

Type D2 FloPro™ Control Valve

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Figure 1. Type D2 FloPro Control Valve

Introduction

Scope of Manual

This instruction manual provides installation, maintenance, and parts information for the 1-inch Type D2 FloPro control valve and actuator.

No person may install, operate, or maintain a Type D2 FloPro control valve without first (1) being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance, and (2) carefully reading and understanding the contents of this manual. If you have any questions about these instructions, contact your Fisher sales office before proceeding.

Description

The Type D2 FloPro control valve (patents pending) (figures 1 and 2) is a compact, rugged valve designed for on-off control of a variety of fluids at

pressures up to 155 bar (2250 psig). This valve is ideal for use as a dump valve on gas separators and scrubbers. It is also well suited for other high pressure applications in natural gas production, compression, and processing. The Type D2 FloPro valve has threaded end connections and is available in a 1-inch globe style body.

Note

Fisher does not assume responsibility for the selection, use, or maintenance of any product. Responsibility for proper selection, use, and maintenance of any Fisher product remains solely with the purchaser and end-user.

Specifications

Table 1 lists specifications for the Type D2 FloPro control valve. Some of the specifications for a given control valve as it originally comes from the factory are stamped on a nameplate located on the upper diaphragm casing flange.



Table 1. Specifications

Valve Assembly Pressure Class ASME B16.34 Class 900	Port Diameter 13 mm (1/2 inch)
Maximum Inlet Pressure and Temperature⁽¹⁾ 155 bar from –46 to 93°C, and 150 bar at 149°C. (2250 psig from –50 to 200°F, and 2185 psig at 300°F)	Maximum Travel 13 mm (1/2 inch)
Maximum Allowable Pressure Drop⁽¹⁾ Spring-to-Close - Flow Down⁽²⁾: 155 bar (2250 psig) Spring-to-Open - Flow Down⁽²⁾: 103 bar (1500 psig) Spring-to-Close - Flow Up: 103 bar (1500 psig) Spring-to-Open - Flow Up: 103 bar (1500 psig)	Approximate Weight 7.7 kg (17 lb)
Shutoff Classification ANSI Class IV ANSI/FCI 70-2 and IEC 60534-4	Material Temperature Capabilities Valve Body Assembly: –46 to 149°C (–50 to 300°F) Actuator Assembly: –46 to 93°C (–50 to 200°F)
Construction Materials Valve Body and Bonnet: ASME SA 352 LCC Stress relieved Valve Plug and Seat: (R0006) Alloy 6 Valve Stem: (S31600) 316 SST O-Rings: (HNBR) Hydrogenated Nitrile Packing: PTFE/Carbon PTFE Packing Springs: (N07718) Inconel 718 Stem Bushing: (Ryton) PPS Actuator Diaphragm: Nitrile/Polyester Actuator Springs: Zinc-plated steel	Bonnet/Body Connection Threaded with leakoff bleed
Flow Characteristic FloPro Characterized	Actuator Configuration The D2 FloPro actuator is an on-off spring-and-diaphragm. Actuator action is Spring-to-Close from the factory. For Spring-to-Open actuator action, a Spring-to-Open Spring Kit (10C1998X012) must be used
	Maximum Actuator Casing Pressure 2.4 bar (35 psig)
	Minimum Required Actuator Casing Pressure 2.1 to 2.4 bar (30 to 35 psig)
	Actuator Diaphragm Effective Area 194 cm ² (30 square inches)
	Actuator Pressure Connections 1/4 inch NPT female

1. The pressure or temperature limits in the referenced tables and any applicable ASME code limitations should not be exceeded.

2. Standard flow direction.

Installation



WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for overpressure protection as required by accepted industry or local, state, and Federal codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

CAUTION

This valve is intended for a specific range of pressures, temperatures, and other service conditions (see table 1). Applying different pressure, temperature, and other conditions to the valve could result in parts damage, malfunction of the valve, or loss of control of the process. *Do not expose this valve to service conditions or variables other than those for which this valve is intended.* If you are not sure what these conditions are, you should contact Fisher for more complete specifications. Provide the product serial number (shown on the nameplate) and all other pertinent information.

1. Before installing the valve, inspect it to be certain that the valve body cavity is free of foreign material. Clean out all pipelines to remove scale, welding slag, and other foreign materials.
2. The control valve assembly may be installed in any orientation unless limited by seismic criteria. However, the normal method is with the actuator vertical above the valve body.

The standard flow direction is indicated by the arrow on the valve body.

3. Use accepted piping practices when installing the valve in the pipeline.
4. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.

Note

The 1-inch Type D2 FloPro valve is equipped with ENVIRO-SEAL® D2 packing.

The actuator, as shipped from the factory, is spring-to-close. If spring-to-open action is required, see the Changing Actuator Action section in this manual.

Additionally, the actuator as shipped from the factory, has the FloPro flow adjuster set at a 3/8 inch port flow rate position. If some other flow rate is desired, see the Setting Valve Flow Rate section in this manual.

Setting Valve FloPro Flow Adjuster

Spring-to-Close Actuator Action

1. To change the valve flow rate, loosen the flow adjuster socket head cap screws (key 29), and reposition the flow adjuster halves (key 14 and 15) to the desired flow rate position. See figure 4 for flow rate settings.

Spring-to-Open Actuator Action

1. Attach a pressure line to the actuator. Supply pressure to the actuator to seat the plug in the seat ring.
2. To change the valve flow rate, loosen the flow adjuster socket head cap screws (key 29), and reposition the flow adjuster halves (key 14 and 15) to the desired flow rate position. See figure 4 for flow rate settings.

Changing Actuator Action from (Spring-to-Close) to (Spring-to-Open)

Key numbers are referenced in figures 6 and 7.

Note

The following procedure requires use of Spring Kit 10C1998X012.

1. Remove the six **short** actuator casing cap screws (key 22) first. Once these have been removed from the actuator assembly, carefully remove the two **long** actuator cap screws (key 30).

Note

Be aware as you loosen and remove the actuator cap screws that the actuator springs are under compression.

2. Remove the upper casing (key 21) and the springs (key 27).

3. Do not turn the valve stem (key 4) while removing the diaphragm hex nut (key 26). Use an appropriate tool on the machined flats located on the valve stem above the flow adjuster for this procedure. Continue the actuator disassembly by removing the washer (key 24) diaphragm plate (key 25), diaphragm (key 19), and washer (key 24). Inspect the diaphragm for any wear or damage. Replace with a new one if necessary.

4. Unscrew the socket head cap screws (key 29), and remove the flow adjuster halves (key 14 and 15). Position the stem (key 4) to its most upward position.

5. Place the 3 springs (key 27) from the Spring Kit in their approximate, equally spaced, locations in the bottom casing (key 20). Place the washer (key 24) over the valve stem. Then install the diaphragm plate (key 25) and, using the diaphragm plate, correctly position the actuator springs.

6. Place the diaphragm (key 19) over the stem, along with washer (key 24). Position the diaphragm so the holes in the diaphragm align with the holes in the bottom casing.

7. Insert a 1/8 inch diameter drift punch, or other suitable device through the 5/32 diameter hole in the valve stem located below the bottom of the previously removed flow adjuster. Install hex nut (key 26) and tighten to 11 N•m (95 lbf•in). Remove the 1/8 inch drift punch or other holding device.

8. Attach the upper casing by first installing the two **long** cap screws (key 30) opposite one another. Begin tightening the two long screws evenly until the remaining six shorter cap screws (key 22) can be installed with their hex nuts. Continue tightening the actuator casing cap screws evenly using a cross-tightening procedure. Torque to 14 N•m (10 lbf•ft).

9. Connect a pressure line to the top actuator pressure connection, and apply pressure to the

actuator. Stroke the actuator until the valve plug is seated on the seat ring. Install the flow adjuster, positioning it to the desired travel. Tighten the flow adjuster socket head cap screws to 3 N•m (26 lbf•in).

10. Release the actuator pressure, and install the vent plug (key 28) into the bottom casing pressure connection.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing and trim maintenance, reversing the action, and replacing actuator parts.

All maintenance operations can be performed with the valve in the line.

Note

Whenever a gasket seal or O-ring is disturbed by removing or shifting gasketed parts, a new gasket should be installed upon reassembly. This is necessary to ensure a good gasket seal, since the used gasket or O-ring will not seal properly.



WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.

- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline.* Process fluids may spray out under pressure when removing the packing hardware or packing rings.

- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Valve Trim Maintenance

Note

The following maintenance procedures apply to both spring-to-close and spring-to-open actuator configurations, except for steps 2 and 8 as noted.

Key numbers are referenced in figures 6 and 7.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve.

2. **For spring-to-close actuator action only**, apply pressure to the actuator to fully stroke it open. This will raise the plug off its seat so that the valve stem serrations are visible inside the flow adjuster window (see figure 5). Loosen the socket head screws (key 29) and lower the flow adjuster (key 14 and 15) to its lowest position on the valve stem. Retighten the socket head screws (key 29) to 3 N•m (26 lbf•in). Relieve pressure to the actuator, shut off all pressure lines to the actuator, and disconnect. Use lockout procedures to be sure that the above measures stay in effect while you work on the equipment.

Note

The preceding step is intended to prevent damage to the valve plug (key 3) and seat ring (key 5) during the removal of the bonnet and actuator.

3. Unscrew the bonnet from the valve body.



WARNING

Avoid personal injury from sudden release of process pressure. If the process media starts to escape from the safety vent (see figure 4) located in the bonnet neck of the valve body,

STOP DISASSEMBLY IMMEDIATELY!

The escape of process media indicates that the valve has NOT been isolated from the process media, or process pressure is trapped in the valve body.

4. Once the bonnet has been removed from the valve body, inspect the seat ring (key 5) for wear or damage. If the seating surface has been damaged, remove it from the valve body. Also remove the seat ring gasket (key 6). Clean and inspect the valve body gasket surface for damage. Visually inspect the valve body interior below the seat ring for erosion. Replace the valve body if necessary.

To replace the seat ring, first install a new seat ring gasket. Install the new seat ring and tighten to 230 N•m (170 lbf•ft).

Cover the opening in the valve body to prevent foreign material from getting into the valve body cavity.

5. Inspect the valve stem for scratches or wear, and valve plug for wear or damage. Replace if necessary.

6. If the valve plug requires replacement, use an appropriate tool on the machined flats located on the valve stem above the flow adjuster and unscrew the valve plug from the valve stem. Replace it with a new valve plug. Screw the valve plug into the valve stem, being careful not to damage the plug seat or plug contour. Tighten to 18 N•m (13 lbf•ft).

7. Lubricate a new O-ring (key 13) with Dow Corning 111 compound or equivalent and place it into the valve body as shown in figure 6 or 7. Ensure that no foreign material blocks the safety vent hole. Screw the bonnet into the valve body, and torque to a range of 542.3 to 677.9 N•m (400 to 500 lbf•ft).

8. **For spring-to-close actuator action only**, attach the pressure line to the actuator, and supply pressure to the actuator. Move the flow adjuster to approximately midpoint on the valve stem serration. Release the pressure to the actuator. This allows the plug to find its seated position.

9. Set the flow adjuster to the desired travel position (see figure 4), and tighten the flow adjuster socket head cap screws to 3 N•m (26 lbf•in).

Packing and Valve Trim Maintenance

Note

The following maintenance procedures apply to both spring-to-close and spring-to-open actuator configurations, except for steps 2, 23, and 26 as noted.

Key numbers are referenced in figures 6 and 7.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve.
2. **For spring-to-close actuator action only**, apply pressure to the actuator to fully stroke it open. This will raise the plug off its seat so that the valve stem serrations are visible inside the flow adjuster window (see figure 5). Loosen the socket head screws (key 29) and lower the flow adjuster (key 14 and 15) to its lowest position on the valve stem. Retighten the socket head screws (key 29) to 3 N•m (26 lbf•in). Relieve pressure to the actuator, shut off all pressure lines to actuator, and disconnect. Use lockout procedures to be sure that the above measures stay in effect while you work on the equipment.

Note

The preceding step is intended to prevent damage to the valve plug (key 3) and seat ring (key 5) during the removal of the bonnet and actuator.

3. Unscrew the bonnet from the valve body.



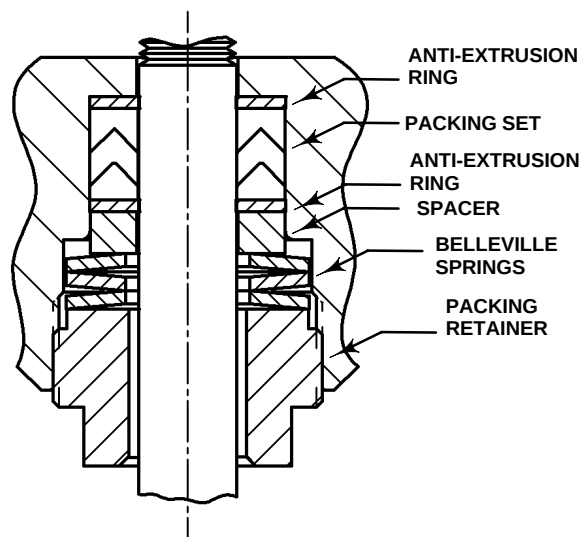
WARNING

Avoid personal injury from sudden release of process pressure. If the process media starts to escape from the safety vent (see figure 4) located in the bonnet neck of the valve body,

STOP DISASSEMBLY IMMEDIATELY!

The escape of process media indicates that the valve has NOT been isolated from the process media, or process pressure is trapped in the valve body.

4. Once the bonnet has been removed from the valve body, inspect the valve seat (key 5) for wear or



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Figure 2. Packing and Belleville Spring Stacking Order

damage. If the seating surface has been damaged, remove it from the valve body. Also remove the seat ring gasket (key 6). Clean and inspect the valve body gasket surface for damage. Visually inspect the valve body interior below the seat ring for erosion. Replace the valve body if necessary.

To replace the seat ring, first install a new seat ring gasket. Install the new seat ring and tighten to 230 N•m (170 lbf•ft).

Cover the opening in the valve body to prevent foreign material from getting into the valve body cavity.

5. Remove the six **short** actuator casing cap screws (key 22) first. Once these have been removed from the actuator assembly, carefully remove the two **long** actuator cap screws (key 30).

Note

Be aware as you loosen and remove the actuator cap screws that the actuator springs are under compression.

6. Remove the upper casing (key 21) and the springs (key 27).
7. Do not turn the valve stem (key 4) while removing the diaphragm hex nut (key 26). Use an appropriate tool on the machined flats located on the valve stem above the flow adjuster for this procedure. Continue the actuator disassembly by removing the washer (key 24) diaphragm plate (key 25), diaphragm (key 19), and washer (key 24 for spring-to-open or key 36

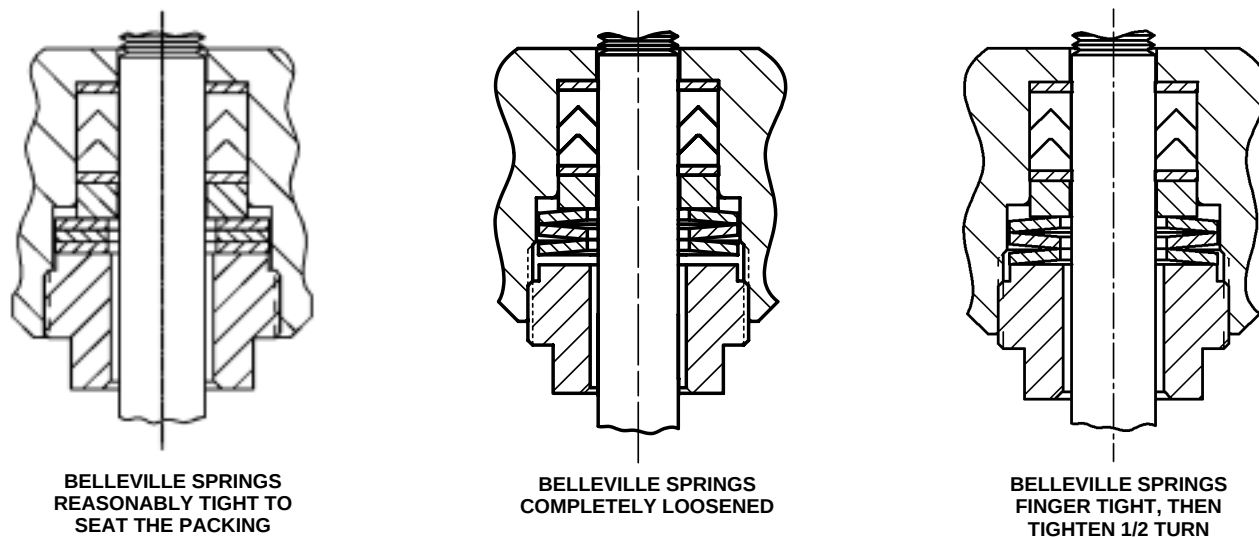


Figure 3. Belleville Spring Procedure

for spring-to-close). Inspect the diaphragm for any wear or damage. Replace with a new one if necessary.

If you wish to inspect/replace the bonnet to actuator casing O-ring (key 16), mark the orientation of the actuator pressure connection to the bonnet for later reference (see figure 5). Unscrew the hex nut (key 18) from the bonnet. Remove the bottom casing (key 20).

8. Unscrew the flow adjuster socket head cap screws (key 29), and remove the flow adjuster halves.

9. Unscrew the packing retainer (key 7) from the bonnet (key 2). After the packing retainer has been unscrewed from the bonnet, pull the valve stem and plug out of the bonnet.

10. Remove the three Belleville springs (key 9), packing spacer (key 10), packing (key 11), and two anti-extrusion rings (key 12) from the bonnet. See figure 2.

11. Clean and inspect the packing box wall to ensure that the packing surfaces are not damaged. If the surface condition is damaged, and cannot be improved by light sanding, replace the bonnet by contacting your Fisher sales office.

12. Inspect the valve stem for scratches or wear, and valve plug for wear or damage. Replace if necessary.

13. If the valve plug requires replacement, use an appropriate tool on the machined flats located on the valve stem above the flow adjuster and unscrew the

valve plug from the valve stem. Replace it with a new valve plug. Screw the valve plug into the valve stem, being careful not to damage the plug seat or plug contour. Tighten to 18 N•m (13 lbf•ft).

14. Inspect the valve stem bushing (key 8) located in the upper end of the bonnet. If damaged, remove and replace it with new bushing (key 8). Replace the valve stem bushing by inserting the bushing, flange end first, into the bore located at the top of the bonnet flow adjuster window. Insert until the flange snaps into the groove provided for it.

15. Remove the O-ring (key 17) from the upper end of the bonnet. Replace it with a new one, and lubricate it with Dow Corning 111 compound or equivalent.

16. Install new packing according to the packing arrangement shown in figure 2. Slide the valve stem through the packing retainer. Place the Belleville springs over the valve stem, positioned as shown in figure 2. Carefully slide the stem through the packing to a point where the serration extends completely into the flow adjuster window of the bonnet (see figure 5).

17. Apply a light film of Dow Corning 111 lubricant or equivalent (key 33) to the threads of the packing retainer (key 7).

18. Install the packing retainer into the bonnet and tighten until the Belleville springs (key 9) are reasonably tight to seat the packing. See figure 3.

19. Completely loosen the packing retainer to relieve all Belleville spring compression. See figure 3.

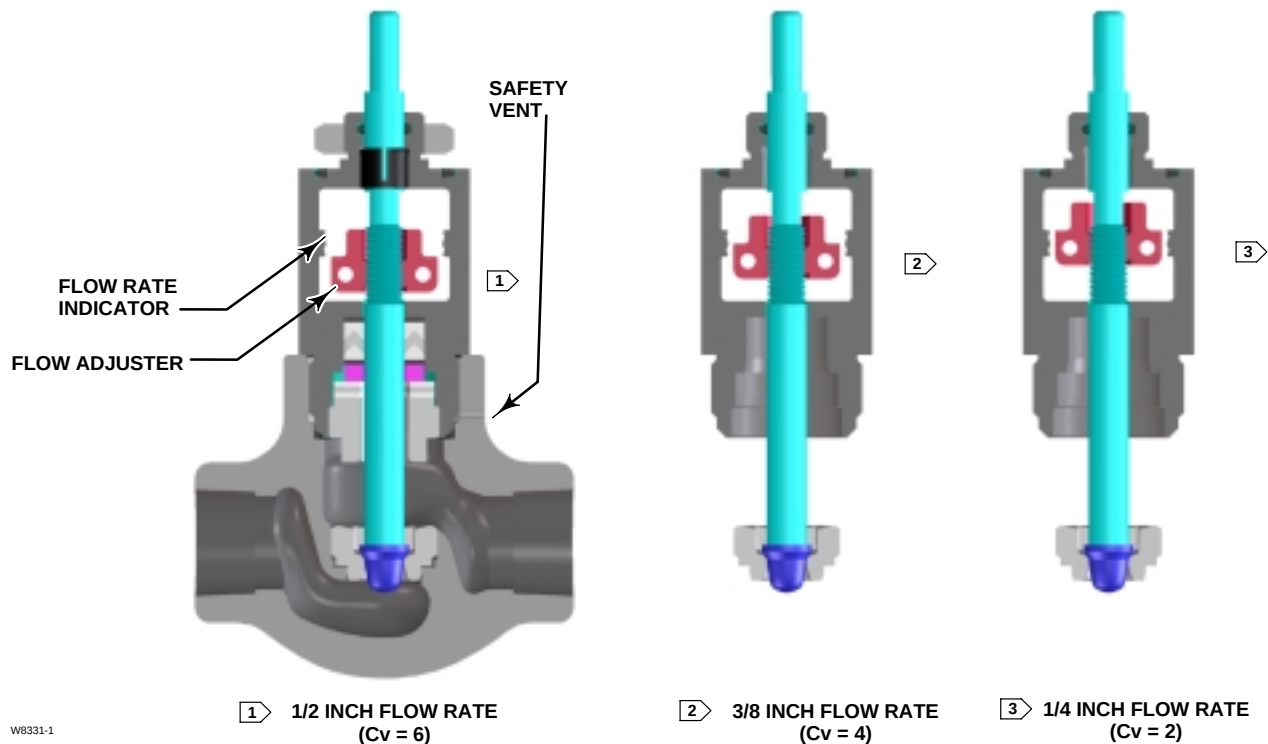


Figure 4. Flow Rate Adjustments

20. Retighten the packing retainer with your fingers until the packing retainer contacts the Belleville springs. See figure 3.

21. Tighten the packing retainer 1/2 turn clockwise. See figure 3.

22. If the bottom casing (key 20) has been removed, place O-ring (key 16) into the groove provided in the top of the bonnet. Place the bottom casing on the bonnet, oriented in the same position as marked in step 7 on page 7. Screw the hex nut (key 18) onto the bonnet, and tighten to 203 N•m (150 lbf•ft).

23. **For spring-to-close actuator action only,** assemble the actuator by first placing the washer (key 24) over the valve stem. Then place the diaphragm (key 19) over the valve stem, and position it so the holes in the diaphragm match the holes in the casing. Place the diaphragm plate (key 25) over the valve stem. Install the washer (key 24), diaphragm hex nut (key 26). Tighten the diaphragm hex nut to 11 N•m (95 lbf•in), while holding the stem by the flats. Install the springs (key 27) and attach the upper casing (key 21) by first installing the two **long** cap screws (key 30) opposite one another.

24. Begin tightening the two long screws evenly until the remaining six shorter cap screws (key 22)

can be installed with their hex nuts. Continue tightening the actuator casing cap screws evenly using a cross-tightening procedure. Torque to 14 N•m (10 lbf•ft).

25. Lubricate a new O-ring (key 13) with Dow Corning 111 compound or equivalent and place it into the valve body as shown in figure 6 or 7. Ensure that no foreign material blocks the safety vent hole. Screw the bonnet into the valve body, and torque to a range of 542 to 678 N•m (400 to 500 lbf•ft).

26. **For spring-to-close actuator action only,** attach the pressure line to the actuator, and supply pressure to the actuator. Move the flow adjuster to approximately midpoint on the valve stem serration. Release the pressure to the actuator. This allows the plug to find its seated position.

27. Set the flow adjuster to the desired travel position (see figure 4), and tighten the flow adjuster socket head cap screws to 3 N•m (26 lbf•in).

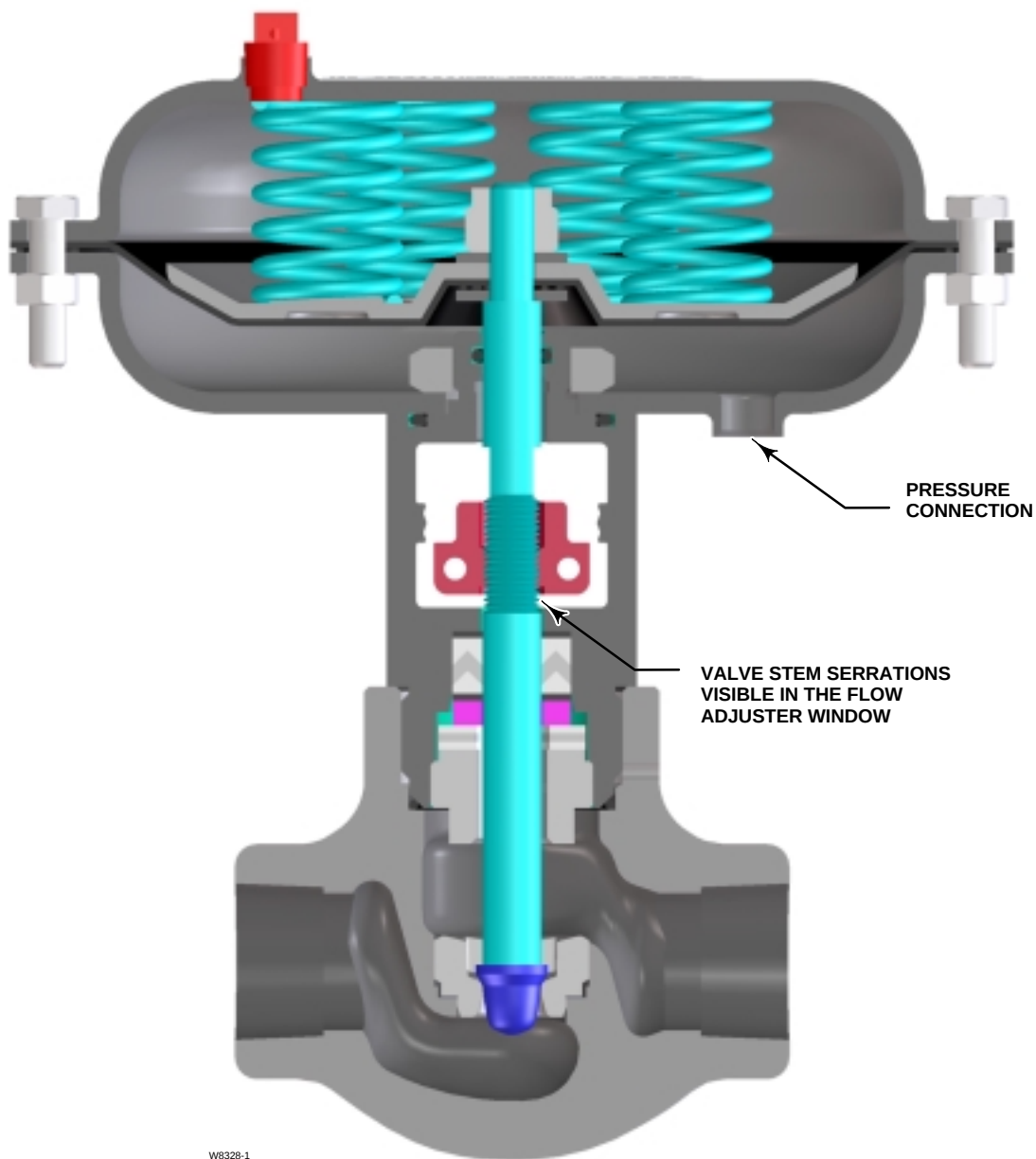
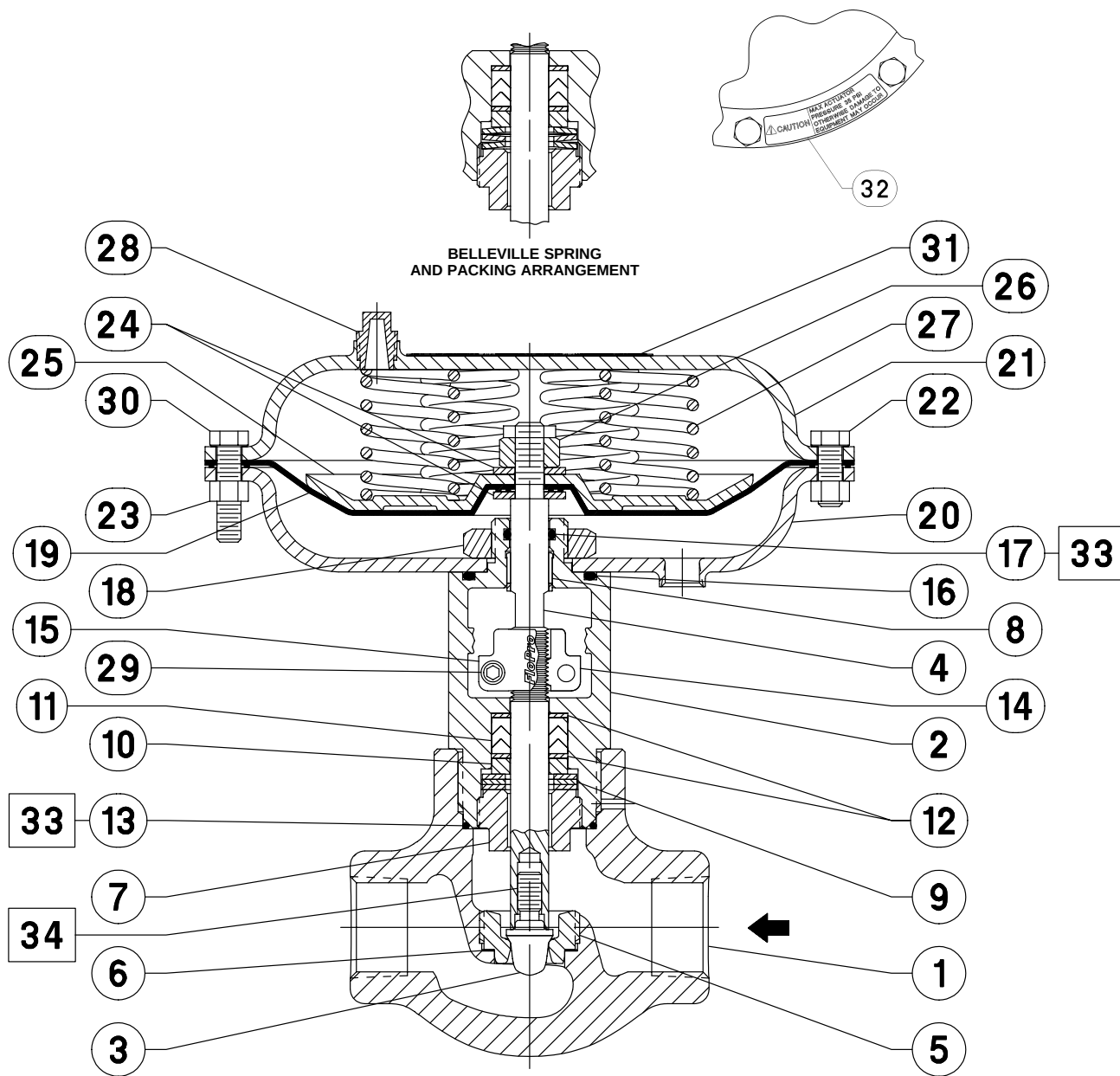


Figure 5. Type D2 FloPro Interior Detail



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Figure 6. Type D2 FloPro Assembly—Spring-to-Close

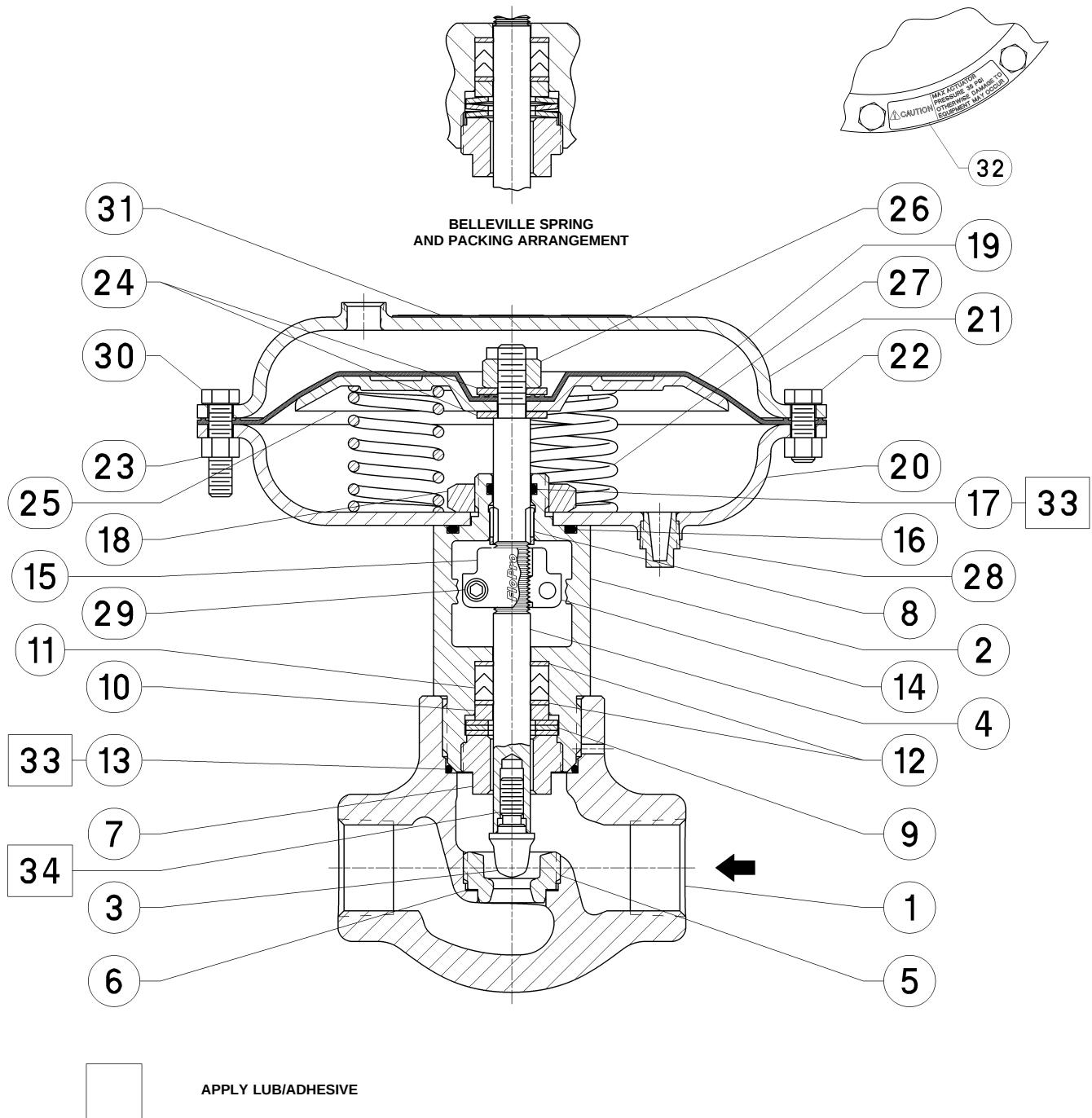


Figure 7. Type D2 FloPro Assembly—Spring-to-Open

Parts Ordering

Components that are not manufactured by Fisher should not, under any circumstances, be used in any Fisher valve. The use of parts not manufactured by Fisher may adversely affect the performance of the valve as well as worker and workplace safety.

Note

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Parts Kits

	Description	Part Number
*	Valve Trim Kit Includes key numbers 3, 5, 6, and 13	19B8485X012
*	Valve Packing Kit Includes key numbers 8, 11, 12 (2 req'd), 13, 16, and 17	19B8486X012
*	Spring-to-Open Spring Kit Includes key number 27 (3 springs)	10C1998X012

Parts List

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your Fisher sales office.

Key	Description	Part Number
1	Valve Body	
2	Bonnet	
3	Valve Plug	
4*	Valve Stem	39B5914X012
5	Seat Ring	
6*	Seat Ring Gasket	19B5887X012
7	Packing Retainer	
8	Valve Stem Bushing	
9	Belleville Springs (3 req'd)	
10	Packing Spacer	
11	ENVIRO-SEAL D2 Packing Set	
12	Anti-Extrusion Ring (2 req'd)	
13	Valve Body O-ring	
14	Flow Adjuster Half	
15	Flow Adjuster Half	
16	Casing O-ring	
17	Valve Stem O-ring	
18	Hex Nut	
19*	Diaphragm	39B3849X012
20	Bottom Casing	
21	Upper Casing	
22	Short Actuator Casing Cap Screws (6 req'd)	
23	Nut	
24	Washer (2 req'd for spring-to-open, 1 req'd for spring-to-close)	
25	Diaphragm Plate	
26	Diaphragm Hex Nut	
27	Springs Spring-to-Close (6 springs) Spring-to-Open (Spring Kit, 3 springs included)	
28	Vent Plug	
29	Flow Adjuster Socket Head Cap Screws (2 req'd)	
30	Long Actuator Casing Cap Screws (2 req'd)	
31	Nameplate	
32	Caution Label	
33	Lubricant, Dow Corning 111 Compound or equivalent	
36	Washer (spring-to-close)	

*Recommended spare parts

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