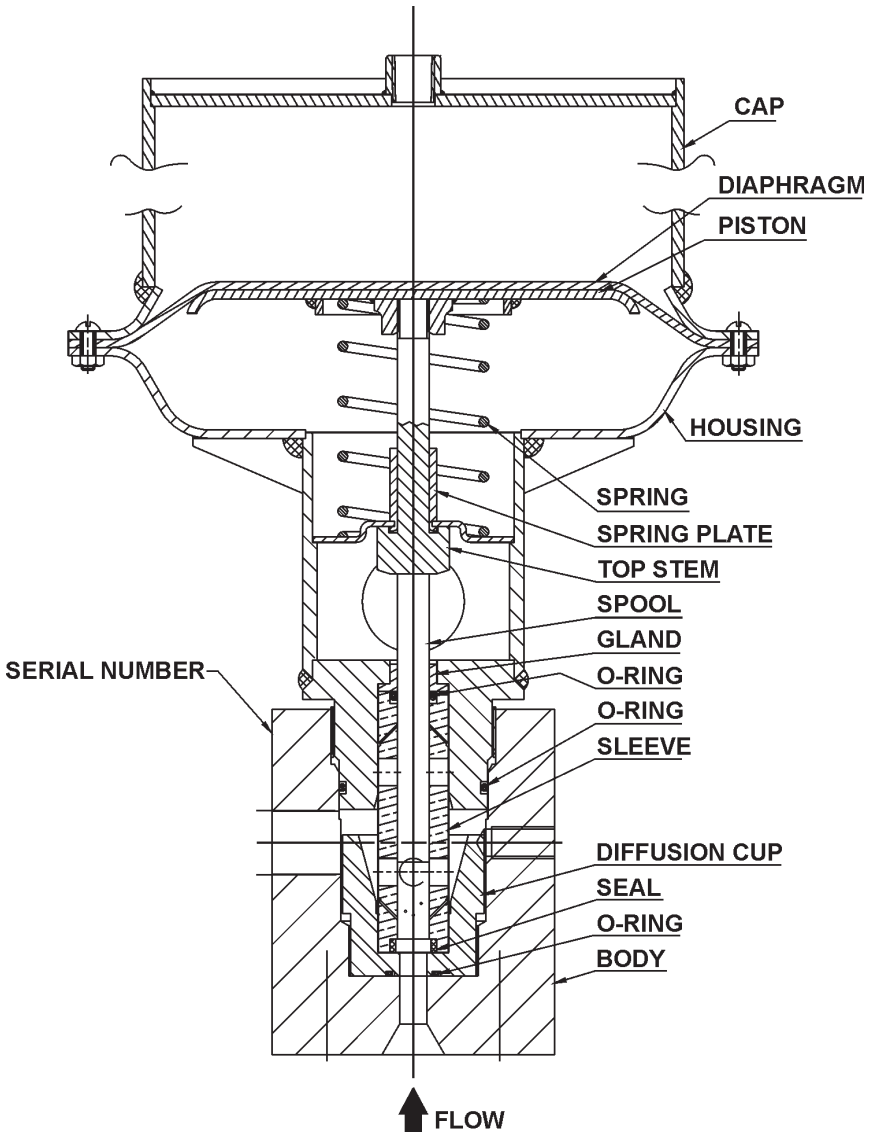
Installation and Operating Instructions
For Valv-Trol Back Pressure Relief Valves

These instructions cover Valv-Trol Back Pressure Relief valves in series #C-0274, C-0284, and C-0294. These valves share common principles of operation, and construction, but differ in flow capacity, materials of construction, and/or actuator size. Valv-Trol prints are available to illustrate specific features. These prints show the valve parts, repair kits, dimensions, and cut-away views of specific valves. Further information can also be found on Valv-Trol Bulletin #A-33

Principle of Operation

Back Pressure Relief Valves are generally used for controlling the discharge pressure (back pressure) of positive displacement pumps. They operate by balancing the liquid system pressure and an air signal applied to the diaphragm by a precision air regulator or transducer. **No external controllers are required.** An internal spool is positioned to adjust the effective orifice size for proper bypass flow to maintain a given pressure setting.



On most spray systems, the pump is oversized slightly to allow some bypass flow through the valve when operating with new nozzles. This flow is the extra capacity that can be used to compensate for nozzle wear.

For startup of the pump, the air signal to the valve is vented, or started at a lower than normal air pressure. This allows the pump to start unloaded, easing the job of the motor. Once the pump is up to speed and a constant air pressure is applied, the spool finds its balancing point, and the discharge pressure stabilizes. **The higher the air pressure, the higher the liquid system pressure**.

If system demand increases (more valves opened, nozzles added, etc.), the spool automatically moves down to reduce the effective bypass orifice, and send more flow to the system. As long as the pump has enough flow capacity to meet the demand, this will prevent a pressure drop. If system demand decreases, the spool moves up to increase the orifice and prevent a pressure rise.

Installation and Operation

The bottom inlet port of a Back Pressure Relief Valve should be tee'd off the high pressure pump discharge line. The side port can be plumbed back to reservoir with low pressure pipe. (A visible section in this line may help in troubleshooting the condition of the system.) The pump should always be protected with a separate safety relief valve. Air from the control regulator is plumbed into the top of the air chamber.

In a well-maintained system, the Valv-Trol Back Pressure Relief Valve will bypass any extra pump flow not required by the nozzles, to maintain system pressure. During normal operation, the spool is pushed up by system pressure, and pushed down by the air signal. The spool will find a position to balance the forces, and stay there until something changes. This is easily observed by looking into the windows (holes) in the housing, during operation. You should note this spool position at initial startup, when all components are new. **CAUTION-PINCH POINT: Do not place fingers or objects in the windows, as the spool may move up suddenly if a pump is started or the valve senses pressure.**

As nozzles wear, the Back Pressure Relief Valve will automatically compensate by reducing the bypass flow. This is accomplished as the spool is pushed further down into the sleeve, reducing the effective orifice. As the wear increases, the spool will ride lower until it cannot close any further (top of spool is even with the bonnet). By comparing the current spool position to the position when new, you can get a good indication of the condition of the system.

When the top of the spool is flush with the bonnet, and the top stem is fully extended, the valve cannot close any further. If components are not replaced, system pressure will continue to fall off. This is where it is handy to see how much flow is going back to the reservoir. If bypass flow is excessive, the Back Pressure Relief Valve itself may be worn and need service.

Service Life

The service life of these valves is dependent on many factors such as type of fluid, operating pressures, pump flows, cleanliness levels, temperatures, duty cycles, entrained solids, etc.

Since it takes just a few minutes to open the valve for inspection, we suggest making an initial inspection at about 1000 hours. This will let you monitor valve wear under your operating conditions. We recommend that the user regularly monitor the condition of the spool, sleeve, diffusion cup, and body, and record conditions for tracking of service life. Once a pattern is established, it will be easier to predict when service is necessary. Subsequent inspections can then be scheduled at appropriate times.

Built-in Spares

One unique feature that is sometimes overlooked is that the sleeve and spool are the same on both ends. This is done to provide built-in spare trim. If the spool or sleeve has worn enough that your pump cannot keep up, and your pressure is dropping off, you can invert these parts to expose the new end, and be back in business again, with no additional parts needed (The seal and o-ring need to be switched from end to end). Of course, any parts that are not serviceable should also be replaced at this time.

Servicing the Diaphragm

A ruptured diaphragm will not allow the proper force to be generated to balance the spool. If you can feel air escaping around the window area when the valve is not moving, you may need to replace the diaphragm.

To remove the old diaphragm, remove and lock out all power to the machine, and vent the air chamber. Remove all nuts around the top cap, and lift it off. Inspect the diaphragm for damage, and decide whether to re-install or replace.

To install a new diaphragm, place the top cap upside down on a bench, or screw it onto a pipe nipple mounted vertically in a vise. The diaphragm may appear to be too large, but insert the screws up through the holes in the cap and diaphragm, leaving 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 it will mold to the proper shape.

Place cap and diaphragm back on the 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 airtight seal. Over tightening may distort the cap and cause extra leakage.

After reinstalling the actuator assembly, apply air to check for leaks and to form the diaphragm.

FLAT DIAPHRAGM INSTALLATION

C-CLAMPS HELP DRAW DOWN THE HOUSING

Valve Disassembly

The Valv-Trol Back Pressure Relief Valve is very easy to service and no special tools are needed. Removing the actuator (housing assembly) from the valve body exposes all the working parts that are contacted by the liquid being pumped. To reduce down time, valves can usually be repaired without removal from the piping.

The first step to maintaining the valve is to remove and lock out all power to the machine. Once all residual pressure is bled off, the valve can be opened for service by simply removing the air connection at the center of the top cap, grabbing the housing, and unscrewing the actuator from the body. If you need a little extra help, you can put a bar through the windows in the housing for added leverage. Once the housing threads are backed off completely, lift off the actuator and set aside.

Valve Disassembly (continued)

If the sleeve or gland sticks in the housing, be careful not to let it fall to the floor. An impact with a hard floor could shatter a carbide spool or damage otherwise good parts. When the housing assembly is removed, you now have full access to the spool, sleeve, diffusion cup, and all the seals and o-rings.

Parts should be cleaned and carefully inspected. The diffusion cup is a sacrificial part, which protects the valve body from the high velocity jets coming through the sleeve. After many hours of operation, it is normal to find some surface discoloration and wear on the inside of this cup.

What you want to look for is severe erosion. If there are ragged holes in the diffusion cup, but none are completely through, the parts may still be serviceable. As long as you can rotate the parts so that the holes in the sleeve do not line up with the eroded area, you should be able to reuse the cup.

If the diffusion cup has holes clear through the sides, it is no longer able to protect the valve body, and should be replaced.

Reassembly

When all parts are cleaned and ready, lightly lubricate the o-rings and seal, and place the diffusion cup (with o-ring) in the body. Install the sleeve, spool, gland, and then screw on the housing until it makes contact with the sleeve.

The valve has been designed to go back together without the need for any wrenches. Simply grab both sides of the diaphragm top, back it off about 1/4 turn, and give it a quick spin clockwise to tighten. Hand tight is sufficient, and using a bar will only increase the chance of distorting the sleeve.

Reinstall the air connection, and prepare for startup. Any scale, or foreign material in the lines that may have been disturbed should be allowed to flush through the valve before the air is applied. Proceed with normal operation

Testing after Servicing

Valv-Trol always advises testing for internal and external leakage, after repairs are made. If repairs are made in-line, watch for signs of leakage upon startup. If anything unusual is detected, shut down the pump, determine the cause, and take corrective action.