167D Series Switching Valves

P1185

TYPE 167D TWO-WAY SWITCHING VALVE

P1184

TYPE 167DA THREE-WAY SWITCHING VALVE

Figure 1. *167D Series Switching Valves*

WARNING

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

Fisher® switching valves must be installed, operated, and maintained in accordance with federal, state, and local codes, rules, and regulations, and Emerson Process Management Regulator Technologies, Inc. instructions.

If the switching valve vents gas or a leak develops in the system, service to the unit may be required. Failure to correct trouble could result in a hazardous condition.

Installation, operation, and maintenance procedures performed by unqualified personnel may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Use qualified personnel when installing, operating, and maintaining the 167D Series switching valves.

Introduction

Scope of the Manual

This manual provides instructions for the installation, maintenance, and parts ordering for the 167D Series Switching Valves. Instructions and parts lists for other equipment mentioned in this instruction manual, as well as for other switching valves are found in separate manuals.

D103234X012

Specifications

Some general 167D Series switching valve ratings and other specifications are given on this page. A label on the spring case gives the control spring range for a given valve as it comes from the factory.

Available Configurations

Types 167D and 167DS: Two-way switching valve
Types 167DA and 167DAS: Three-way switching valves

Body Size, Inlet and Outlet Connection Style

Ports A and C: 1/4 or 1/2 NPT
Vent and Control Pressure Connections (Port D) and Port B: 1/4 NPT

Maximum Operating Inlet Pressure[1]

Types 167D and 167DS: 400 psig / 27,6 bar
Types 167DA and 167DAS: 125 psig / 8,6 bar
Types 167DA and 167DAS (NACE): 100 psig / 6,9 bar

Set Pressure Ranges

See Tables 1 and 2

Maximum Diaphragm Pressure[1]

150 psi / 10,3 bar over outlet pressure setting up to a maximum of 250 psi / 17,2 bar

Flow and Sizing Coefficients

See Table 3

Spring Case Vent Location

Aligned with inlet **(standard)**, other positions optional

Temperature Capabilities[1]

Nitrile (NBR)

Standard Service (Types 167D and 167DA only): -20° to 180°F / -29° to 82°C
Low Temperature Service (Types 167D and 167DA only) and Standard Service (Types 167DS and 167DAS only): -40° to 180°F / -40° to 82°C

Fluorocarbon (FKM)

High Temperature Service: 0° to 300°F / -18° to 149°C

Approximate Weights

Types 167D and 167DA: 1.2 pounds / 0,5 kg
Types 167DS and 167DAS: 2.8 pounds / 1 kg

Options

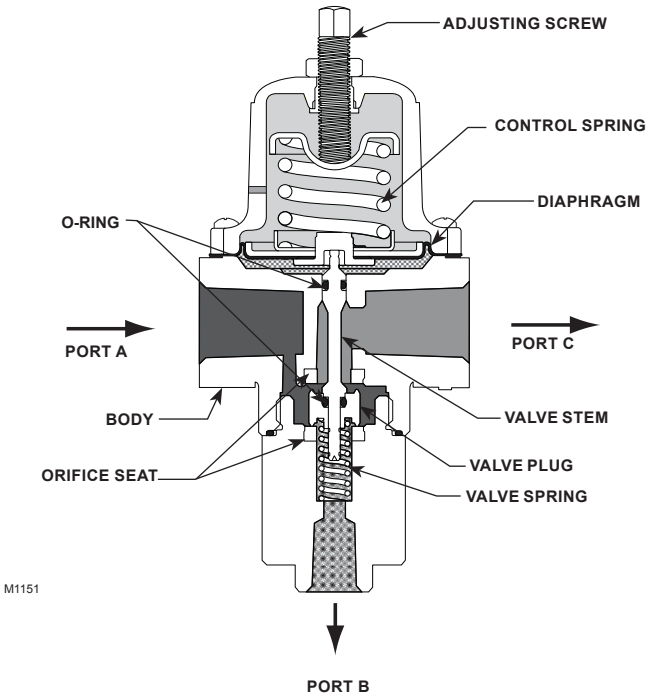
Types 167D and 167DA

- Handwheel adjusting screw
- Fluorocarbon (FKM) diaphragm, soft seat, seat, and O-rings
- Stainless steel valve stem and plug. Includes stainless steel seat
- 1-hole panel mount with handwheel adjusting screw and 1/4 NPT tap spring case
- 3-hole panel mount bonnet with handwheel adjusting screw and 1/4 NPT spring case
- 1/4 NPT tapped vent spring case
- 1/4 NPT tapped vent and closing cap
- Adjusting screw with locknut and a lock wire to one flange bolt (For Type 167D only)
- Panel mounting bracket. Includes 1/4 NPT spring case, standard adjusting screw, nut, and bracket
- Yoke mounting bracket. Includes 1/4 NPT spring case, standard adjusting screw, nut, fasteners, and bracket
- Size 30-70 casing mounting bracket. Includes 1/4 NPT spring case, standard adjusting screw, nut, fasteners, and bracket
- NACE MR0175 or NACE MR0103 construction[2]

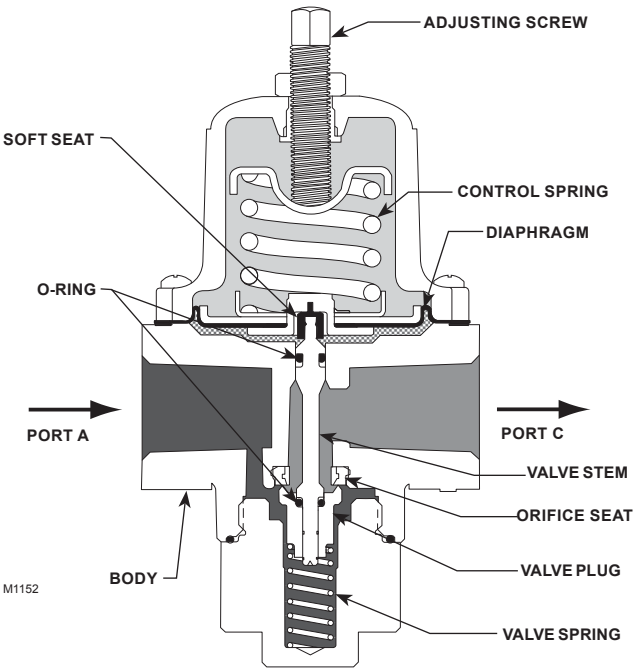
Types 167DS and 167DAS

- Handwheel adjusting screw
- Fluorocarbon (FKM) diaphragm, soft seat, seat, and O-rings
- 1-hole panel mount with handwheel adjusting screw and 1/4 NPT tap spring case
- Panel mounting bracket. Includes 1/4 NPT spring case, standard adjusting screw, nut, and bracket
- Yoke mounting bracket. Includes 1/4 NPT spring case, standard adjusting screw, nut, fasteners, and bracket
- Size 30-70 casing mounting bracket. Includes nut, fasteners, and bracket

1. The pressure/temperature limits in this Instruction Manual and any applicable standard or code limitation should not be exceeded.
2. Product complies with the material requirements of NACE MR0175 or MR0103. Environmental limits may apply.



TYPE 167DA THREE-WAY SWITCHING VALVE



TYPE 167D TWO-WAY SWITCHING VALVE

INLET PRESSURE
OUTLET PRESSURE (WHEN LOADING PRESSURE IS LESS THAN SETPOINT)
OUTLET PRESSURE (WHEN LOADING PRESSURE IS EQUAL TO OR GREATER THAN SETPOINT)
ATMOSPHERIC PRESSURE
LOADING PRESSURE

Figure 2. *167D Series Operational Schematics (Port D not shown)*

Table 1. *Three-Way Switching Valves Set Pressure Ranges and Control Spring Data*

TYPE	SET PRESSURE RANGE				CONTROL SPRING DATA							MAXIMUM PRESSURE CHANGE ON TO SHIFT FROM PORT B CLOSED TO PORT C CLOSED	
	Port A or C as Inlet		Port B as Inlet		Color Code	Material	Part Number	Wire Diameter		Free Length			
	psig	bar	psig	bar				Inch	mm	Inch	mm	psid	bar d
167DA	14 to 20 16 to 35	0,97 to 1,4 1,1 to 2,4	7 to 20 10 to 30	0,48 to 1,4 0,69 to 2,1	White stripe Purple stripe	Zinc-plated Music Wire	GE40282X012 GE40283X012	0.145 0.156	3,68 3,96	1.425	36,2	10 13	0,69 0,90
	25 to 60 40 to 125	1,7 to 4,1 2,8 to 8,6	25 to 50 40 to 90	1,7 to 3,4 2,8 to 6,2	Brown stripe Pink stripe	Chrome Silicon	GE40284X012 GE40345X012	0.172 0.207	4,37 5,26			17 35	1,2 2,4
167DAS	14 to 20 16 to 35 25 to 60 40 to 125	0,97 to 1,4 1,1 to 2,4 1,7 to 4,1 2,8 to 8,6	7 to 20 10 to 30 25 to 50 40 to 90	0,48 to 1,4 0,69 to 2,1 1,7 to 3,4 2,8 to 6,2	White Purple Brown Pink	Inconel® X-750	GE40320X012 GE40321X012 GE40322X012 GE40323X012	0.148 0.162 0.177 0.218	3,76 4,12 4,50 5,54	1.750	44,4	8 12 16 31	0,55 0,83 1,1 2,1

Table 2. *Two-Way Switching Valves Set Pressure Ranges and Control Spring Data*

TYPE	SET PRESSURE RANGE		CONTROL SPRING DATA						
	Port A as Inlet		Color Code	Material	Part Number	Wire Diameter		Free Length	
	psig	bar				Inch	mm	Inch	mm
167D	3 to 15 5 to 20 5 to 35	0,21 to 1,0 0,34 to 1,4 0,34 to 2,4	Yellow stripe White stripe Purple stripe	Zinc-plated Music Wire	GG00421X012 GE40282X012 GE40283X012	0.142 0.145 0.156	3,61 3,68 3,96	1.425	36,2
	25 to 60 40 to 125	1,7 to 4,1 2,8 to 8,6	Brown stripe Pink stripe	Chrome Silicon	GE40284X012 GE40345X012	0.172 0.207	4,37 5,26		
167DS	5 to 20 5 to 35 25 to 60 40 to 125 50 to 150	0,34 to 1,4 0,34 to 2,4 1,7 to 4,1 2,8 to 8,6 3,4 to 10,3	White Purple Brown Pink Gold	Inconel® X-750	GE40320X012 GE40321X012 GE40322X012 GE40323X012 GE40324X012	0.148 0.162 0.177 0.218 0.234	3,76 4,12 4,50 5,54 5,94	1.750	44,4

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Product Description

The 167D Series switching valves are pneumatically operated and controlled units, built with a wide range of capabilities to handle those switching applications that involve venting, on-off control, and failure modes.

- The Types 167D and 167DS are two-way switching valves.
- The Types 167DA and 167DAS are three-way switching valves.

Principle of Operation

Refer to Figure 2 and also refer to Figures 3 through 5 for port D location. Control pressure enters the switching valve through port D (not shown in Figure 2) and registers under the diaphragm. Control pressure overcomes the spring force and the diaphragm and raise the valve plug, closing port C and opening port B of the Type 167DA three-way switching valve. In this condition, the Type 167D construction is turned off and the Type 167DA construction provides flow from path A to B. If, either intentionally or through pneumatic failure, the control pressure drops below the spring force, the diaphragm and valve plug move downward, opening port C and closing port B of the Type 167DA three-way switching valve. In this condition both constructions provide a flow path from port A to port C. The pressure change necessary to switch the valve depends on the spring used and the setting of the adjusting screw on the switching valve.

Overpressure Protection

The 167D Series switching valves have maximum outlet pressure ratings that are lower than their maximum inlet pressure ratings. A pressure-relieving or pressure-limiting device is needed if inlet pressure can exceed the maximum outlet pressure rating. Overpressuring any portion of a switching valve or associated equipment may cause leakage, parts damage, or personal injury due to bursting of pressure-containing parts or explosion of accumulated gas. Switching valve operation within ratings does not preclude the possibility of damage from external sources or from debris in the pipeline. A switching valve should be inspected for damage periodically and after any overpressure condition.

Installation

Note

If the switching valve is shipped mounted on another unit, install that unit according to the appropriate Instruction Manual.

WARNING

Personal injury, property damage, equipment damage, or leakage due to escaping gas or bursting of pressure-containing parts may result if this switching valve is overpressured or is installed where service conditions could exceed the limits given in the Specifications section, or where conditions exceed any ratings of the adjacent piping or piping connections. To avoid such injury or damage, provide pressure-relieving or pressure-limiting devices (as required by the appropriate code, regulation, or standard) to prevent service conditions from exceeding those limits.

Before installing a Type 167D, 167DA, 167DS, or 167DAS switching valve, be sure the installation complies with the following installation guidelines:

1. Switching valve operation within ratings does not preclude the possibility of damage from debris in

Table 3. *Flow and Sizing Coefficients*

TYPES	BODY SIZE	PORT	WIDE-OPEN FLOW COEFFICIENTS		C_1	IEC SIZING COEFFICIENTS
			C_g	C_v		X_t
167D, 167DS	1/4 NPT	C	41.46	1.09	37.56	0.89
	1/2 NPT		46.50	1.18	39.03	0.96
167DA, 167DAS	All sizes	B	27.79	0.96	28.74	0.52
	1/4 NPT	C	49.35	1.60	30.58	0.59
	1/2 NPT		58.86	1.81	32.22	0.66

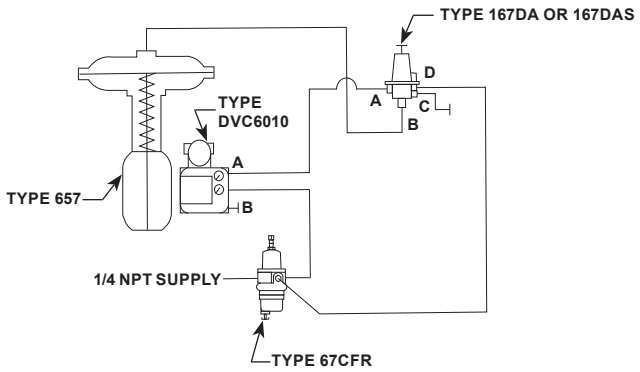

Figure 3. *Typical 167DA or 167DAS Installation*
(Lockup system using Type 167DA or 167DAS to close air circuit to diaphragm of main valve in case of plant air failure. Main valve will remain in position it occupied at time of supply pressure failure.)

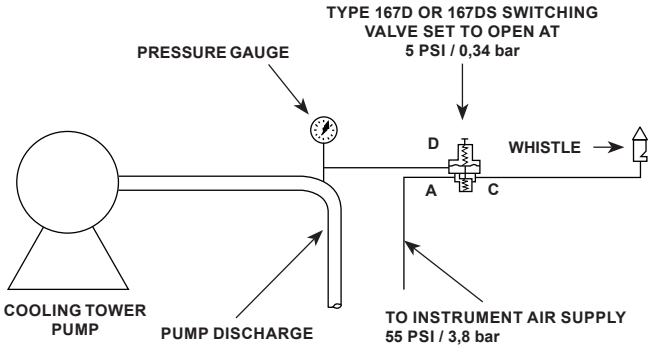

Figure 4. *Typical 167D or 167DS Installation*
(Warning system using Type 167D or 167DS two-way valve to activate a whistle when pump discharge pressure falls.)

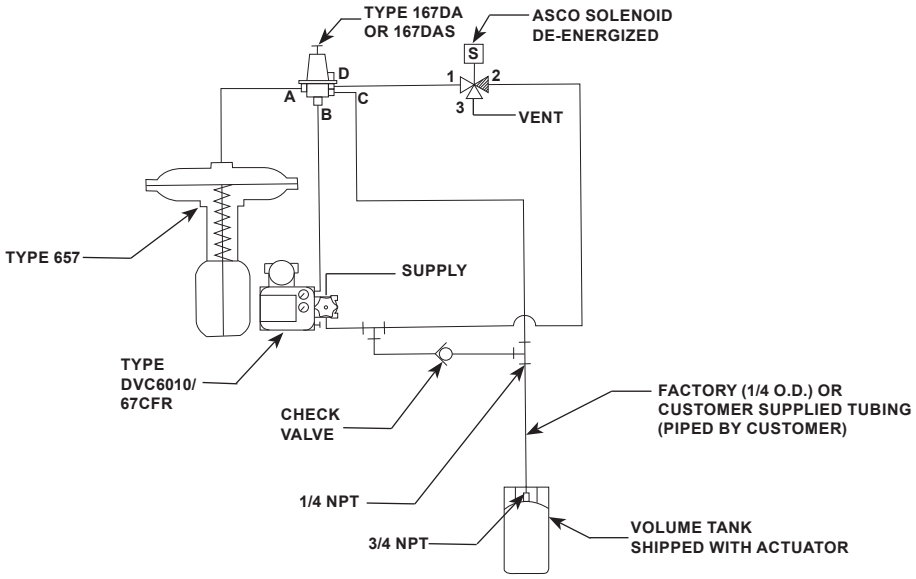

Figure 5. *Typical Switching Valve Schematic*

the lines or from external sources. Switching valves should be inspected for damage periodically and after any overpressure condition.

2. Only personnel qualified through training and experience should install, operate, and maintain a switching valve. Make sure that there is no damage to or foreign material in the switching valve. Also ensure that all tubing and piping is free of debris.
3. Install the switching valve to achieve the desired switching results. Connect the control pressure line to either D port. Verify that the other D port is plugged. The port labeled “IN” or port A is the common inlet connection and ports B and C are the outlet connections. Flow is either from A to B or A to C.
4. A clogged spring case vent hole may cause the switching valve to function improperly. To keep this vent hole from being plugged (and to keep the spring case from collecting moisture, corrosive chemicals, or other foreign material) orient the vent to the lowest possible point on the spring case or otherwise protect it.

   Inspect the vent hole regularly to make sure it is not plugged. Spring case vent hole orientation may be changed by rotating the spring case with respect to the body. A 1/4 NPT spring case vent may be remotely vented by installing obstruction-free tubing or piping into the vent. Protect the remote vent by installing a screened vent cap on the remote end of the vent pipe.
5. For use in switching valve shutdown, install upstream block and vent valves and downstream block and vent valves (if required), or provide some other suitable means of properly venting the switching valves inlet and outlet pressures. Install a pressure gauge to monitor instruments on startup.
6. Apply a good grade of pipe compound to the external pipe threads before making connections, making sure not to get the pipe compound inside the switching valves.
7. Install tubing fitting or piping into the threaded NPT inlet connection on the body (key 1) and into the threaded NPT outlet connections.
8. The 1/4 NPT control pressure ports must be plugged if not in use.

Startup and Adjustment

Key numbers are referenced in Figures 7 through 13.

1. With proper installation completed and downstream equipment properly adjusted, slowly open the upstream and downstream shut-off valve (when used) while using pressure gauges to monitor pressure.

WARNING

To avoid personal injury, property damage, or equipment damage caused by bursting of pressure containing parts or explosion of accumulated gas, never adjust the control spring to produce an outlet pressure higher than the upper limit of the outlet pressure range for that particular spring. If the desired outlet pressure is not within the range of the control spring, install a spring of the proper range according to the diaphragm parts maintenance procedure.

2. If outlet pressure adjustment is necessary, monitor outlet pressure with a gauge during the adjustment procedure. The switching valve is adjusted by loosening the hexnut (key 19), if used, and turning the adjusting screw or handwheel (key 18) clockwise to increase or counterclockwise to decrease the outlet pressure setting. Retighten the hexnut to maintain the adjustment position.

Maintenance

Switching valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement of parts depend on the severity of service conditions and applicable codes and government regulations.

Note

If sufficient clearance exists, the body (key 1) may remain mounted on other equipment or in a line or panel during maintenance unless the entire switching valve will be replaced.

WARNING

To avoid personal injury, property damage, or equipment damage caused by sudden release of pressure or explosion of accumulated gas, do not attempt any maintenance or disassembly without first isolating the switching valve from system pressure and relieving all internal pressure from the switching valve.

Trim Maintenance

Key numbers are referenced in Figures 7 through 10.

1. Unscrew the spring retainer (key 48) and separate the spring retainer and O-ring (key 14) from the body (key 1).
2. Inspect the removed parts for damage and debris. Replace any damaged parts. Apply a high quality lubricant to the O-ring (key 50) before reassembling.
3. To remove the valve stem (key 11) and valve plug (key 57), grasp the end and pull it straight out of the body (key 1). Inspect the parts for damage and debris. Replace any damaged parts. The valve stem and valve plug may be cleaned or replaced. Types 167D and 167DS: If the soft seat (key 15) was removed, make sure it is properly snapped into place before installing the valve stem. Apply a high quality lubricant to the O-ring (key 50) before reinstalling the valve stem.
4. Install valve stem and valve plug by sliding the valve stem through center of the seat (key 58) until the valve plug contacts the seat. Apply lubricant to O-ring (key 14) and thread in spring retainer (key 48). Torque spring retainer to 18 to 22 foot-pounds / 24 to 30 N•m.

Diaphragm Maintenance

Key numbers are referenced in Figures 7, 8, 9, 10, and 12.

1. Back out the adjusting screw or handwheel (key 18) until compression is removed from the spring (key 17).
2. Remove the flange screws (key 3) to separate the spring case assembly (key 7) from the body (key 1). Remove the upper spring seat (key 20) and the control spring (key 17).
3. Remove the diaphragm assembly (key 16), inspect the diaphragm, and replace the assembly, if necessary.

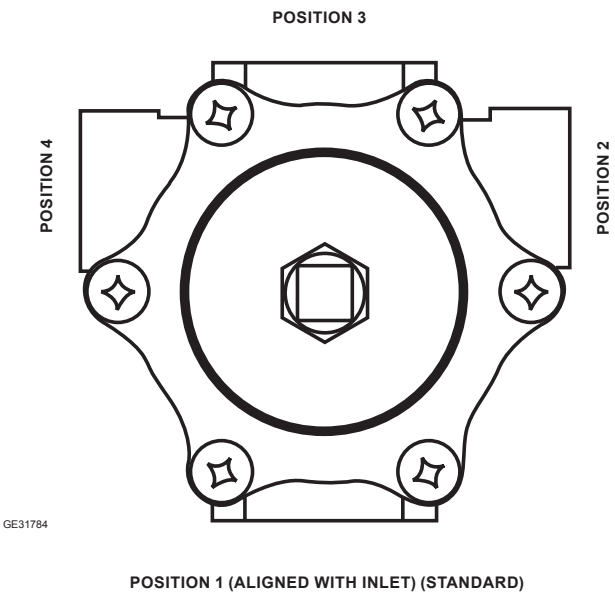

Figure 6. *167D Series Spring Case Vent Positions*

4. Place the diaphragm assembly (key 16) on the body (key 1) as shown in Figures 7 through 10. Push down on the diaphragm assembly to make sure the valve plug (key 57) strokes smoothly and approximately 1/16-inch / 1,6 mm.

Note

In step 5, if installing a control spring of a different range, be sure to delete the spring range originally appearing on the label and indicate the new spring range.

5. Stack the control spring (key 17) and upper spring seat (key 20) onto the diaphragm assembly (key 16).
6. Install the spring case assembly (key 7) on the body (key 1) with the vent oriented to prevent clogging or entrance of moisture. Install the six flange screws (key 3) using a crisscross pattern and torque to 15 to 30-inch-pounds / 1,7 to 3,4 N•m.

Note

On Types 167DS and 167DAS, lubricate the adjusting screw (key 18) thread to reduce galling of the stainless steel.

7. When all maintenance is complete, refer to the Startup and Adjustment section to put the switching valve back into operation and adjust the pressure setting. Tighten the hexnut (key 19) if used, and install the closing cap (key 33) if used.

Parts Ordering

When corresponding with the local Sales Office about this switching valve, include the type number and all other pertinent information printed on the label. Specify the eleven-character part number when ordering new parts from the following parts list.

Parts List

Key	Description	Part Number
	Types 167D and 167DS - Includes O-ring (key 14), seat (key 58), plug assembly (keys 15, 50, 57, 11, 64), and diaphragm assembly (key 16).	
	Type 167D	
	Brass/Nitrile (NBR) seat and plug assembly	R167DX00012
	Types 167D NACE, 167DS, and 167DS NACE	
	316L Stainless steel/Nitrile (NBR) seat and plug assembly	R167DSX0N12
	Types 167DA and 167DAS - Includes O-ring (key 14), two seats (key 58), plug assembly (keys 50, 57, 11, 64), and diaphragm assembly (key 16).	
	Type 167DA	
	Brass/Nitrile (NBR) seat and plug assembly	R167DAX0022
	Types 167DA NACE, 167DAS, and 167DAS NACE	
	316L Stainless steel/Nitrile (NBR) seat and plug assembly	R167DASXN22
1	Body	
	1/4 NPT (Ports A and C)	
	Type 167D or 167DA, Aluminum	GE35383X012
	Type 167DS or 167DAS, CF3M/CF8M Stainless steel	GE35385X012
	1/2 NPT (Ports A and C)	
	Type 167D or 167DA, Aluminum	GE31787X012
	Type 167DS or 167DAS, CF3M/CF8M Stainless steel	GE31804X012
3	Flange Screw	
	Types 167D and 167DA	
	For Standard spring case and spring case with 1/4 NPT vent (6 required), Zinc-plated steel	T13526T0012
	For Standard Spring Case (6 required), 316/316L Stainless steel	T13526T0042
	For wire seal	
	Flange Screw (5 required), Zinc-plated steel	T13526T0012
	Flange Screw (1 required), Steel	14B3987X012
	Types 167DS and 167DAS (6 required), 316L Stainless steel	T13526T0042
7	Spring Case Assembly	
	Types 167D and 167DA, Aluminum	
	Drilled hole vent **(standard)**	T14070T0012
	1/4 NPT vent	T14070T0022
	Types 167DS and 167DAS, CF8M/CF3M Stainless steel	20C1727X012
11	Valve Stem	
	Types 167D and 167DA,	
	Brass	GE35519X012
	316L Stainless Steel	GE35519X032
	Types 167DS and 167DAS	
	316L Stainless steel	GE35519X032
12*	Valve Spring	
	Type 167D or 167DS	
	302 Stainless steel	GE31783X012
	Inconel® X-750 (NACE)	GG00430X012
	Type 167DA or 167DAS	
	302 Stainless steel	ERAA00153A0
	Inconel® X-750 (NACE)	ERAA00154A0
14*	O-ring (Spring Retainer)	
	Nitrile (NBR)	10A3803X092
	Fluorocarbon (FKM)	10A3803X112
15	Soft Seat (Types 167D and 167DS only)	
	Nitrile (NBR)	T14055T0012
	Fluorocarbon (FKM)	T14055T0022
16*	Diaphragm Assembly	
	Type 167D	
	Nitrile(NBR)/Polyester	T14119T0022
	Fluorocarbon(FKM)/Polyester	T14119T0042
	Type 167DS	
	Nitrile(NBR)/Polyester	T14119T0062
	Fluorocarbon(FKM)/Polyester	T14119T0072
	Type 167DA	
	Nitrile(NBR)/Brass	T14119T0112
	Nitrile(NBR)/316L Stainless Steel	T14119T0122
	Fluorocarbon(FKM)/316L Stainless Steel	T14119T0132
	Type 167DAS	
	Nitrile(NBR)/316L Stainless Steel	T14119T0122
	Fluorocarbon(FKM)/316L Stainless Steel	T14119T0132
17	Control Spring	See Tables 1 and 2
18	Adjusting Screw	
	Types 167D and 167DA	
	Zinc-plated steel (For standard spring case)	
	Square head **(standard)**	T14061T0012
	Handwheel	T14102T0012
	Wire seal (not shown)	T14104T0012
	Zinc-plated steel (For spring case with 1/4 NPT vent)	
	Square head for closing cap	T14101T0012
	Handwheel	T14103T0012
	Wire seal (not shown)	T14198T0012
	316 Stainless Steel	
	(For Spring case with 1/4 NPT vent)	
	Square head for closing cap	T14101T0022
	Types 167DS and 167DAS	
	Square head with or without closing cap, 316L Stainless steel	T14101T0022
	Handwheel, Zinc-plated steel	T14103T0012
19	Hexnut	
	Types 167D and 167DA	
	Zinc-plated steel	1A946324122
	316 Stainless steel	1A9463X0042
	Types 167DS and 167DAS	
	316 Stainless steel	1A9463X0042
20	Upper Spring Seat	
	Types 167D and 167DA, Zinc-plated steel	T14051T0012
	Types 167DS and 67DAS, 316 Stainless steel	10C1725X012
23	1/4 NPT Pipe Plug	
	Socket head, Steel	
	(for Types 167D and 167DA only)	1C333528992
	Hex head, 316 Stainless steel	1A767535072
30	NACE Tag, 18-8 Stainless Steel (not shown)	19A6034X012
31	Panel Mounting Nut, 303 Stainless steel	10B2657X012
32	Wire Seal (not shown)	
	(for Types 167D and 167DA only)	
	304 Stainless steel	1U7581000A2

*Recommended Spare Parts

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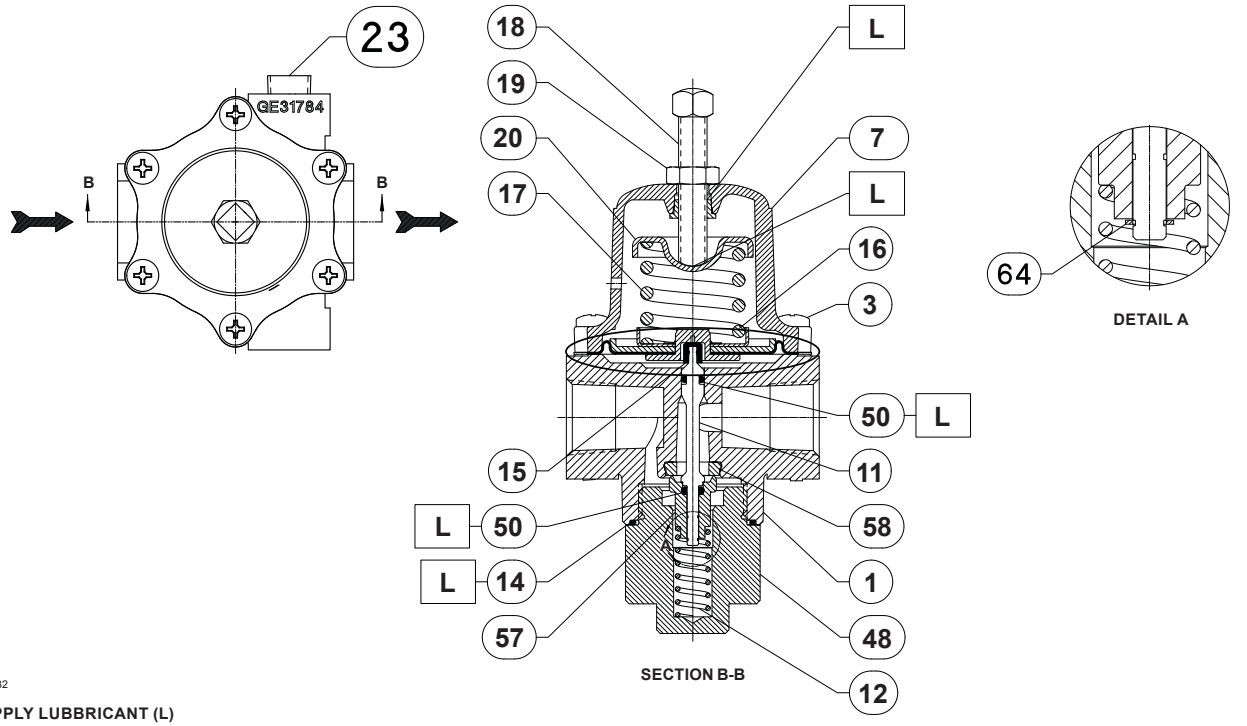

Figure 7. *Type 167D Assembly*

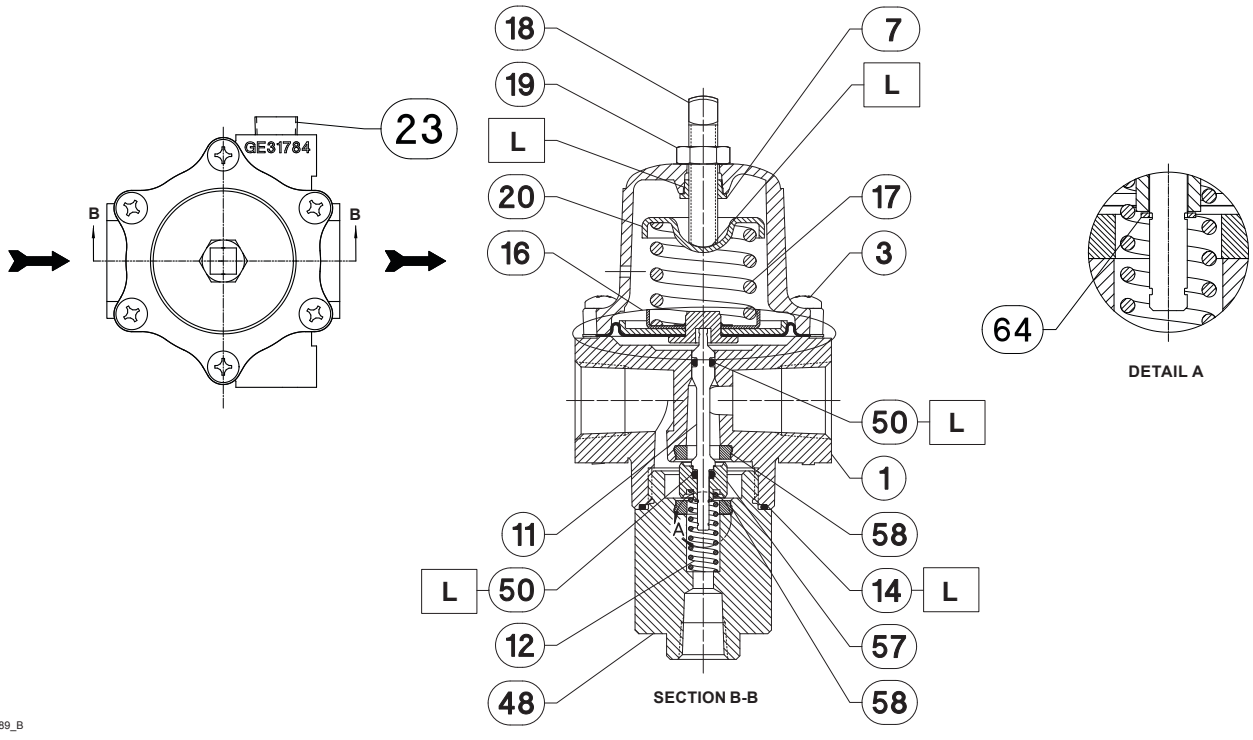

Figure 8. *Type 167DA Assembly*

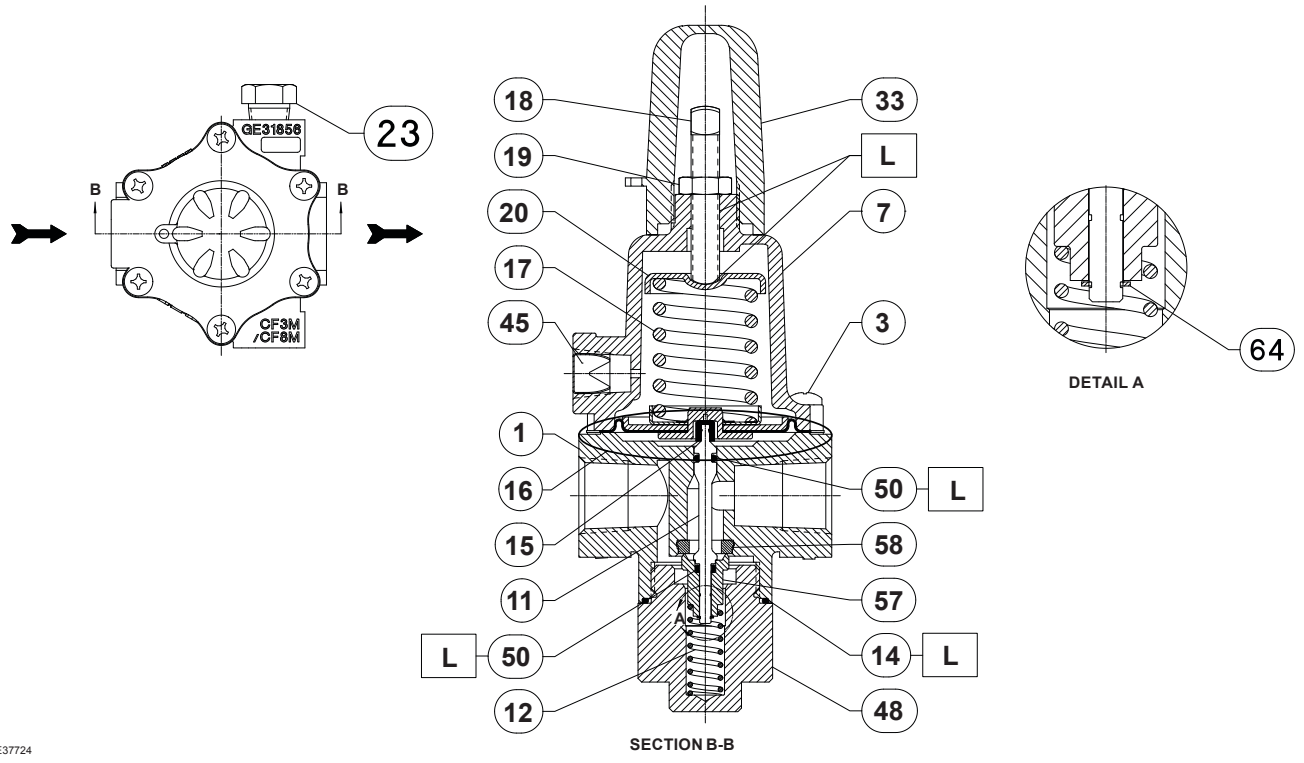

Figure 9. *Type 167DS Assembly*

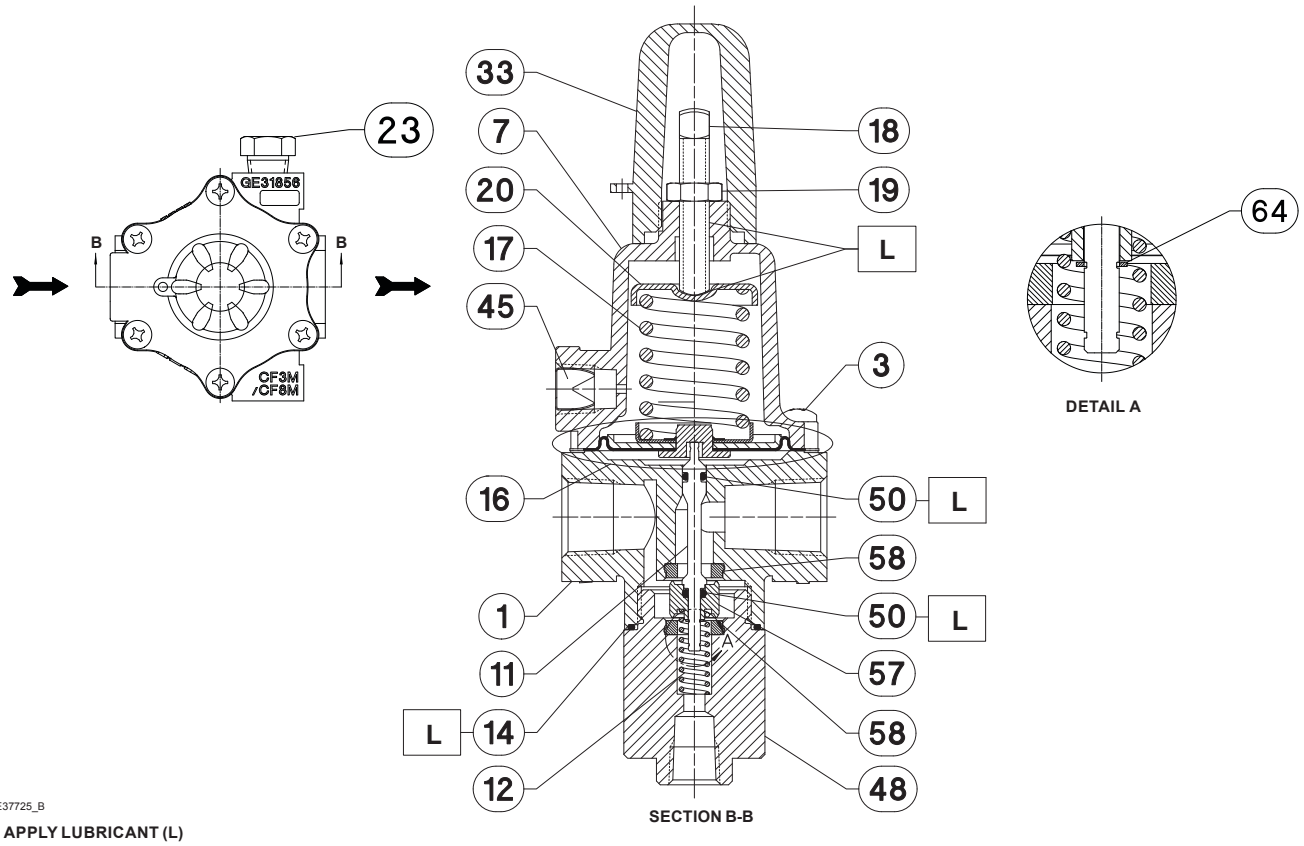

Figure 10. *Type 167DAS Assembly*

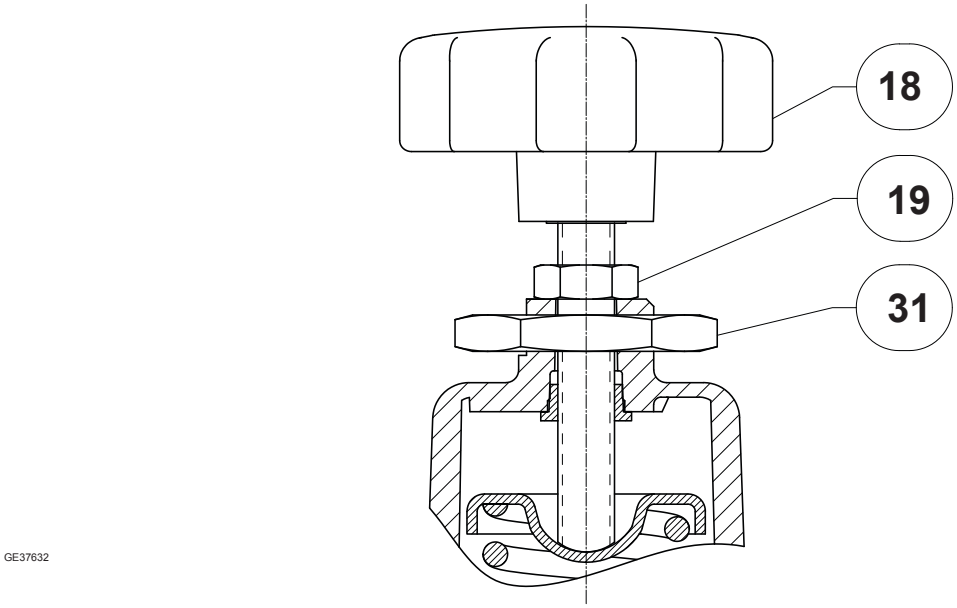

Figure 11. *Optional Panel Mount*

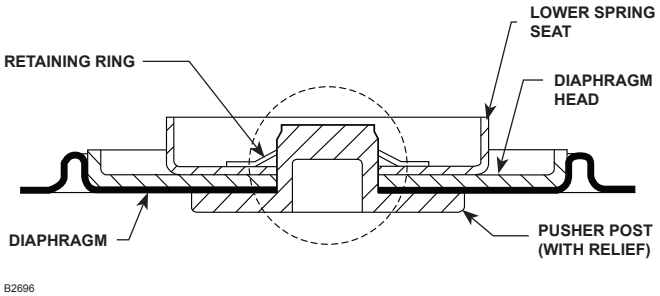

Figure 12. *Types 167D and 167DS Diaphragm Assembly (Key 16)*

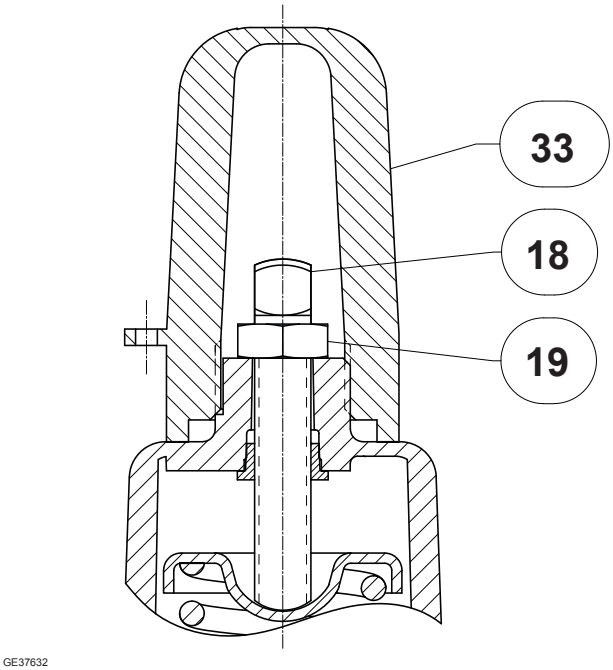

Figure 13. *Optional Closing Cap [Only Available with the 1/4 NPT Spring Case Vent]*

Key	Description	Part Number
33	Closing Cap, Plastic	23B9152X012
45	Screen Vent (for Types 167DS and 167DAS only)	
	18-8 Stainless Steel	0L078343062
48	Spring Retainer	
	Type 167D	
	Aluminum	GG03555X012
	Type 167DS	
	316L Stainless steel	GE31803X022
	Type 167DA	
	Aluminum	GF02286X012
	Type 167DAS	
	316L Stainless steel	GF02286X022
50*	O-ring (Stem and Plug) (2 required)	
	Nitrile (NBR)	1H2926X0052
	Fluorocarbon (FKM)	1H2926X0062
57	Valve Plug	
	Type 167D	
	Brass	GE37022X012
	316L Stainless steel	GE37022X022
	Type 167DS	
	316L Stainless steel	GE37022X022

Key	Description	Part Number
57	Valve Plug (continued)	
	Type 167DA	
	Brass	GE35229X012
	316L Stainless steel	GE35229X022
	Type 167DAS	
	316L Stainless steel	GE35229X022
58*	Orifice Seat	
	Types 167D and 167DA	
	303 Stainless steel/Fluorocarbon (FKM)	GE31782X022
	Brass/Nitrile (NBR)	GE31782X032
	316L Stainless steel/Nitrile (NBR) (NACE)	GE31782X042
	316L Stainless steel/ Fluorocarbon (FKM) (NACE)	GE31782X052
	Types 167DS and 167DAS	
	Stainless steel/Fluorocarbon (FKM)	GE31782X022
	Stainless steel/Nitrile (NBR)	
	Standard	GE31782X012
	(NACE)	GE31782X042
	Stainless steel/Fluorocarbon (FKM) (NACE)	GE31782X052
64	Retaining Ring, Stainless steel	GG00711X012

*Recommended Spare Parts

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