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Keeping Fisher Internal Valves Working

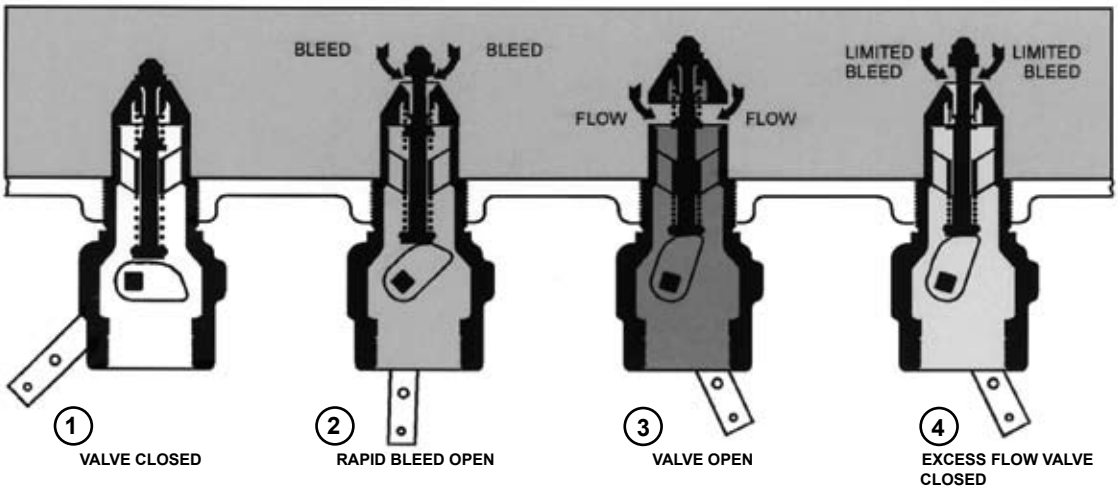

Figure 1. *Operational schematic of a typical Fisher internal valve.*

Introduction

Internal valves are one of the most important elements in a bobtail or transport truck's transfer system. While Fisher internal valves are widely used on trucks hauling LP-gas–as well as other compressed gases–some drivers and maintenance mechanics run into problems when they don't completely understand how the valves work. This bulletin brings out four points about Fisher internal valves: (1) recommended operation, (2) correct installation of valve actuators, (3) proper maintenance, and (4) trouble shooting tips.

Operation

Moving a Fisher internal valve's operating lever to the fully open position does not open the main poppet immediately. Instead a pilot equalizing valve is opened to allow tank pressure to bleed downstream.

Referring to the schematic in Figure 1, the shutoff portion of the valve is held closed by both tank pressure and the closing spring (illustration 1). Positioning the operating lever about mid-point in its 70° travel (illustration 2 in Figure 1, and Figure 2) places a smaller section of the valve's stem in the pilot bleed opening. Pressure can equalize much faster in this position, called "rapid equalization," than if the lever was fully opened.

After a few seconds, a click can be heard indicating that pressure has equalized on both sides of the main poppet and that the poppet has opened (illustration 3). The operating lever can now be moved to the full open position. If, during product transfer, flow exceeds the rating of the excess flow spring, the main poppet closes (illustration 4).

WARNING

Failure to inspect and maintain internal valves and their remote actuating control systems may result in the valve failing to close in an emergency, leaving no way to control the discharge of product. Inspection and maintenance must be performed frequently enough to assure that the valves are operating properly.

The amount of time for the pressure equalization to take place depends on several factors. Among them are:

1. The volume of the downstream line to be pressured through the internal valve. (How near is the next closed line valve?)
2. The tank pressure.
3. The downstream line pressure when the operating lever is opened. If this line is left "wet," the internal valve will usually open immediately.
4. The amount of foreign material plugging the bleed channel.

Unusual temperature conditions can also affect the equalizing time. Sometimes the actual temperature of the propane in the truck can be quite a bit higher than the ambient temperature (if a cold front comes through, for example). Under these conditions the propane that bleeds through the valve is cooled in the downstream piping. Due to the lowered vapor pressure of the cooled gas, the downstream pressure will stay lower than the tank pressure until the piping fills completely with liquid. This process could take a long time; the condition, luckily, happens very rarely.

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Figure 2. *Moving the valve operating lever halfway open gives faster equalizing.*

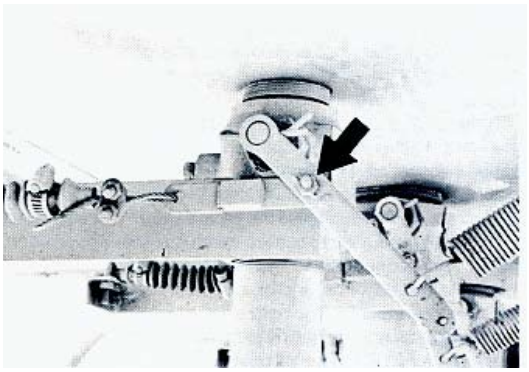

Figure 3. *To obtain full operating lever travel with some cable controls, the cable has to be attached close to the handle pivot.*

It's important to follow the correct sequence of actions when unloading. The recommended sequence for transports would be:

1. Lock the truck brakes. Chock and connect ground wires as needed.
2. Connect the transfer lines, leaving the in-line valves closed.
3. Open the internal valve. On "rapid equalizing" valves, hold the operating levers about halfway open for a few seconds for best equalizing results. Air actuated valves will equalize faster if opened and closed a few times during the equalizing process.
4. After the internal valve opens, gradually open the downstream line valves and allow the lines to fill.
5. Finally, start the pump or compressor to begin the transfer operation.

Since bobtails normally leave the piping pressurized, little or no pressure equalization time is required. Also, there are fewer in-line valves to worry about on bobtails.

Some drivers will claim this sequence too slow and involved, but the few additional seconds it takes will prevent a lot of premature valve closing, pump cavitation and wear, and time lost repeating some other sequence that is not effective.

Note

In the event of an accident during product transfer, it is essential that the attendant activate the remote closure control of the valve. Remote closure controls are the primary safety device for a product transfer system. In most transfer accidents no internal valve, regardless of make, will close unless the valve's closure controls are activated. This is why the attendant should be located so that he has access to the closure controls throughout the transfer operation.

Valve Actuator Installation

A problem that could be experienced with internal valves is the failure of the actuating device to move the valve's operating lever far enough open. Insufficient travel permits the built-in excess flow valve to close once the transfer operation begins. Often times the operator *thinks* the valve lever has been traveled to the wide open position and ignores looking into this possibility as a solution to the trouble.

Cable controls are by far the most popular method of actuating internal valves, both on bobtails and transports. The operating lever on Fisher valves swings through a 70° arc (90° on 1 1/4-inch valves) from the closed to the fully open position. The cable control must move the lever to within 5° of the fully open position to avoid premature excess flow valve closure. A number of manufacturers, including Fisher, make cable controls and a few truck fabricators produce their own. No matter whose control is used, the cable slack has to be adjusted so that the control moves the valve operating lever the correct distance.

The various controls give differing amounts of cable travel. Fisher's current cable control has latch positions for 4, 5, and 6-inch (101, 127, and 152 mm) travels. Thus the internal valves which are intended to mate with the Fisher control have an operating lever of a length that gives the correct 70° turn with this amount of cable travel. Some of the other widely used cable controls have a travel of only 1 1/2 to 2-inch (38,1 to 50,8 mm). In order to achieve the full 70° travel with these controls, the cable attachment point on the operating lever must be moved closer to the handle pivot (see Figure 3). At times the cable attachment point has to be made only 1 1/4 to 1 1/2-inch (31,8 to 38,1 mm) down from the pivot, depending on the make and type of cable control.

Cable stretch after installation can cause problems for a control with a short travel. For instance, a 1/4-inch (6,35 mm) cable stretch after final adjustment results in 17% less operating lever movement (down to 58° rotation) with a control traveling 1 1/2-inch (38,1 mm). The same 1/4-inch (6,35 mm) stretch with a 6-inch (152 mm) travel reduces operating lever movement just 4% (a 67° rotation).

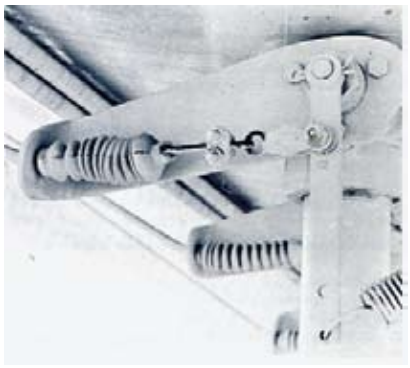

Figure 4. *The cable should be at a right angle to the operating lever at the mid-travel position.*

Over-tightening the cable can also be bad. Most internal valves come to a positive stop internally at the full open position. If the cable is adjusted too short and the stop is reached before the control travels to its latching point, a great deal of force is applied to the valve mechanism by strong-arm attempts to latch the cable control. On some controls with a high mechanical advantage, several hundred pounds of cable pull can be developed. This kind of force can damage the valve's internal parts.

Check the "pull angle" of the cable when routing and attaching it to the lever. At the mid-travel lever position, (see Figure 4) the cable should pull at a right angle to the lever. Because the control cable may have some drag, be sure to use a return spring on the lever. Protect the cable linkage from the elements with a rubber boot or some other means.

Fusible links, of course, must be installed at both ends of the control cable. Make certain to use links with a load capacity equal to the task. Cable controls with short travels may require fuse links with a higher load capacity than those with longer travels.

Air cylinders and hydraulic fluid systems are other ways of actuating internal valves. Here the clevis on the cylinder rod can be adjusted to move the valve lever to the fully open position (the entire 70° or 90° arc). Air interlock systems with the truck brakes give excellent ease of operation in addition to increased safety.

Test air operated valves for closure periodically. Doing this will reveal if wear or dirt in the air cylinder and linkage would keep the valve from closing. The linkage from the air cylinder to the valve lever should also be protected from mud, dirt, ice, and road splatter. And be sure the fusible elements are installed in the air line that opens the valve.

Maintenance

It's human nature to disregard things that aren't causing problems. The trouble with this attitude, especially where internal valves are concerned, is that when things go bad they can create difficulties of enormous proportions. Maintenance and inspection programs help to prevent sudden equipment failures which leave a costly bobtail or transport inoperative.

Figure 5. *Wires like this indicate a lack of valve maintenance.They are used to hold the operating lever open–a very bad practice.*

Much too often the only maintenance an internal valve gets takes place when the valve is suspected of slowing or impeding product transfer. There can be a tendency to make a "temporary fix" which then becomes permanent if product transfer hasn't been slowed down. One such temporary fix is the use of a coathanger wire to hold the valve lever open (see Figure 5). Obviously such a maneuver destroys the ability of the valve to function as designed. **Never wire open an internal valve.** It is an unsafe, unnecessary, illegal, and a highly dangerous practice.

A simple preventive maintenance program for the valve and its controls will eliminate a whole bunch of problems, and it takes very little time. Take a few minutes when the truck is having its oil changed or whatever to look over the valves and the controls. Fisher recommends these steps be conducted at least once a month and more often in harsh environments:

1. Inspect the operating lever to see that it moves freely and smoothly. Also examine the stub shaft bonnet nut for leakage using a soap solution. If there is leakage, the bonnet packing will have to be replaced. Replacement shaft seals are inexpensive and easy to store. Although they are seldom needed, it pays to keep them on hand. A sticking lever indicates mechanism wear or trapped dirt. This could mean the need for new shaft seals, shaft bushings, stem bushings, or a few other things. It's time, in other words, for repair before the trouble gets worse and the valve won't open (or close!) with a tank full of product.
2. Check for tight closure of both seat discs. With the internal valve closed, exhaust downstream pressure. If piping is cold, allow it to warm to ambient temperature. Then close the first downstream valve and note any pressure build-up between the two closed valves with a pressure gauge. If leakage is indicated, both discs should be replaced. This test can reveal some odd and scary things. An owner of a second-hand transport had shutoff problems with the internal valve. It seems the previous owner, faced with an excess flow rating below his normal pumping rate, had removed all the shutoff parts from the valve!
3. AII operating controls should be inspected and cleaned and oiled. The controls should be checked to see that they fully open – but not overtravel – the internal valve operating lever and work freely to close the valve. If wear is detected that could cause trouble later, order replacement parts now.

Trouble Shooting

All of the foregoing won't completely eliminate the chance of some sort of valve malfunction. Parts in equipment like internal valves which receive almost daily use do eventually wear out. Many times, however, the valve gets the blame when some other component in the system is actually the culprit.

Trouble shooting the valve isn't too difficult; the most useful tool for the trouble shooter is a pressure gauge installed at the valve outlet. When the valve is opened, the gauge should show the same pressure as in the tank. With flow through the valve, this gauge should always read within a few psi of the tank pressure.

Four common complaints are listed below along with possible solutions:

Internal Valve Will Not Open – Most frequently due to the operator not using the rapid equalizing position when opening the valve, could also be from leakage downstream, engaging the pump too soon, or excessive internal valve wear. (On older valves cam breakage did occur at times, but it has all but been eliminated now). If excessive volume is in the downstream system, a longer time is required to equalize tank and downstream pressures before the pump can be engaged.

To find out if the valve pilot seat is opening, install a pressure gauge at the valve outlet and open the valve. If pressure does not build up to the tank pressure, the pilot seat is not opening. This test should be done with the pump off. A pilot seat not openlng may be due to internal damage or from foreign material plugging the pilot bleed opening. Try back flowing through the valve to clear it out. If the operating lever rotates past the fully open position, there is something wrong internally and the valve will have to be disassembled.

Premature Valve Closure – An improperly connected operating lever which doesn't fully open the valve (see the "Installation" section) is the first thing to look for. This condition could also be caused from engaging the pump too soon, sudden line surges, or an underrated excess flow spring. The trouble could stem from a valve that has its inlet port obstructed.

Internal Valve Will Not Close – Most frequently due to a faulty or sticking actuator, but the stub shaft or stem could be bent. If the valve leaks even though it seems to close, the seats could be damaged or foreign materials could be trapped on the seats. Before disassembling the valve, check the actuator mechanism to see that it works freely by disconnecting it from the valve lever and cycling it several times. Also, operate the valve lever manually. If it sticks in the open position, the packing and bushings should be replaced which should free the operating mechanism if the valve does not have internal damage.

Low Flow Capacity – First, is the valve large enough? Too small or long downstream piping might be being used. Other possibilities include a plugged screen or strainer, some restriction downstream, or a bypass valve sticking in the open position. The bypass valve could also be set too low and be opening prematurely. Check for high differential pressure across the internal valve to determine if it is at fault.

Conclusion

Internal valves were first introduced in the 1950's. Since that time, they have gained ever increasing acceptance from users, as well as regulating agencies. The valves of today are greatly improved from a performance and durability standpoint from those of ten or even five years ago. They are capable of giving years of trouble-free service, but they do require minimal attention if they are to remain on the job. This article has attempted to point out ways of keeping the valve working properly so that the truck can stay on the road.

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