

Type C403-24 & C404-24 Instruction Manual



WARNING

Failure to follow these instructions or to properly install and maintain this equipment could result in an explosion and/or fire causing property damage and personal injury or death.

Fisher equipment must be installed, operated, and maintained in accordance with federal, state, and local codes and Fisher instructions. The installation in most states must also comply with NFPA No. 58, and ANSI Standard K61.1.

Only personnel trained in the proper procedures, codes, standards, and regulations of the LP-gas industry should install and service this equipment.

The internal valve must be closed except during product transfer. A line break downstream of a pump may not actuate the excess flow valve. If any break occurs in the system or if the excess flow valve closes, the system should be shut down immediately.

Introduction

Scope of Manual

This manual covers instructions for the C403-24 and C404-24 3" flanged internal valves.

Description

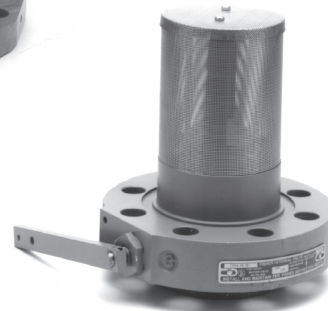
Type C403-24: The C403-24 double flanged internal valve is intended for special bobtail truck applications where the pump must be lowered to clear the truck frame or other obstacles. A shear section in the lower body permits the valve to shear off in the event of an accident, leaving the shutoff parts within the tank.

Type C404-24: The single flanged C404-24 internal valve is widely used on bobtail trucks with direct connected pumps. It can also be used on in-line applications.



TR-58

C403-24



TR-17

C404-24

Figure 1. 3-inch Flanged C400 Series

Both type internal valves can also be used with transports and on stationary storage tanks. The valves can be operated by cable or with air.

Designed for use with Propane, Butane, or Anhydrous Ammonia at ambient temperatures, the valves can be used on other compressed gases, but the user should check with the factory to make sure the valves are suitable for the particular service.

Specifications

Specifications for C403-24 and C404-24 internal valves are in Table 1.

DOT Internal Self-Closing Stop Valve Requirement – U.S. Department of Transportation (DOT) regulations 49 CFR§178.337-8(a)(4) require each liquid or vapor discharge outlet on cargo tanks (except for cargo tanks used to transport chlorine, carbon dioxide, refrigerated liquid, and certain cargo tanks certified prior to January 1, 1995) to be fitted with an internal self-closing stop valve. Fisher's "C" series internal valves comply with the internal self-closing stop valve requirement under the DOT regulations.



Type C403-24 & C404-24 Internal Valves

Table 1. Specifications

BODY SIZE AND END CONNECTIONS	Inlet: 3-in. 300 lb. ANSI RF Modified Flange (4 5/8-in. diameter bore) Outlet: 3-in. 300 lb. ANSI Flange	MATERIAL TEMPERATURE CAPABILITIES	-20° to 150°F (-28.9° to 65.6°C)
MAXIMUM ALLOWABLE INLET PRESSURE	400 psig (27.6 bar) WOG	BODY MATERIAL	Cast Steel WCB
EXCESS FLOW SPRINGS	150, 200, 250, or 400 gpm Propane	APPROXIMATE WEIGHT	C403-24: 32 lbs. (14.5 Kg) C404-24: 18 lbs. (8.6 Kg)

Installation

Internal Valve

Coat both sides of the spiral wound gaskets with Dow Corning #111 silicone grease or equivalent. A 3-inch 300 lb. ANSI RF flange with a modified bore (see figure 2) must be installed in the tank. Special stud bolts, furnished with the valve, are assembled into this flange. The internal valve and the pump or piping flange can then be installed as shown in figure 3.

The screen should be removed if the valve is to be used for both filling and withdrawal service or for filling alone. Filling with screen installed is not recommended.

A hydrostatic relief valve does not need to be installed adjacent to the valve since the internal valve automatically relieves excessive line pressure into the tank.

Keep piping from the valve outlet to the pump full size and as short as possible with a minimum of bends. Reduction in pipe size to suit smaller pump inlets should be made as close to the pump as possible using forged reducers (swage nipples) or venturi tapers rather than bushings. This assures minimum flow resistance and efficient pump operation.

If the valve is also used to provide excess flow protection, the flow rating of the piping, fittings, pump, valves, and hose on both the inlet and outlet of the internal

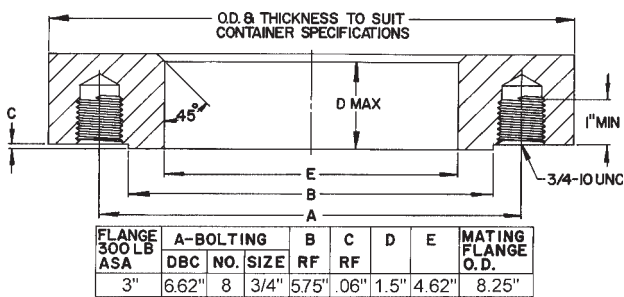
valve must be greater than the flow rating of the integral excess flow valve within the internal valve. If branching or other necessary restrictions are incorporated in the system which reduce the flow rating to less than that of the excess flow valve rating, the internal valve will not give excess flow protection.

Selectively Filling Manifolded Tanks

Fisher internal valves provide positive shut-off only in one direction, from out of the tank to downstream of the valve. The internal valves are designed to allow gas to flow into a tank when the downstream line pressure exceeds tank pressure. If you want to selectively fill one or more of the other tanks in a tank manifold system, you must place a positive shut-off valve downstream of the internal valve, otherwise, all tanks will be filled at the same time and at about the same rate.

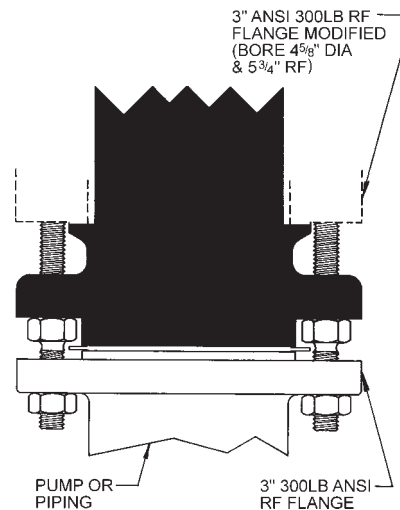
Actuators

The remote operating control system for the valve is extremely important, and it must be installed to conform with the applicable codes. DOT MC331, for example, most generally applies for trucks.



T10489

Figure 2. Tank Flange Dimensions



T11444

Figure 3. C404-24 Typical Valve Installation Schematic

Fisher offers both cable controls and air cylinder systems to operate the C403 & C404 series internal valves. It may also be possible to use cable controls from other manufacturers or to fabricate a linkage mechanism.

Any control system requires thermal protection (fuse links) at the valve, at the remote control point and, if necessary, near the hose connections. The instruction manuals for Fisher Controls actuator systems show how to install the fuse links.

Installation instructions on Fisher P650, P163A, and P164A cable controls, are in Form MCK 1083. Fisher P326 air cylinder actuator installation is covered in Form MCK-1137.

The operating linkage must allow the operating lever to move from the fully closed position to within 2° of the fully open position. The linkage should not apply strong force to the lever past the fully open position or the valve could be damaged.

**CAUTION**

The internal valve's closing spring is not designed to overcome drag in the control linkage in order to close the valve. Depending upon the control system used, an external spring (such as Fisher drawing number 1K4434) or positive closing linkage may be needed. Be sure the control system is installed to prevent binding that could cause the valve to stick in the open position.

Excess Flow Operation

The internal valve contains an excess flow function, or "integral excess flow valve," that will close when the flow exceeds the flow rating established by Fisher. Fisher's integral excess flow valve installed on a bobtail truck or transport can provide protection against the discharge of hazardous materials during an unloading operation of a bobtail truck or transport in the event that a pump or piping attached directly to the internal valve is sheared off before the first valve, pump, or fitting downstream of the internal valve, provided that the cargo tank pressure produces a flow rate greater than the valve's excess flow rating. Likewise, if the internal valve is installed on a stationary tank or in the related downstream piping system, the integral excess flow valve can provide protection against an unintentional release of hazardous materials in the event that a pump or piping attached directly to the internal valve is sheared off before the first valve, pump, or fitting downstream of the internal valve, provided that the flow of product through the internal valve reaches the rated flow specified by Fisher.

**EXPLOSION HAZARD**

Restrictions incorporated in the discharge system of a bobtail truck or transport or of a stationary tank (due to pumps, pipe and hose length and dimensions, branching, elbows, reductions in pipe diameter, or a number of other in-line valves or fittings), low operating pressure as a result of ambient temperature, or a partially closed valve downstream from the integral excess flow valve, can restrict the rate of flow through the internal valve below the level necessary to actuate the integral excess flow valve. Therefore, DO NOT USE the excess flow function of the internal valve for the purpose of providing protection against the discharge of hazardous materials in the event of a rupture of hose or piping at a point in the discharge system downstream from the first valve, pump, or fitting downstream of the internal valve.

The internal valve is designed with an internal bleed feature for equalization of pressure. After the integral excess flow valve closes, the leakage through the bleed must be controlled or a hazard can be created. For this reason the operator must be familiar with the closure controls for the internal valves and must close the internal valve immediately after the integral excess flow valve closes.

Failure to follow this warning could result in serious personal injury or property damage from a fire or explosion.

DOT Passive Shutdown Equipment Requirement – DOT regulations 49 CFR§173.315(n)(2) require certain cargo tanks transporting propane, anhydrous ammonia and other liquified compressed gases to be equipped with passive emergency discharge control equipment that will automatically shut off the flow of product without human intervention within 20 seconds of an unintentional release caused by complete separation of a delivery hose. The design for each passive shut-down system must be certified by a Design Certifying Engineer (DCE) and all components of the discharge system that are integral to the design must be included in the DCE certification. The DCE certification must consider any specifications of the original component manufacturer.

In the case of downstream ruptures in hose or piping, a variety of operating conditions routinely encountered

Type C403-24 & C404-24 Internal Valves

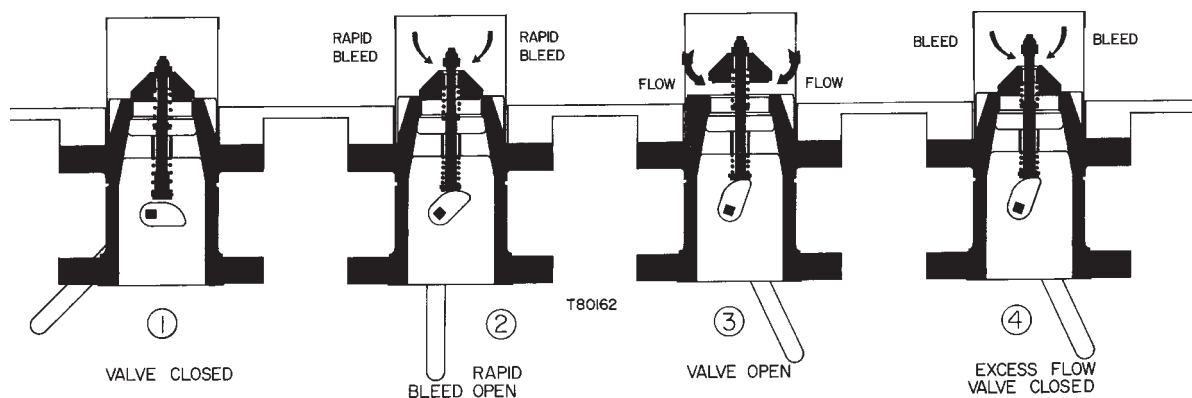


Figure 4. Operational Schematic For C403-24 (shown) & C404-24

during an unloading operation restrict the rate of flow through the integral excess flow valve and make such a valve unsuitable to serve as the means of passive shut-down required under 49 CFR§173.315(n)(2). Such variables include restrictions incorporated in the discharge system (due to pumps, pipe and hose length and dimensions, branching, elbows, reductions in pipe diameter, or a number of other in-line valves or fittings), low operating pressure as a result of ambient temperature, or a partially closed valve downstream from the excess flow valve. Due to the variety of conditions, in the case of a hose separation, that can restrict the rate of flow below the level necessary to activate the excess flow valves, the integral excess flow function of Fisher's "C" series internal valves or "F" series excess flow valves cannot be used to satisfy the passive shut-down equipment requirement under/in 49 CFR§173.315(n)(2). Also, a Design Certifying Engineer cannot include the integral excess flow valve of a Fisher "C" series internal valve or "F" series excess flow valve as a component of the discharge system in any DCE certification under 49 CFR§173.315(n)(2).



EXPLOSION HAZARD

DO NOT USE the excess flow function incorporated into Fisher "C" series internal valves or "F" series excess flow valves to satisfy the passive shutdown equipment requirement in 49 CFR§173.315(n)(2). **DO NOT** include the excess flow function incorporated into Fisher "C" series internal valves or "F" series excess flow valves in a DCE certification under 49 CFR§173.315(n)(2). The cargo tank manufacturer must install some other equipment that satisfies the

requirement for passive shutdown capability under 49 CFR§173.315(n)(2).

Failure to follow this warning could result in serious personal injury or property damage from a fire or explosion in the event of an unintentional release of product during an unloading operation.

Operation

Since the C404-24 and C403-24 are most often used on bobtail trucks, the following procedure applies to that type of application. Follow these points:

1. C400s on bobtails and transports should never be open when the truck is in motion. If the control system is not interlocked to prevent this, the operator is responsible to see that the valves are closed.
2. Always open the internal valve before opening any other valves in the line or starting the pump.
3. Move the lever to the half-open position (figure 2, view #2) to equalize pressure. When the main poppet clicks open, move the operating lever fully open.
4. Open other line valves slowly to avoid sudden surges which could slug the excess flow valve shut.
5. If the excess flow valve does close, stop the pump and close the nearest downstream valve. Move the internal valve's operating lever back to the rapid equalizing position and wait for the valve to click open. Then move the operating lever fully open and slowly open the downstream valve.
6. All valves should be completely open when pumping. (Throttling type valves could prevent the excess flow valve from closing when required.)
7. The operator must always be aware of where the remote closure controls are located and know how to

operate the controls if an emergency requires valve closure. When pumping is finished, make a habit of closing the internal valve from the remote closure point, thus checking to see that the control actually is capable of closing the valve.

8. The valve should be open when backfilling through the valve to fill the tank.

Troubleshooting

Internal Valve Will Not Open – This could be due to leakage downstream, engaging the pump too soon or from excessive wear in the internal valve. If excessive volume is in the downstream system, a longer time is required to equalize the pressures (tank and downstream) before the pump can be engaged. To determine if the valve pilot seat is opening, install a gauge downstream of the valve, operate the valve actuator; if pressure does not build up to the tank pressure, the valve pilot seat is not open. This test should be done with pump off. If the pilot is not opening, it may be plugged with dirt or some internal part may be broken. If by operating the lever manually it can be rotated past the fully open position, there is something wrong internally and the valve must be disassembled.

Premature Valve Closure – This can be caused from engaging the pump too soon, by an underrated excess flow valve spring, or by an improperly connected internal valve operating lever which does not fully open the valve. The trouble could also be from a valve that has its inlet port obstructed or from sudden line surges. In order to check the valve opening travel, operate the lever manually to the full travel, wait until valve opens (usually about 15 seconds), then engage the pump. If the excess flow closes, the points mentioned above should be investigated.

Internal Valve Will Not Close – The stub shaft could be binding or the stem could be bent in the valve. Before disassembling the valve, check the actuator mechanism to see that it operates 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. This should free the operating mechanism if the valve has not been damaged internally. Refer to the "Maintenance" section.

Low Flow Capacity – This could be caused by too small an internal valve, too small or long downstream piping, plugged screens, some other restriction in the downstream system, or by the bypass valve sticking in the open position. The bypass valve could also be set too low and be opening prematurely.

Principle of Operation

Refer to the schematic drawing, figure 4. In view #1, the valve is held closed by both tank pressure and the

valve's closing spring. There is no leakage past the resilient seats in the poppet to the valve outlet.

The valve is opened by moving the operating lever to approximately mid-point in its 70° travel (view #2). This allows the cam to place the rapid equalization portion of the valve stem in the pilot opening, permitting a larger amount of product to bleed downstream than if the operating lever were moved to the full open position.

When tank and downstream pressure are nearly equal after a few seconds, the excess flow spring pushes open the main poppet (view #3) and the operating lever can be moved to the full open position.

If tank pressure is greater than the valve's outlet pressure, the main poppet will remain in the closed position. If valve outlet piping is closed off by other valves, however, product bleeding through the pilot will increase until it nearly equals tank pressure and the main poppet opens.

Note

The main poppet will not open if valve outlet piping is not closed off so that the outlet pressure can approach tank pressure.

Once the main poppet opens, a flow greater than the valve's excess flow spring rating or a sufficient surge in flow forces the main poppet closed against the excess flow spring (view #4). The pilot valve allows a small amount of product to bleed, but much less than view #2 where the rapid equalization portion of the stem is placed in the pilot opening. When the operating lever is moved to the closed position, the valve closes completely and seals tightly (view #1).

Maintenance



Do not use these internal valves if they leak, fail to work properly or have been damaged or have missing parts. Prompt repairs should be made by a properly trained serviceman. Continued use without repair can create a hazardous or injurious situation.

A simple preventative maintenance program for the valve and its controls will eliminate a lot of potential problems.

Fisher recommends these steps be conducted once a month. Also refer to the Department of Transportation (DOT) CFR 49 Sections 180.416 and 180 Appendix A & B which specific monthly maintenance and inspection tests for cargo tank service internal valves and their actuation controls.

Type C403-24 & C404-24 Internal Valves

1. Inspect the operating lever to see that it operates freely and that there is no leakage around the retainer nut. If there is sticking or leakage, replace the packing and bushings. Refer to replacing parts.

2. Check for tight closure of the seat discs. Any detected leakage, which is normally caused by disc wear or dirt, scale or debris embedded in the disc, requires that the internal valve be removed from service and repaired. Repair most often requires the replacement of valve discs. To check for leakage:

A) Close the internal valve and exhaust downstream pressure. Close the first valve downstream from the internal valve, and note any pressure buildup, using a pressure gauge, between the closed valve and the internal valve. If piping is cold allow it to warm to ambient temperature.

B) Refer to CFR 49 Section 180 Appendix B for Meter Creep Test Methods.

3. All operating controls should be inspected and cleaned and oiled. The controls should be checked to see that they fully open—but not over-travel—the internal valve operating lever and operate freely to close the valve.

4. Standard construction internal valves must be removed if the container is to be steam cleaned. Heat can damage the valve's seats and seals.

5. Standard construction internal valves are not designed for water service. Immediately after a container is hydrostatically tested, remove all water and allow the container to thoroughly dry out.

Disassembly



WARNING

Tank pressure must be released before removing the valve from the container. Failure to do so could result in personal injury.

Numbers in parenthesis refer to key numbers in figures 5, and 6.

To Replace Packing (15F, 15G, & 15H), bushings (15B & 15K) or cam (15P):

1. With the valve in the tank, close the operating lever and remove the downstream pressure in the system.
2. **For C404-24:** Unscrew the cap screw (15R) with a 7/16 wrench. **For C403-24:** Remove the pipe plug (22). Using a 3/16" Allen wrench, unscrew the cap screw (15R). Remove the washer (15S) and the cam (15P).
3. After removing the operating lever (18), the packing

can be reached by unscrewing the bonnet nut (15M) and removing the stub shaft (15J). Inspect and replace if necessary, the packing (15F, 15G, & 15H), bushings (15B & 15K). Lubricate the packing with Magna Lub G (51), and the bonnet (15M) with Never Seize (50).

4. Reassemble in the reverse order. Replace the cap screw (15R) with 30-35 inch-pounds torque.
5. Make sure the operating lever can move freely after the new parts are installed. Conduct a leak test under pressure with a leak detection solution.

To Replace Seat Discs (7) & (11) or the Excess Flow Spring (3).

1. Remove the valve from the tank and remove the screen from the valve.
2. Remove the Guide Bracket (47) for type C403-24 or the Valve Cage (37) for the type C404-24.
3. Unscrew hex nut (13).
4. Remove both disc holders (6) & (12) from the stem (2).
5. Unscrew the 3 screws (9) holding the disc retainer (8) to replace the main disc seat. (7).
6. Examine both seat discs (7) & (11) and replace if necessary.
7. If the excess flow spring (3) is changed, restamp the nameplate with the new excess flow rating and type number.
8. Always replace the sealing washer (23).
9. Reassemble in the reverse order using 15-20 foot-pounds torque to install the disc retainer (8). Apply Loctite 242 (46) or equivalent on the stem threads before installing the hex nut (13). Tighten hex nut (13) to 80 inch-pounds torque.

Pressure test the repaired valve for seat leakage, opening and closing, and excess flow operation as described in earlier portions of this manual.

Parts Ordering

When corresponding about this equipment, always reference the equipment type number found on the nameplate. A replacement Parts List MCK-1153 is available for the valves. When ordering replacement parts, reference the complete 11-character part number for each needed part.

Type C403-24 & C404-24 Internal Valves

Parts Reference

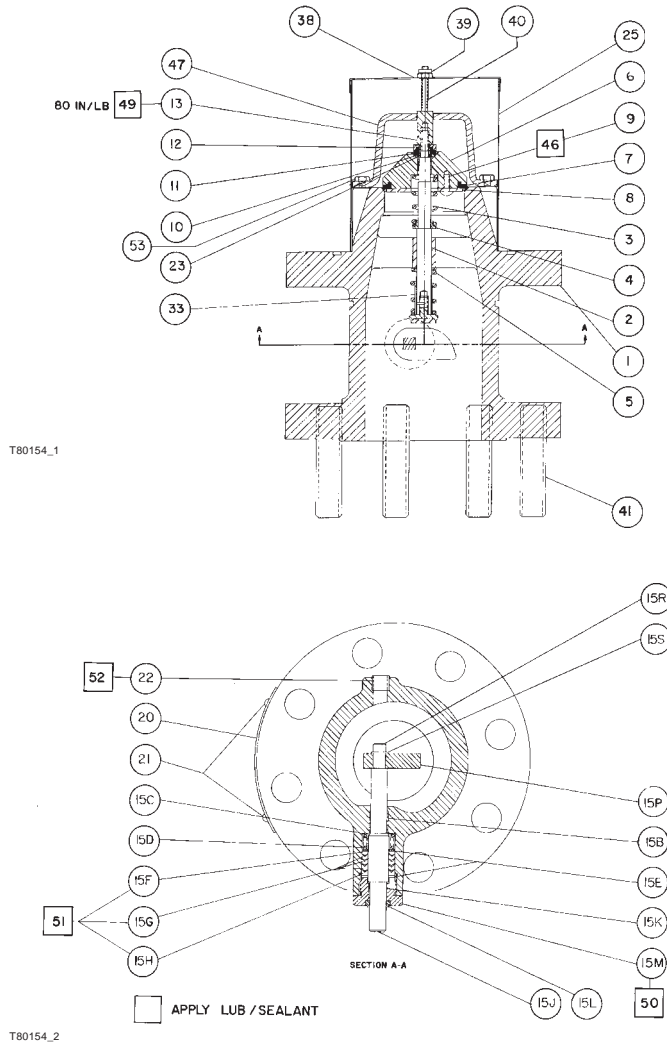


Figure 5. Type C403-24

Key No.	Name of Part	Key No.	Name of Part	Key No.	Name of Part
1	Body	(15F)	Male Packing Adaptor	30	Fuse Link (Not Shown)
2	Stem/Follower Assembly	(15G)	Packing Ring (3 req'd)	33	Travel Stop
3	Excess Flow Spring	(15H)	Female Packing Adaptor	38	Strainer Cap
4	Spring Seat	15J	Shaft	39	Nut (2 req'd)
5	Closing Spring	(15K)	Bushing	40	Bolt (2 req'd)
6	Disc Holder	15L	Rod Wiper	41	Stud Bolt (16 req'd)
(7)	Main Disc	15M	Bonnet	42	Nut (16 req'd) (Not shown)
8	Disc Retainer	15P	Cam	(43)	Upper Gasket (Not Shown)
9	Screw (3 req'd)	15R	Cap Screw	(44)	Lower Gasket (Not Shown)
10	Disc Retainer	15S	Washer	45	Dow Corning III
(11)	Bleed Disc	18	Operating Lever	46	Loctite 242
12	Disc Holder	19	Cotter Pin	47	Guide Bracket
13	Nut	20	Nameplate	49	Loctite 277
(15B)	Bushing	21	Drive Screw (2 req'd)	50	Never Seize
15C	Washer	22	Pipe Plug	51	Magna Lub G
15D	Spring	(23)	Washer	52	Pipe Compound
15E	Washer (2 req'd)	25	Strainer		

() Recommended Spare Parts.

Type C403-24 & C404-24 Internal Valves

Parts Reference

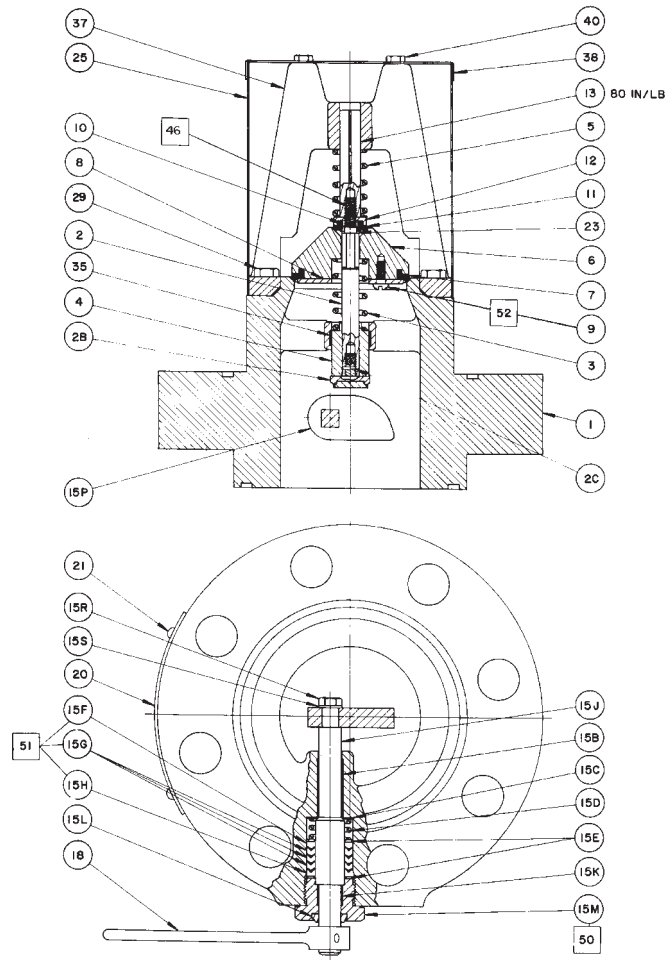


Figure 6. Type C404-24

Key No.	Name of Part	Key No.	Name of Part	Key No.	Name of Part	Key No.	Name of Part
1	Body	(15B)	Bushing	15S	Washer	41	Stud Bolt (8 req'd)
2	Stem Assembly	15C	Washer	18	Operating Lever	42	Nut (16 req'd)
3	Excess Flow Spring	15D	Spring	19	Cotter Pin (Not Shown)	(43)	Upper Gasket (Not Shown)
4	Spring Seat	15E	Washer (2 req'd)	20	Nameplate	(44)	Lower Gasket (Not Shown)
5	Closing Spring	(15F)	Male Packing Adaptor	21	Drive Screw (2 req'd)	45	Dow Corning III
6	Disc Holder	(15G)	Packing Ring (3 req'd)	(23)	Washer	46	Loctite 242
(7)	Main Disc	(15H)	Female Packing Adaptor	25	Screen	50	Never Seize
8	Disc Retainer	15J	Shaft	29	Cap Screw (4 req'd)	51	Magna Lub G
9	Screw (3 req'd)	(15K)	Bushing	30	Fusible Link (Not Shown)	()	Recommended Spare Parts.
10	Disc Retainer	15L	Rod Wiper	35	Bushing		
(11)	Bleed Disc	15M	Bonnet Nut	37	Valve Cage		
12	Disc Holder	15P	Cam	38	Screen Cap		
13	Nut	15R	Cap Screw	40	Bolt (2 req'd)		

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