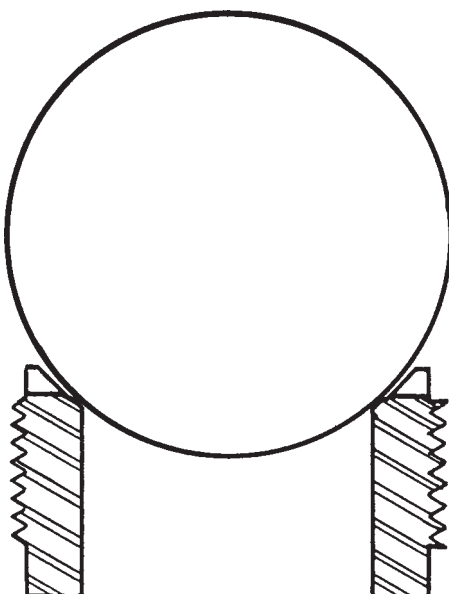
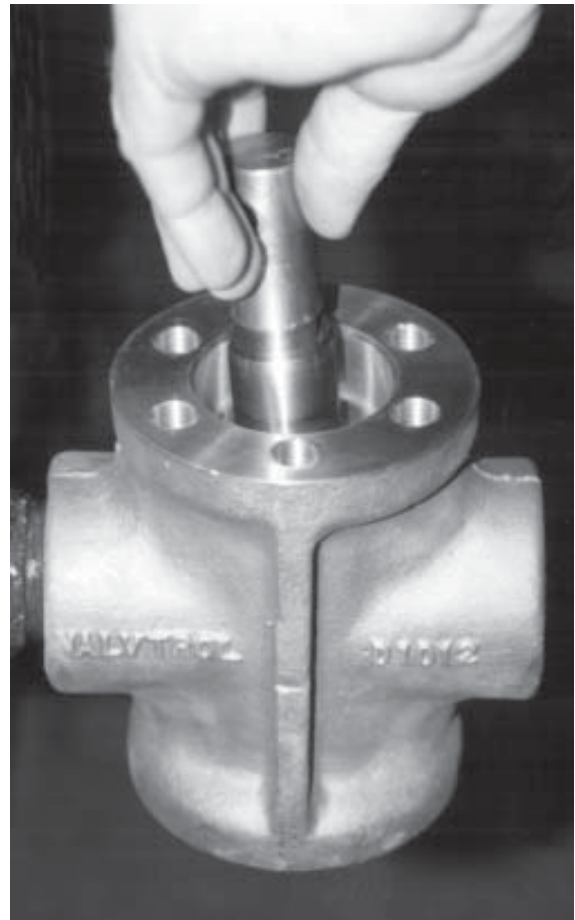
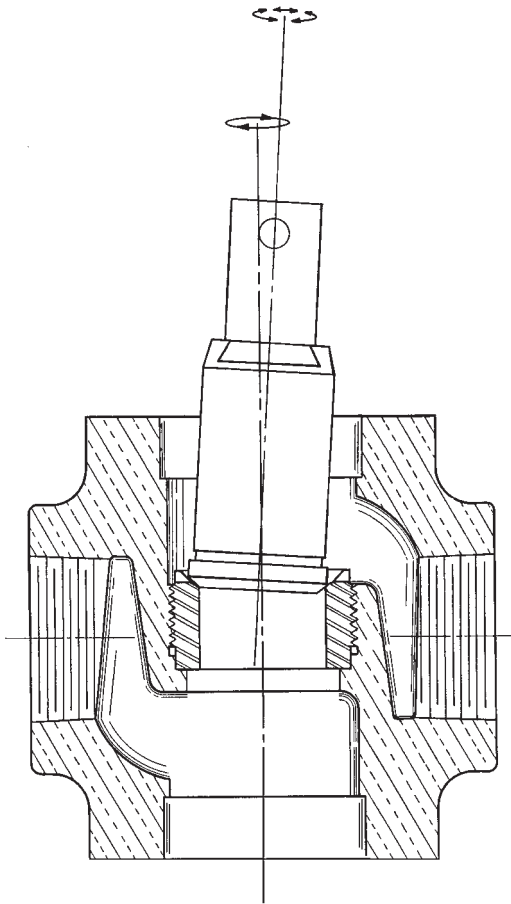


ILLUSTRATION OF VALV-TROL'S SPHERICAL RADIUS CONCEPT

LAPPING PROCEDURE

1. Mount the valve body in a vise with seat ring installed and facing upward.
2. Apply a small amount of 240 grit or finer abrasive lapping compound to the radius of the disc.
3. Carefully lower the disc into its seating position on the seat ring. (It may be helpful to thread a spare connector into the back end of the disc to get a better grip for lapping.) Allow the weight of the disc to hold it in contact with the seat ring as you use a light back and forth twisting motion (see illustration).



Continue this oscillating motion while also allowing the disc to gradually rotate at least 360 degrees.

5. On discs with a spherical radius (all except 3/4" valves), the disc should be rotated at various angles off the main axis of the valve. This preserves the radius while letting all points of the disc contact all points around the seat ring angle.

6. Most 3/4" valves have discs with an angle rather than the spherical radius of the larger sizes. To lap these valves, it is necessary to guide the disc and keep it in line with the bore of the body. This can be done by making a brass bushing that will fit the disc and body and will guide the disc during lapping.
7. Occasionally lift the disc to allow new compound to find it's way onto the seating area. Never let the compound dry out, as this can cause galling. If the compound has broken down or dried out, pull out the disc, clean, and apply more compound. Repeat the lapping and cleaning until you see a solid light gray area all around both parts, indicating that they are in complete contact with each other. As you approach completion, let the compound break down into a finer grit for final lapping. As usual with any skill, lapping will get easier and faster each time you do it.
8. On repairs done in our shop, we also go one step further by checking with "Prussian Blue" for complete contact of the two parts. Remember, the better the contact between these parts, the better the valve will shut off, and the longer it will give trouble free performance.
9. Once the lapping is complete, thoroughly clean all parts of excess abrasive compound and flush out the body as much as possible. Set aside the clean disc in preparation for reassembly. Remember that even though the seat and disc are made of very hard materials, accidentally bumping with a harder material can damage the seating area, spoiling your freshly lapped surfaces.
10. Proceed with reassembly per previous instructions.

TESTING AFTER MAINTENANCE

We always recommend testing the valve at operating pressures after servicing the valve seats. By pressurizing one side of the valve with water or oil, and leaving the other port open, you can test how well your repairs have been made by watching for leaks. All valves should shut off "Drop Tight" or have zero leakage at their operating pressures. Testing with liquid allows a better simulation of actual operating conditions.

OTHER VALV-TROL SERVICES

- COMPLETE PROFESSIONAL VALVE REPAIRS AND TESTING TO NEW STANDARDS. NO ONE ELSE HAS THE EXPERIENCE, KNOWLEDGE, AND FIXTURES TO BRING YOUR VALVES BACK TO **LIKE-NEW** CONDITION.
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