



ITT

Industrial Process

Installation, Operation, and Maintenance Manual

Advantage[®] Excel - Series S Actuator



Engineered for life

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Introduction and Safety

Safety message levels

Definitions

Safety message level	Indication
 <p>DANGER:</p>	A hazardous situation which, if not avoided, will result in death or serious injury
 <p>WARNING:</p>	A hazardous situation which, if not avoided, could result in death or serious injury
 <p>CAUTION:</p>	A hazardous situation which, if not avoided, could result in minor or moderate injury
 <p>Electrical Hazard:</p>	The possibility of electrical risks if instructions are not followed in a proper manner
NOTICE:	<ul style="list-style-type: none"> • A potential situation which, if not avoided, could result in an undesirable result or state • A practice not related to personal injury

User health and safety

General precautions

This product is designed and manufactured using good workmanship and materials, and meets all applicable industry standards. This product should be used only as recommended by an IIT engineer.



WARNING:

- Misapplication of the valve can result in injury or property damage. Select valves and valve components of the proper materials and make sure that they are consistent with your specific performance requirements. Incorrect application of this product includes but is not limited to:
 - Exceeding the pressure or temperature rating
 - Failing to maintain this product according to the recommendations
 - Using this product to handle caustic or hazardous substances that it is not designed to handle
- If the product exhibits any indication of leakage, do not operate. Isolate the product and either repair it or replace it as outlined within this manual.

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Qualifications and training

The personnel responsible for the assembly, operation, inspection, and maintenance of the valve must be appropriately qualified. The operating company must do the following tasks:

- Define the responsibilities and competency of all personnel handling this equipment.
- Provide instruction and training.
- Ensure that the contents of the operating instructions have been fully understood by the personnel.

Instruction and training can be carried out by either IIT or the reseller of the valve by order of the operating company.

Non-compliance risks

Failure to comply with all safety precautions can result in the following conditions:

- Death or serious injury due to electrical, mechanical, and chemical influences
- Environmental damage due to the leakage of dangerous materials
- Product damage
- Property damage
- Loss of all claims for damages

Operational safety precautions

Be aware of these safety precautions when operating this product:

- Do not leave hot or cold components of the product unsecured against contact if they are a source of danger.
- Do not remove the contact guard for moving parts when the product is in operation. Never operate the product without the contact guard installed.
- Do not hang items from the product. Any accessories must be firmly or permanently attached.
- Do not use the product as a step or hand hold.
- Do not paint over the identification tag, warnings, notices, or other identification marks associated with the product.
- PTFE diaphragms emit toxic fumes due to thermal decomposition at temperatures of 716°F (380°C) or greater.
- Allow ample clearance for indicating spindle travel.
- Do not actuate cylinder without diaphragm in place.
- Use eye protection when working with compressed air and pressurized fluids.

Maintenance safety precautions

Be aware of these safety precautions when performing maintenance on this product:

- You must decontaminate the product if it has been exposed to harmful substances such as caustic chemicals.
- You must immediately fit or reactivate all safety and protective equipment upon completion of work.
- Work on externally actuated valves should only be performed when the valve is removed from service.
- On completion of work, all safety and protective equipment must immediately be fitted again or reactivated.
- Before the re-operation, pay attention to the points in the following sections.

Use of unauthorized parts

Reconstruction or modification of the product is only permissible after consultation with IIT. Genuine spare parts and accessories authorized by IIT serve to maintain safety. Use of non-genuine IIT parts can annul liability of the manufacturer for the consequences. IIT parts are not to be used in conjunction with products not supplied by IIT as this improper use can annul all liability for the consequences.

The use of diaphragms other than genuine IIT diaphragms violates diaphragm valve industry standard MSS SP-88. Valve pressure, temperature, and overall performance can not be guaranteed.

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Unacceptable modes of operation

The operational reliability of this product is only guaranteed when it is used as designated. The operating limits given on the identification tag and in the data sheet may not be exceeded under any circumstances. If the identification tag is missing or worn, contact ITT for specific instructions.

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Transportation and storage

Handling and unpacking guidelines

**CAUTION:**

Always observe the applicable standards and regulations regarding the prevention of accidents when handling the product.

Handling guidelines

Follow these guidelines when handling the product to prevent damage:

- Use care when handling the product.
- Leave protective caps and covers on the product until installation.

Unpacking guidelines

Follow these guidelines when unpacking the product:

1. Inspect the package for damaged or missing items upon delivery.
2. Note any damaged or missing items on the receipt and freight bill.
3. If anything is out of order, file a claim with the shipping company.

Storage, disposal, and return requirements

Storage

If you are not immediately installing the product after delivery, store it as follows:

- Store the product in a dry room that maintains a constant temperature.
- Make sure that the products are not stacked on top of one another.

Disposal

Dispose of this product and associated components in compliance with federal, state, and local regulations.

Return

Ensure these requirements are met before you return a product to ITT:

- Contact ITT for specific instructions on how to return the product.
- Clean the valve of all hazardous material.
- Complete a Material Safety Data Sheet or Process Data Sheet for any process fluid that could remain on the valve.
- Obtain a Return Material Authorization from the factory.

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Product Description

Actuator identification

Model number

An AXS model number contains the following:

Table 1: Actuator

Code	Description
AXS	Advantage Excel Series S actuator

Table 2: Mode of operation

Code	Description
1	Fail open
26	Fail close with 60# spring
29	Fail close with 90# spring
3	Double acting
1S	Fail open (sealed bonnet)
26S	Fail close with 60# spring (sealed bonnet)
29S	Fail close with 90# spring (sealed bonnet)
3S	Double acting (sealed bonnet)

Table 3: Adjustable opening stop (optional)

Code	Description
XAO	Adjustable opening stop sealed with indicator
XAOL	Adjustable opening stop with switch mount
XOB	Adjustable opening stop - bolt assembly

Table 4: Model number examples

Model number	Description
AXS29	Advantage Excel Series S actuator, fail close with 90# spring
AXS3S	Advantage Excel Series S actuator, double acting (sealed bonnet)
AXS1-XOB	Advantage Excel Series S actuator, fail open with Adjustable opening stop - bolt assembly

Identification tag

The model number is located on the ITT identification tag.

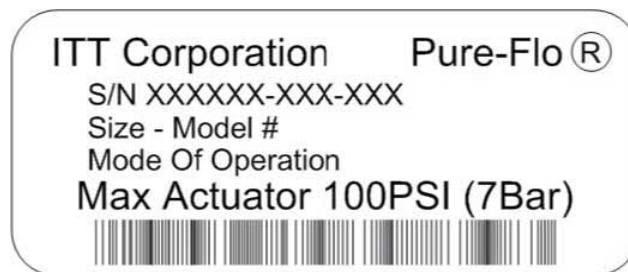


Figure 1

Provided by:

Line	Description
1	Valve serial number
2	Valve size and model number
3	Actuator mode of operation
4	Maximum recommended actuation pressure

Bonnet description

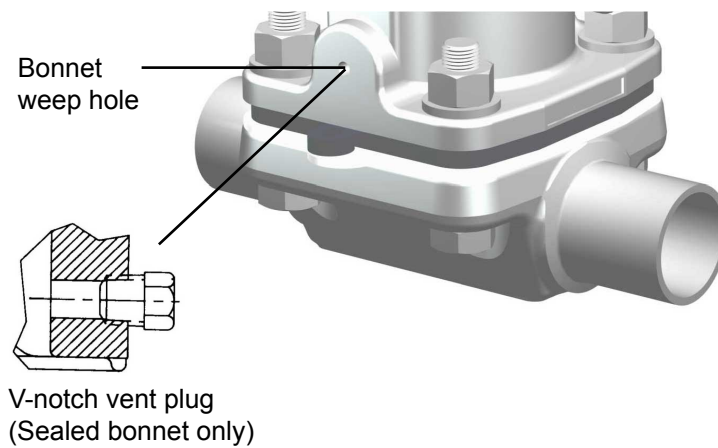
Non-Sealed bonnet

The non-sealed bonnet has a weep hole that permits leakage of the process fluid if the diaphragm ruptures.

Sealed bonnet

The sealed bonnet uses a special “V-notch” vent plug, which permits diaphragm inspection.

Figure 2: Weep hole and V-notch vent plug



Valve diaphragm identification

Diaphragm tab codes

All diaphragm materials and physical properties are batch traceable via permanent codes molded into the diaphragm tabs. The molding date, grade of diaphragm, and valve size provide traceability to original batch records.



Figure 3: Elastomer diaphragm front

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Figure 4: Elastomer diaphragm back

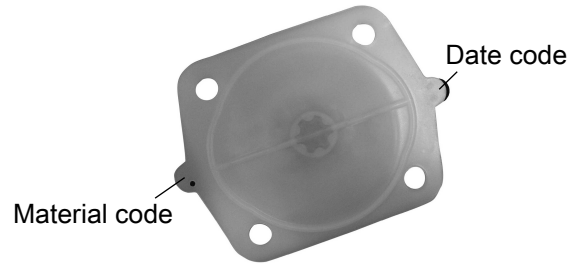


Figure 5: PTFE diaphragm

Installation and Maintenance

Precautions



WARNING:

- All procedures must be performed by qualified personnel.
- When the process fluid is hazardous, thermal (hot or cold), or corrosive, take extra precautions. Employ the appropriate safety devices and be prepared to control a process media leak.
- Always wear protective clothing and equipment to safeguard the eyes, face, hands, skin, and lungs from the particular fluid in the line.
- Do not disassemble the actuator in the field. The actuator contains energized springs which can cause injury. The product is designed to be recycled in its entirety.



CAUTION:

- Disconnect electrical, pneumatic, and hydraulic power before servicing actuator or automation components.

Install the valve and topworks

NOTICE:

The topworks size and configuration can limit the actual operating pressure. Consult the engineering catalog for topworks sizing. Consult the factory or engineering catalog for vacuum operation.

Consider the following information before installing the actuator:

- The maximum valve operating pressure is 150 psig (10.34 bar). This pressure is applicable up to 100° F (38° C). Valves at maximum pressure cannot be used at maximum temperatures.
- The maximum actuator pressure is 100 psi (6.9 bar).

1. If you have a weld end valve, then consider the following:

If you are welding ...	Then ...
Manually	Remove the topworks.
In line for schedule 10 or heavier pipe	Remove the topworks.
In line for schedule 5 or lighter pipe and tubing	You can weld with automatic equipment. Before you perform the weld: <ol style="list-style-type: none"> 1. Do not remove the topworks. 2. Set the valve to the open position. 3. Properly purge the valve with an inert gas.

2. Install the valve.

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Install with the raised hash marks (castings) or small machined dots (forgings) on the valve body at the 12 o'clock position to achieve the optimum drain angle.



3. Prior to pressurization (with the valve slightly open), tighten the bonnet fasteners.
For more information, see [Tighten the bonnet fasteners](#) (page 11).
4. Connect the air line.
 - a) Turn the upper cover to optimize air line fit up.

Actuator topworks may be rotated 360°.

If the actuator mode of operation is ...	Then ...
Fail close	Turn the upper cover clockwise as viewed from the top. You may need tools to turn the upper cover
Fail open	Turn the upper cover clockwise or counter clockwise
Direct acting	

NOTICE:

Make sure to rotate the cover with the compressor in place to maintain the correct spindle orientation.

- b) If the spindle is rotated and misaligned, then turn the spindle clockwise as viewed from the bottom to re-establish the correct orientation.



Weep hole

Connection size is 1/8" NPT.

NOTICE:

Air line connections should be made with care so as not to damage the actuator covers.

5. Cycle the valve two to three times to verify smooth operation.

Mount the topworks to the valve

1. Regulate the air pressure

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If the topworks is ...	Then regulate the air pressure ...
AXS1, AXS1S, AXS3, AXS3S	In the upper cover to extend the compressor.
AXS26, AXS26S, AXS29, AXS29S	In the lower cover to properly position the valve diaphragm.

2. Install the valve diaphragm.
For more information, see [Replace the valve diaphragm](#) (page 12).
3. Assemble the valve body and tighten the bonnet fasteners.
For more information, see [Tighten the bonnet fasteners](#) (page 11).

Tighten the bonnet fasteners



CAUTION:

Do not tighten fasteners while the system is pressurized or at elevated temperatures (greater than 100°F (38°C)).

1. Depressurize the system.
2. Use regulated air pressure to position diaphragm so that valve is slightly open.
You may need to use air pressure to actuate the valve.
3. Tighten the bonnet fasteners in a crisscross pattern.
For more information, see [Fastener torque table for valve body to topworks](#) (page 11).
4. Make multiple crisscross passes to build up torque to the final table value. Make additional crisscross passes using final table values to evenly tighten each fastener to within 5% of torque value.
5. Retighten the bonnet fasteners as noted above at ambient conditions after the system has cycled through operating pressure and temperature.
6. Monitor the valve for leakage:

If leakage ...	Then ...
Occurs at the body/bonnet flange sealing area	Depressurize the system and retighten the bonnet fasteners as noted above.
Continues	Depressurize the system and retighten the bonnet fasteners as noted above. (maximum 3rd re-torque)
Continues	Replace the valve diaphragm.

For more information, see [Replace the valve diaphragm](#) (page 12).

Fastener torque table for valve body to topworks

Values given are for lubricated fasteners.

Valve size		Bolt size		PTFE diaphragm		Elastomer diaphragm	
Inch	DN	Imperial	Metric	in-lb	N-m	in-lb	N-m
0.50	15	1/4"	M6	25-60	2.8-6.8	20-40	2.3-4.5
0.75	20	1/4"	M6	50-65	5.7-9.1	20-50	2.3-5.7
1.00	25	5/16"	M8	65-90	7.4-11.3	45-70	5.1-7.9
1.50	40	3/8"	M10	200-225	23-25	75-130	8.5-14.7
2.00	50	7/16"	M12	225-275	25-31	100-180	11-20

Guidelines

- Minimum values given will provide a longer diaphragm cycle life for valves in non-autoclave and low thermal cycle conditions.
- Maximum values given may be necessary for autoclave conditions and for high thermal cycle conditions.
- Torques should be applied at near ambient conditions (less than 100°F (38°C)).

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Actuator operating pressure

Maximum permitted air supply pressure

psig	bar	kPA
100	6.9	690

Actuator pressure rating

The actuator will withstand pressures well in excess of the rated pressure without risk of bursting. Maintaining operating pressure at or below the pressure rating will ensure optimum life of the operating components.

psig	bar	kPA
100	6.9	690

Inspection

The actuator cannot be disassembled and reassembled.

Inspection area	What to look for	Action if problem is found
External valve parts	Excessive wear or corrosion	<ul style="list-style-type: none"> • Replace the affected parts • Contact ITT to obtain replacement parts or for specific instructions
Non sealed bonnet	Fluid weeping from the plug	Replace the valve diaphragm
Sealed bonnet	Fluid weeping from the plug Loosen the v-notch vent plug 2-3 turns to check	Replace the valve diaphragm
Actuator's bonnet weep hole and air ports	Air pressure	Contact ITT for specific instructions
Topworks	Spindle binding, excessive noise, or dried lubricant	Contact ITT for specific instructions
Diaphragm and valve body	Leakage between the diaphragm and valve body	Tighten the bonnet fasteners

For more information, see:

- Replace the valve diaphragm in this manual.
- Tighten the bonnet fasteners in this manual.

Disassemble the valve

1. Remove all line pressure.
2. If the actuator mode of operation is fail open or fail close, then load the actuator with air.

If the actuator mode of operation is ...	Then ...
Fail open	Load the actuator with sufficient air to partially close the valve.
Fail close	Load the actuator with sufficient air to partially open the valve.

3. Remove the bonnet fasteners.
4. Lift the topworks assembly from the valve body.
5. If the actuator mode of operation is fail open, then remove pressure load from the actuator.

Replace the valve diaphragm

1. Disassemble the valve.

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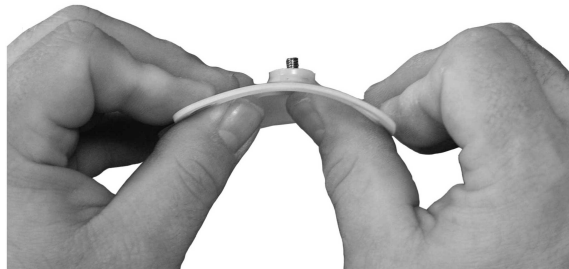


For more information, see Disassemble the valve in this manual.

2. Unscrew the diaphragm from the compressor by turning the diaphragm counterclockwise. The replacement diaphragm should be identical in size and grade to the original diaphragm.
3. If replacing a PTFE diaphragm, follow these steps.
 - a) Install the new elastomer backing cushion over the tube nut.



- b) Invert the PTFE diaphragm by pressing the center of the diaphragm face with your thumbs while holding the edge of the diaphragm with your fingers.



- c) Engage the threads of the diaphragm into the tube nut by rotating clockwise.



- d) Continue rotating the PTFE diaphragm clockwise into the compressor while securing the backing cushion from rotating.



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4. Rotate the diaphragm until hard stop or heavy resistance is achieved and additional force does not significantly rotate the diaphragm into the compressor.



5. If replacing a PTFE diaphragm, re-invert the diaphragm.



6. If the actuator mode of operation is fail open or fail close, select one of these steps.

If the actuator mode of operation is ...	Then ...
Fail open	Reduce the air pressure until the back of the diaphragm is flat against the bonnet.
Fail close	<ol style="list-style-type: none"> 1. Connect the air line to the bonnet's cylinder. 2. Load the chamber with sufficient air to move the diaphragm upward until the back of diaphragm is flat against the bonnet. Do not apply excessive air pressure that results in inversion of the diaphragm.

7. Replace the topworks assembly on the body and tighten the bonnet fasteners.
For more information, see Tighten the bonnet fasteners in this manual.
8. If the actuator mode of operation is fail open, release the air, allowing the valve to open.

Install and set the adjustable opening stop bolt assembly

1. Remove the cap or other accessory assembly from the actuator's upper cover by rotating the assembly counterclockwise.
2. Loosen the adjustable opening stop's jam nut and extend the cap screw by rotating them counterclockwise.
3. Lightly lubricate the periphery of the indicating spindle with Chevron F^{Provided by:}
4. Slide the assembly over the indicating spindle and assemble it into the a

5. Turn the assembly clockwise and tighten it until snug.
The maximum allowable torque on this joint for all actuator sizes is 80 in-lbs (9.0 N-m).
6. Use air pressure and a bleed-type regulator to open the valve to the desired position.
7. Rotate the cap screw clockwise until you feel resistance.
8. Tighten the jam nut against the adapter to lock the opening stop into position.

Install and set the adjustable opening stop sealed

1. Remove the cap or other accessory assembly from the actuator's upper cover by rotating the assembly counterclockwise.
2. Loosen the adjustable opening stop's set screw located in the locking collar by rotating it counterclockwise.
3. Fully extend the adjustable opening stop's locking collar by rotating it counterclockwise.
4. Lightly lubricate the periphery of the indicating spindle with Chevron FM ALC EP 2 lubricant.
5. Apply Blue Loctite #242 to the internal thread of the actuator's indicating spindle that will engage the indicating rod.
6. Assemble the indicating rod into the actuator's indicating spindle by turning the indicating rod clockwise and tighten until it is snug.
The maximum allowable torque on this joint for all assembly sizes is 32 in-lbs (3.6 N-m).
7. Wipe any excess Blue Loctite #242 from the joint.
8. Slide the assembly over the indicating spindle and assemble it into the actuator's upper cover by turning the assembly clockwise and tighten it until it is snug.
The maximum allowable torque on this joint for all actuator sizes is 80 in-lbs (9.0 N-m).
9. Use air pressure and a bleed type regulator to open the valve to the desired position.
10. Rotate the locking collar clockwise until you feel resistance.
11. Tighten the locking collar's set screw against the adapter to lock the opening stop into position.

Install and set the adjustable opening stop switch mount assembly

1. Remove the cap or other accessory assembly from the actuator's upper cover by rotating the assembly counterclockwise.
2. Loosen the adjustable opening stop's set screw located in the locking collar by rotating it counterclockwise.
3. Fully extend the adjustable opening stop's locking collar by rotating it counterclockwise.

NOTICE:

Verify that the stop is oriented properly so it can receive the operating rod. The locking collar is initially positioned to trap the stop in the proper orientation. The stop may orient itself improperly while handling the assembly once the locking collar is fully extended.

4. Lightly lubricate the periphery of the indicating spindle with Chevron FM ALC EP 2 lubricant.
5. Apply Blue Loctite #242 to the internal thread of the actuator's indicating spindle that will engage the operating rod.
6. Slide the assembly over the indicating spindle and assemble it into the actuator's upper cover by turning the assembly clockwise and tighten until it is snug.
The maximum allowable torque on this joint for all actuator sizes is 80 in-lbs (9.0 N-m).
7. Slide the operating rod through the assembly's upper adapter and stop.
8. Assemble the operating rod into the actuator's indicating spindle by turning the operating rod clockwise and tighten until it is snug.
The maximum allowable torque on this joint for all assembly sizes is 32 in-lbs (3.6 N-m).
9. Use air pressure and a bleed type regulator to open the valve to the desi^{Provided by:}
10. Rotate the locking collar clockwise until you feel resistance.

11. Tighten the locking collar's set screw against the adapter to lock the opening stop into position.
12. Assemble the switch to the assembly by following the mounting and switch setting instructions found within the switch's instruction manual.

Install the VSP direct mount adapter assembly

1. Remove the cap or other accessory assembly from the actuator's upper cover by rotating the assembly counterclockwise.
2. Lightly lubricate the periphery of the indicating spindle with Chevron FM ALC EP 2 lubricant.
3. Apply Blue Loctite #242 to the internal thread of the actuator's indicating spindle that will engage the VSP's switch rod.
4. Slide the assembly over the indicating spindle and assemble it into the actuator's upper cover by turning the assembly clockwise and tighten until it is snug.

The maximum allowable torque on this joint for all actuator sizes is 80 in-lbs (9.0 N-m).

5. Assemble the VSP to the assembly by following the mounting and switch setting instructions found within the VSP's instruction manual.

The VSP direct mount adapter replaces the follow parts noted within the VSP's instruction manual:

- adapter
- adapter to actuator's upper cover fasteners
- o-ring that would seal against the switch rod
- o-ring that would seal against the switch pack housing

Install the universal switch pack adapter assembly

1. Remove the cap or other accessory assembly from the actuator's upper cover by rotating the assembly counterclockwise.
2. Lightly lubricate the periphery of the indicating spindle with Chevron FM ALC EP 2 lubricant.
3. Apply Blue Loctite #242 to the internal thread of the actuator's indicating spindle that will engage the rod adapter.
4. Slide the assembly over the indicating spindle and assemble it into the actuator's upper cover by turning the assembly clockwise to tighten it until snug.

The maximum allowable torque on this joint for all actuator sizes is 80 in-lbs (9.0 N-m).

5. Assemble the rod adapter into the actuator's indicating spindle by turning the rod adapter clockwise and tighten until it is snug.

The maximum allowable torque on this joint for all assembly size is 32 in-lbs (3.6 N-m).

6. Assemble the switch to the assembly by following the mounting and switch setting instructions found within the switch's instruction manual.

Install the cap assembly

1. Remove the accessory assembly from the actuator's upper cover by rotating the assembly counterclockwise.
2. Lightly lubricate the periphery of the indicating spindle with Chevron FM ALC EP 2 lubricant.
3. Slide the assembly over the indicating spindle and assemble it into the actuator's upper cover by turning the assembly clockwise to tighten it until snug.

The maximum allowable torque on this joint for all actuator sizes is 80 in-lbs (9.0 N-m).

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Parts Listing and Cross-Sectional Drawings

AXS actuator

List of parts

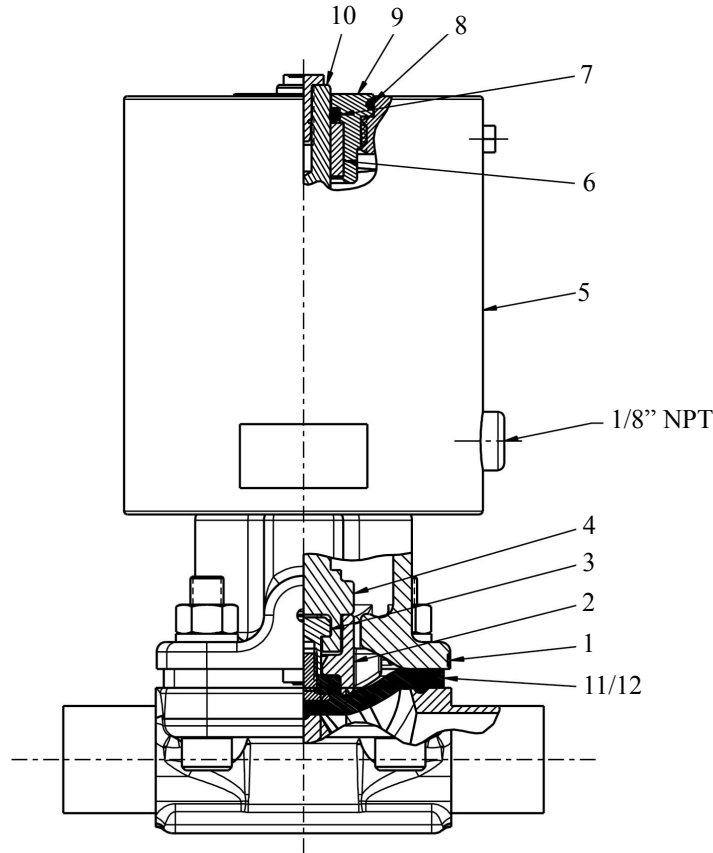


Figure 6

Item	Description	Material	Quantity
1	Bonnet	Stainless steel	1
2	Compressor	Stainless steel	1
3	Tube nut	Stainless steel	1
4	Spindle	Stainless steel	1
5	Upper cover	Stainless steel	1
6	Sleeve bearing	Plastic	1
7	O-ring	FKM	1
8	O-ring	FKM	1
9	Cap	Stainless steel	1
10	Indicating spindle	Stainless steel	1
11 ¹	Diaphragm	As required	1
12 ¹	Backing cushion	As required	1

¹ Recommended spare part

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Adjustable opening stop bolt assembly

List of parts

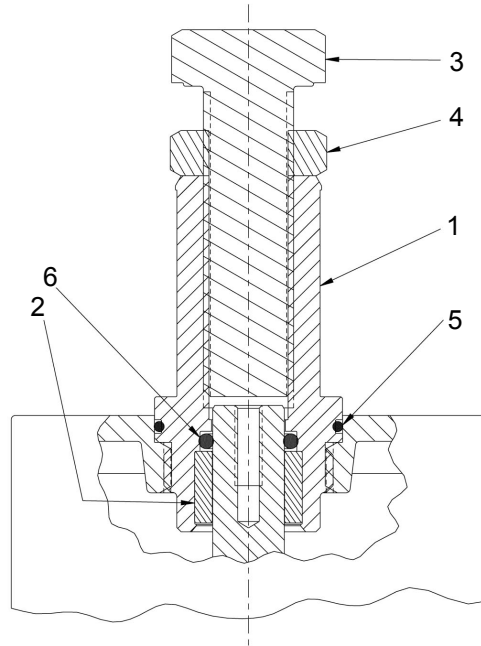


Figure 7

Item	Description	Material	Quantity
1	Adapter	Stainless steel	1
2	Sleeve bearing	Plastic	1
3	Cap screw	Stainless steel	1
4	Jam nut	Stainless steel	1
5	O-ring	FKM	1
6	O-ring	FKM	1

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Adjustable opening stop sealed with indicator assembly

List of parts

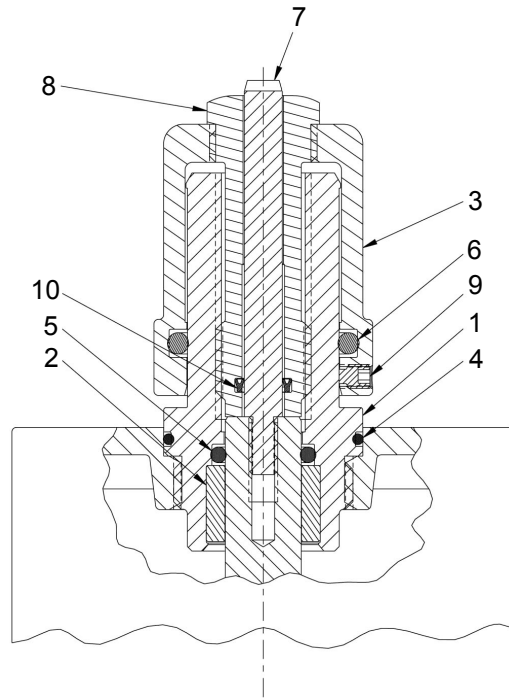


Figure 8

Item	Description	Material	Quantity
1	Adapter	Stainless steel	1
2	Sleeve bearing	Plastic	1
3	Locking collar	Stainless steel	1
4	O-ring	FKM	1
5	O-ring	FKM	1
6	O-ring	FKM	1
7	Indicating rod	Stainless steel	1
8	Adjusting screw	Stainless steel	1
9	Set screw	Stainless steel with brass tip	1
10	U-cup seal	Ethylene propylene	1

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Adjustable opening stop switch mount assembly

List of parts

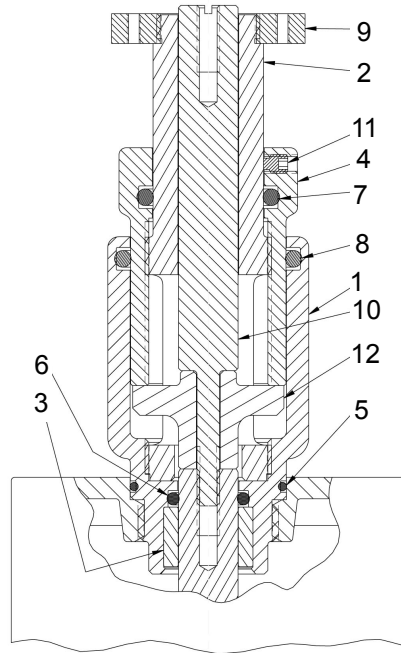


Figure 9

Item	Description	Material	Quantity
1	Lower adapter	Stainless steel	1
2	Upper adapter	Stainless steel	1
3	Sleeve bearing	Plastic	1
4	Locking collar	Stainless steel	1
5	O-ring	FKM	1
6	O-ring	FKM	1
7	O-ring	FKM	1
8	O-ring	FKM	1
9	Mounting plate	Stainless steel	1
10	Operating rod	Stainless steel	1
11	Set screw	Stainless steel with brass tip	1
12	Stop	Stainless steel	1

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VSP direct mount adapter assembly

List of parts

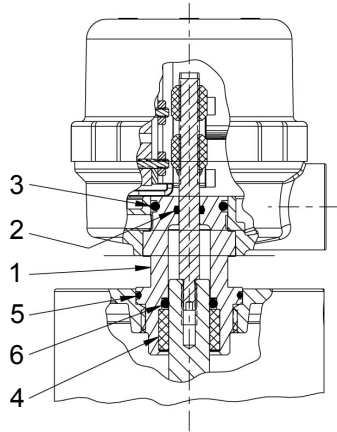


Figure 10

Item	Description	Material	Quantity
1	Adapter	Stainless steel	1
2	O-ring	FKM	1
3	O-ring	FKM	1
4	Sleeve bearing	Plastic	1
5	O-ring	FKM	1
6	O-ring	FKM	1

Universal switch pack adapter assembly

List of parts

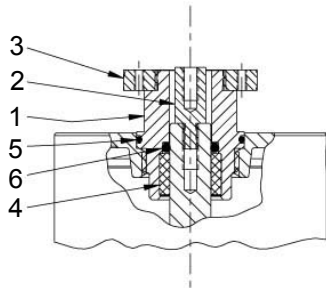


Figure 11

Item	Description	Material	Quantity
1	Adapter	Stainless steel	1
2	Rod adapter	Stainless steel	1
3	Mounting plate	Stainless steel	1
4	Sleeve bearing	Plastic	1
5	O-ring	FKM	1
6	O-ring	FKM	1

Provided by:

Cap assembly

List of parts

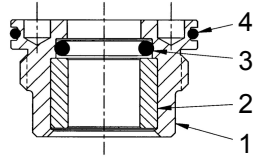


Figure 12

Item	Description	Material	Quantity
1	Cap	Stainless steel	1
2	Sleeve bearing	Plastic	1
3	O-ring	FKM	1
4	O-ring	FKM	1



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