

# Fisher® SS-263 Volume Booster

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Figure 1. Fisher SS-263 Volume Booster



## Introduction

### Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts information for the SS-263 volume booster (figure 1). Refer to separate instruction manuals for information regarding the valve body, actuator, and other accessories.

Do not install, operate, or maintain an SS-263 volume booster without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your Emerson Process Management sales office before proceeding.

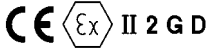
### Description

The SS-263 volume booster is used exclusively in Fisher Optimized Digital Valve (ODV) packages. The booster amplifies the output signal from the FIELDVUE™ digital valve controller to increase the stroking speed of pneumatic actuators. It has fixed deadband and incorporates soft-seat construction for use with the Fisher 377 Trip Valve.

The booster features dynamically stabilized trim and integral bypass restriction for use with the digital valve controller. The SS-263 volume booster delivers high-volume output for fast stroking speeds when responding to large input signal changes. However, it also delivers smooth, stable, low-volume output when responding to small input signal changes. This allows stable, accurate throttling control which is often necessary during the startup or commissioning of process control equipment.



Table 1. Specifications

<p><b>Port Diameters</b> Supply Port: 19 mm (0.75 inch) Exhaust Port: 19 mm (0.75 inch)</p> <p><b>Input Signal</b> Positioner output</p> <p><b>Maximum Input Signal Pressure</b> 10.3 bar (150 psig)</p> <p><b>Input to Output Pressure Ratio</b> Fixed at 1 to 1</p> <p><b>Supply Pressure Ranges<sup>(1)</sup></b> Maximum pressure must not exceed 10.3 bar (150 psig)</p> <p><b>Operative Temperature Limits<sup>(1)</sup></b> -40 to 71 °C (-40 to 160 °F)</p> <p><b>Maximum Flow Coefficients</b> Supply: 9.5 Cv Exhaust: 9.5 Cv C1: 35 Xt: .77</p>	<p><b>Connections</b> Input Signal: 1/4 NPT Supply: 1 NPT Output: 1 NPT or 1-1/4 NPT<sup>(2)</sup></p> <p><b>Hazardous Area Classification</b> Complies with the requirements of ATEX Group II Category 2 Gas and Dust</p> <p></p> <p><b>Declaration of SEP</b> Fisher Controls International LLC declares this product to be in compliance with Article 3 paragraph 3 of the Pressure Equipment Directive (PED) 97 / 23 / EC. It was designed and manufactured in accordance with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance.  However, the product <i>may</i> bear the CE marking to indicate compliance with <i>other</i> applicable EC Directives.</p> <p><b>Approximate Weight</b> Aluminum: 3.6 kg (8 lbs) Stainless Steel: 10.8 kg (24 lbs)</p>
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NOTE: Specialized instrument terms are defined in ANSI/ISA Standard 51.1 - Process Instrument Terminology

1. The pressure/temperature limits in this document, and any applicable code or standard limitation should not be exceeded.

2. Consult factory for additional sizes.

## Educational Services

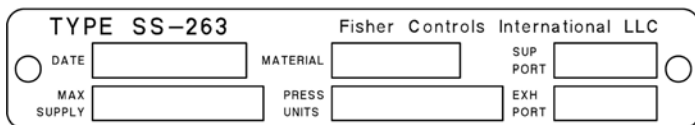
For information on available courses for Fisher SS-263 volume booster, as well as a variety of other products, contact:

Emerson Process Management  
Educational Services - Registration  
Phone: 1-641-754-3771 or 1-800-338-8158  
E-mail: [education@emerson.com](mailto:education@emerson.com)  
<http://www.emersonprocess.com/education>

## Specifications

Specifications for the SS-263 volume booster are listed in table 1. Information for an individual unit as it comes from the factory appears on the nameplate (figure 2).

Figure 2. Example Nameplate



## Installation

### **▲ WARNING**

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

System damage may result if a volume booster is installed in a way that it can be physically damaged.

Personal injury or system damage may result when service conditions exceed booster or other equipment ratings. Exceeding the pressure specifications in table 1 may cause leakage, parts damage, or personal injury due to bursting of pressure-containing parts or explosion of accumulated gas.

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

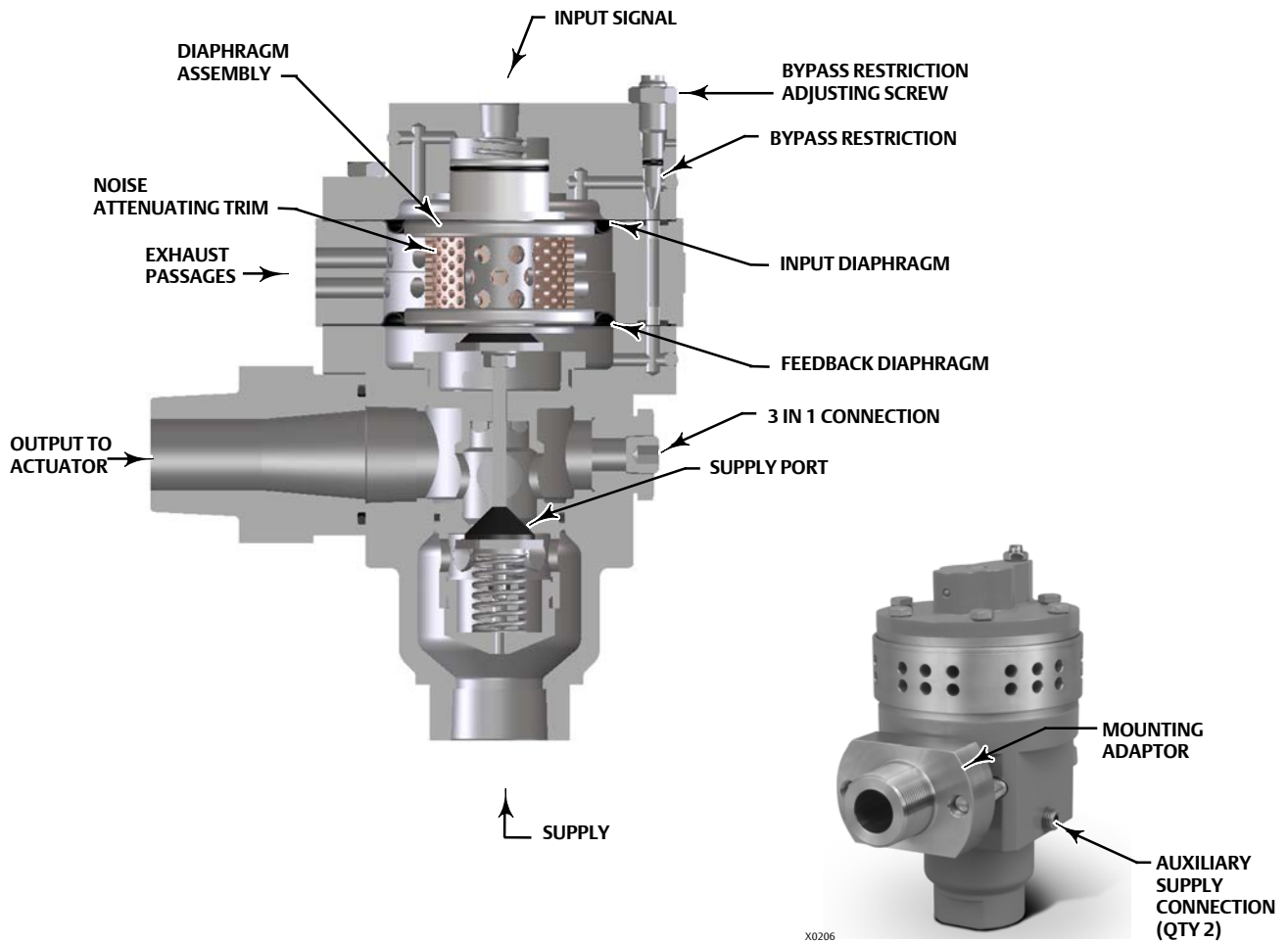
### **Note**

Do not use separate pressure supplies for the volume booster and associated positioner.

The volume booster may not exhaust immediately upon loss of a separate pressure supply. However, if the system is in a transient state at the time of pressure supply loss or if changes to the booster's input signal are sufficient to overcome the deadband, the booster will exhaust.

A high-capacity regulator is required to provide sufficient capacity to supply both components. A high-capacity filter should be installed in the supply line to the regulator.

Figure 3. Volume Booster Sectional View



## Mounting

The volume booster is mounted to the actuator using the provided mounting adaptor (figure 3) that attaches to the top or bottom of the piston cylinder using a 1 NPT or 1-1/4 NPT connection and to the SS-263 using a flange-type connection. For mounting to an ATI piston actuator, a 1-1/4 NPT pipe elbow (key 34) is installed between the mounting adaptor and piston cylinder. Mounting of the SS-263 to the actuator is typically performed at the factory; however the following instructions can be used to mount the SS-263 to a Fisher 685 or ATI piston actuator.

### Mounting to a Fisher 685 Piston Actuator

1. Apply a suitable thread sealant to the threads of the mounting adaptor (key 29) and thread into the appropriate 1 NPT or 1-1/4 NPT connection port on the actuator.
2. Install O-ring (key 30) into the groove in the mounting adaptor (key 29).
3. Using studs (key 31), lock washers (key 33) and hex nuts (key 32) mount the SS-263 onto the actuator. Tighten hex nuts (key 32) to 50 ft-lbs.

### Mounting to an ATI Piston Actuator

1. Apply a suitable thread sealant to the threads of the 1-1/4 NPT pipe elbow (key 34) and thread into the appropriate 1-1/4 NPT connection port on the actuator.
2. Apply a suitable thread sealant to the threads of the mounting adaptor (key 29) and thread into the 1-1/4 NPT pipe elbow (key 34).
3. Install O-ring (key 30) into the groove in the mounting adaptor (key 29).
4. Using studs (key 31), lock washers (key 33) and hex nuts (key 32) mount the SS-263 onto the actuator. Tighten hex nuts (key 32) to 50 ft-lbs.

## Pressure Connections

The input signal connection is 1/4 NPT, the supply connection is 1 NPT, and the output connection is 1 NPT or 1-1/4 NPT depending on application. Ensure that the piping is of proper size to meet the capacity demands of the booster and that the actuator is equipped with properly sized input connections.

The SS-263 includes two 1/4 NPT auxiliary supply connections that allow additional accessories, such as a Fisher 377 trip valve, to be connected to supply pressure. The 3 in 1 connection provides either a 1/4 NPT diagnostic connection, 1/4 NPT actuator bypass assembly connection (for use on an actuator with a handwheel), or a 3/4 NPT dump valve connection. Consult the appropriate actuator instruction manual for the assembly of the actuator bypass connection.

## Supply Pressure

Supply pressure must be filtered clean dry air or noncorrosive gas.

### **▲ WARNING**

**If a flammable or hazardous gas is to be used as the supply pressure medium, personal injury, property damage or equipment damage could result from fire or explosion of accumulated gas or from contact with hazardous gas. The volume booster has no provision for piping away the vented exhaust gas. Therefore, do not use flammable or otherwise hazardous gas as a supply medium unless the unit is in a well-ventilated area and all ignition sources have been removed.**

## Exhaust Passages

Exhaust to the atmosphere is through exhaust passages located on the perimeter of the diaphragm spacer assembly. Keep the exhaust passages free of any obstructions or foreign materials that might clog them.

## Operating Information

Proper installation of the SS-263 and adjustment of the bypass restriction and tuning of the digital valve controller are required for stable actuator performance. Installation and adjustments are typically performed at the factory.

Retain original piping configuration when replacing an SS-263 volume booster that was originally installed at the factory.

To calibrate and tune the volume booster, turn the bypass restriction adjusting screw (figure 3) two turns counterclockwise from the fully closed position. With the actuator in operation, slowly turn the restriction clockwise until the booster operates in response to large changes in the input signal, yet allows small changes to move the actuator without initiating booster operation. When additional capacity is required, multiple boosters can be used in parallel. The minimum required adjustment for each bypass restriction adjustment screw is 1/6 turn, regardless of configuration.

## Principle of Operation

Refer to figure 3.

Because of the restriction, large input signal changes register on the booster input diaphragm sooner than in the actuator. A large, sudden change in the input signal causes a pressure differential to exist between the input signal and the feedback diaphragm of the booster. When this occurs, the diaphragms move to open either the supply port or the exhaust port, whichever action is required to reduce the pressure differential. The port remains open until the difference between the booster input and output pressures returns to within the deadband limits of the booster.

With the bypass restriction adjusted for stable operation, signals having small magnitude and rate changes pass through the bypass restriction and into the actuator without initiating booster operation. Both the supply and exhaust ports remain closed, allowing the output of the digital valve controller to act directly on the actuator piston.

## Maintenance

### **▲ WARNING**

**Always wear protective clothing, gloves, and eyewear when performing any maintenance procedures to avoid personal injury.**

**Maintenance requires taking the volume booster out of service periodically. To avoid personal injury or equipment damage, disconnect or bypass any pressure lines to the booster, and vent any pressure locked in the unit before you begin maintenance.**

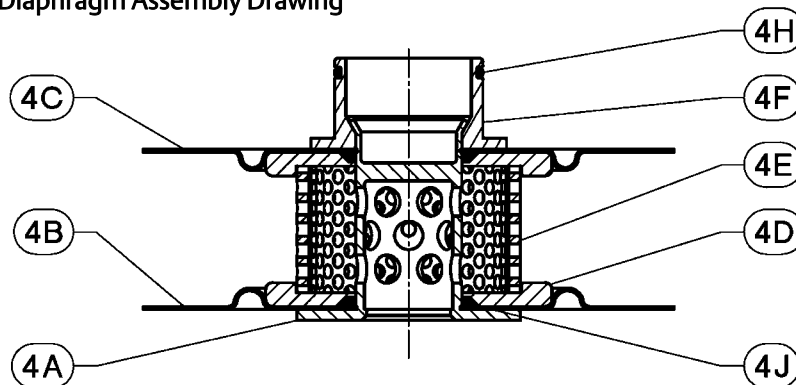
**Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

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## Diaphragm Assembly Replacement

Key numbers refer to figures 4 and 6.

Figure 4. Diaphragm Assembly Drawing



GE47590-A

1. Remove the six cap screws (key 10) from the perimeter of the spring case assembly (key 3), and lift off the assembly, taking care you do not lose the upper spring (key 6).
2. Remove the diaphragm assembly (key 4) and diaphragm spacer assembly (key 2) as a unit. The two small O-rings (key 22) will stay attached to the diaphragm spacer assembly (key 2).
3. Separate the diaphragm assembly (key 4) from the diaphragm spacer assembly (key 2). Inspect the upper diaphragm (key 4C) and the lower diaphragm (key 4B) for damage and replace if necessary.

### Note

The diaphragms are not individually replaceable, but must be ordered as a diaphragm assembly (key 4).

4. Replace the two O-rings (key 22).
5. Carefully install the diaphragm assembly (key 4) into the diaphragm spacer assembly (key 2) by folding the upper diaphragm (key 4C) inward. Rotate the diaphragm assembly (key 4) until the oversized hole in each diaphragm aligns with the flow passage in the diaphragm spacer assembly (key 2).
6. Install the diaphragm assembly (key 4) and the diaphragm spacer assembly (key 2) onto the body (key 1) while making sure the lower diaphragm (key 4B) is flat and not folded or pinched. Orient the parts to form the bypass restriction passage as shown in figure 6.
7. Apply lubricant (key 18) to the O-ring (4H) and the outside diameter of the spring seat (4F).
8. Install the upper spring (key 6) and the spring case assembly (key 3) on the upper diaphragm (key 4C).

### CAUTION

To avoid damage to the diaphragms, do not overtighten the screws.

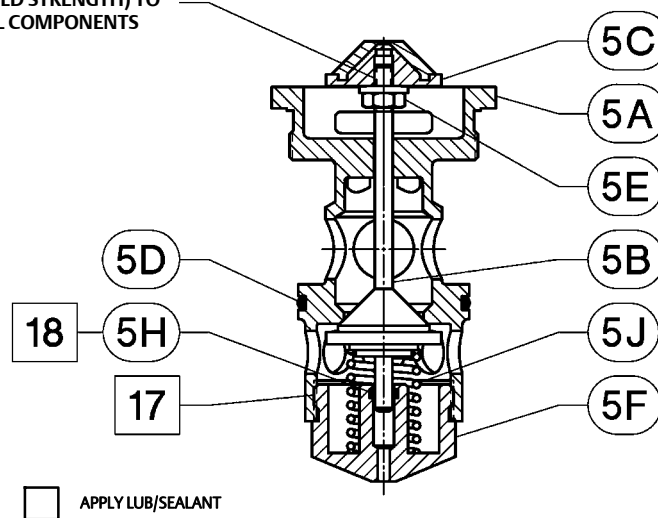
9. Replace the six cap screws (key 10) and tighten them in a crisscross manner using multiple patterns working up to a final torque of 15.8 N•m (140 lbf•in).

## Valve Assembly Replacement

For key numbers refer to figures 5 and 6.

Figure 5. Valve Assembly Drawing

APPLY THREAD LOCKING ADHESIVE (MILD STRENGTH) TO  
THREAD WHEN REPLACING INDIVIDUAL COMPONENTS



CE476000-A

□ APPLY LUB/SEALANT

1. Remove the six cap screws (key 10) from the perimeter of the spring case assembly (key 3), and lift off the assembly, taking care you do not lose the upper spring (key 6).
2. Remove the diaphragm assembly (key 4) and diaphragm spacer assembly (key 2) as a unit. The two small O-rings (key 22) will stay attached to the diaphragm spacer assembly (key 2).
3. Unscrew the valve assembly (key 5) from the body, using the 2-inch hex located on the seat ring (key 5A).
4. If you are replacing a complete valve assembly (key 5), proceed to step 10.
5. If you are replacing an upper valve (key 5C) and a lower valve and stem (key 5B), loosen the hex nut (key 5E), and remove the upper valve. Remove the hex nut (key 5E). Remove the lower guide (key 5F) and the lower spring (key 5J). Remove the lower valve and stem (key 5B) from the seat ring (key 5A).
6. Insert the replacement lower valve and stem (key 5B) into the seat ring (key 5A) and install the hex nut (key 5E) on the stem.
7. Replace the O-ring (key 5H) and apply lubricant (key 18) to both the O-ring (key 5H) and the guide bore of the lower guide (key 5F).
8. Install the lower spring (key 5J) and the lower guide (key 5F). Tighten to 61 N•m (45 lbf•ft).
9. Apply threadlock adhesive (mild strength) or equivalent to the threads of the lower valve and stem (key 5B) and install the upper valve (key 5C). Tighten the hex nut (key 5E) to 4.5 N•m (40 lbf•in) with the lower surface of the upper valve (key 5C) aligned with the upper surface of the seat ring (key 5A) as shown in figure 5.
10. Apply lubricant (key 18) to the O-ring (key 5D) and apply sealant (key 17) to the thread of the seat ring (key 5A).
11. Install the valve assembly (key 5) into the body (key 1). Torque to 102 N•m (75 lbf•ft).
12. Replace the O-rings (key 22).
13. Install the diaphragm assembly (key 4) and the diaphragm spacer assembly (key 2) onto the body (key 1) while making sure the lower diaphragm (key 4B) is flat and not folded or pinched. Orient the parts to form the bypass restriction passage as shown in figure 6.



14. Apply lubricant (key 18) to the O-ring (4H) and the outside diameter of the spring seat (4F).
15. Install the upper spring (key 6) and the spring case assembly (key 3) on the upper diaphragm (key 4C).

### **CAUTION**

**To avoid damage to the diaphragms, do not overtighten the screws.**

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16. Replace the six cap screws (key 10) and tighten them in a crisscross manner using multiple patterns working up to a final torque of 15.8 N•m (140 lbf•in).

## Parts Ordering

Whenever corresponding with your Emerson Process Management sales office about this equipment, mention the serial number of the valve assembly. This serial number can be found on the actuator nameplate. It may also be helpful to mention the date and other information on the volume booster nameplate as shown in figure 2.

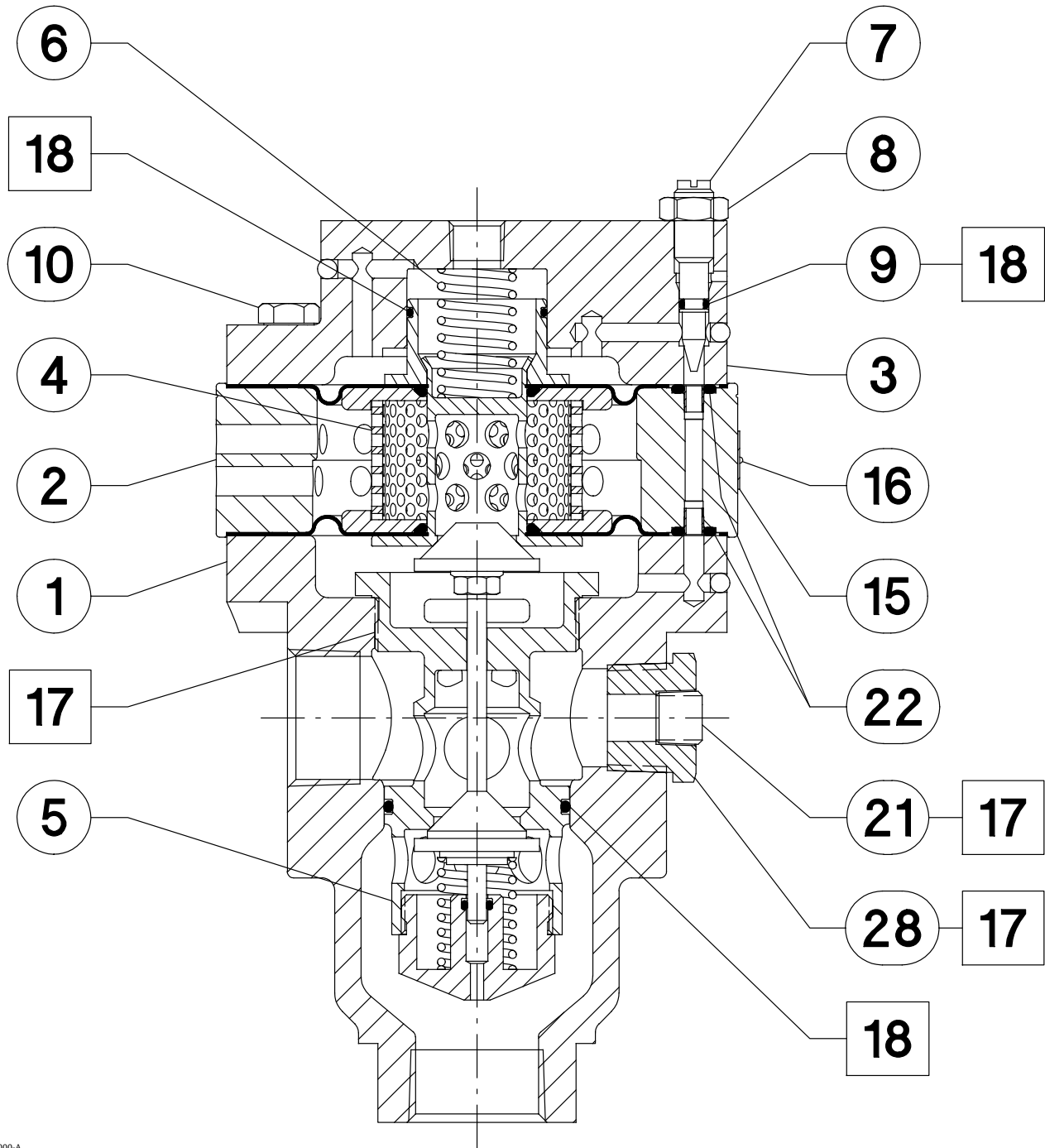
When ordering replacement parts, state the complete eleven-digit part number of each part required as found in the following parts list.

### **⚠ WARNING**

**Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Process Management should not, under any circumstances, be used in any Fisher instrument, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.**

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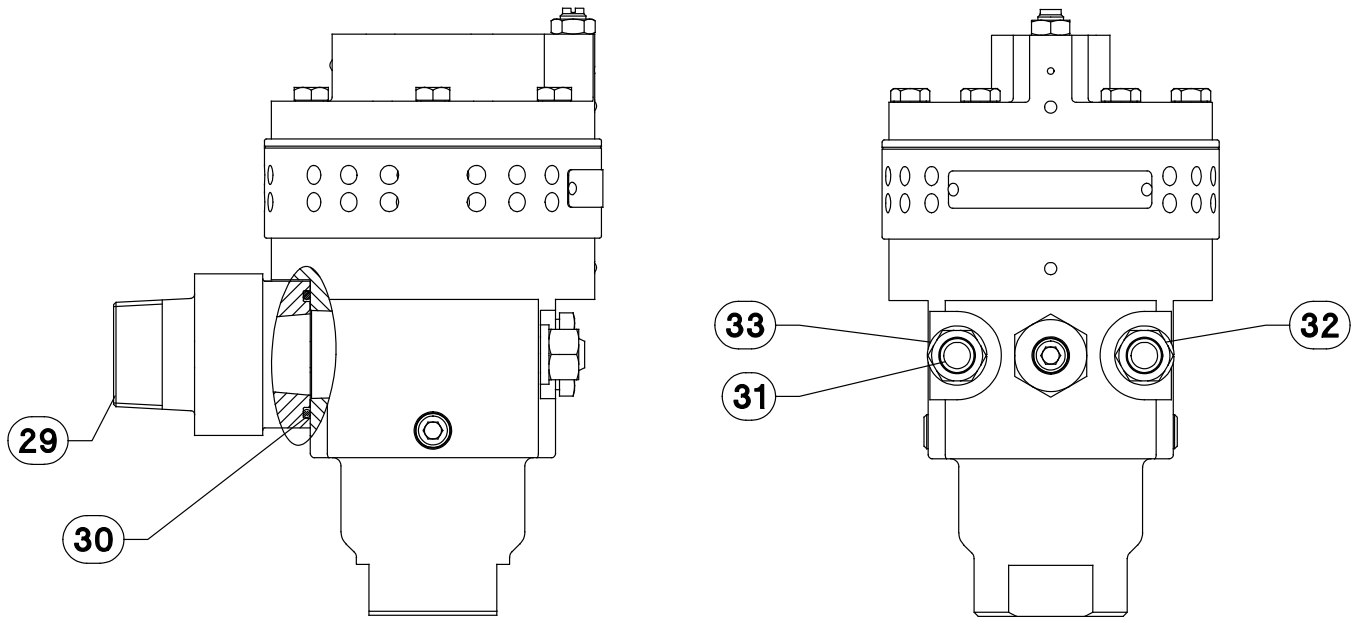
Figure 6. Volume Booster Assembly Drawing



GE49000-A

APPLY LUB/SEALANT

**Figure 7. Volume Booster Assembly with Mounting Adaptor**



GE56173-A

## Parts Kits

Table 2. Parts Kits

Description	Key Number Included in Kit	Part Number
Diaphragm Assembly Kit (key 4)	4A, 4B, 4C, 4D (qty 2), 4E, 4F, 4H, 4J (qty 2)	RSS263X0012
O-Ring Kit	5D, 5H, 9, 22 (qty 2), 30	RSS263X0022

## Parts List (figures 4, 5, 6, and 7)

Key	Description	Part Number
<b>Note</b>		
For part numbers not shown, contact your Emerson Process Management sales office.		
1	Body Assembly, Aluminum	
2	Diaphragm Spacer Assembly, Aluminum	
3	Spring Case Assembly, Aluminum	
4*	Diaphragm Assembly, Aluminum/Nitrile/Nylon	see parts kit
4A	Orifice	see parts kit
4B	Lower Diaphragm	see parts kit
4C	Upper Diaphragm	see parts kit
4D	Diaphragm Plate (2 req'd)	see parts kit
4E	Exhaust Diffuser	see parts kit
4F	Spring Seat	see parts kit
4H	O-ring	see parts kit
4J	O-ring (2 req'd)	see parts kit
5*	Valve Assembly, Brass/Nitrile	GE47600X012
5A	Seat Ring	
5B*	Lower Valve and Stem Assembly	GE47594X012
5C*	Upper Valve	1V198470972
5D*	O-Ring	see parts kit
5E	Flange Hex Nut	
5F	Lower Guide	
5H*	O-Ring	see parts kit
5J	Lower Spring	
6	Upper Spring	
7	Restriction	
8	Hex Nut	
9*	O-Ring	see parts kit
10	Cap Screw	
15	Nameplate	
16	Drivescrew	
17	Sealant, anti-seize	
18	Lubricant, silicone based	
21	Pipe Plug	
22*	O-Ring	see parts kit
28	Hex Pipe Bushing	
29	Mounting Adaptor	
30*	O-ring	see parts kit
31	Stud (2 req'd)	
32	Hex Nut (2 req'd)	
33	Lock Washer (2 req'd)	
34	1-1/4 NPT Pipe Elbow	

\*Recommended spare parts

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