



ITT

Industrial Process

Maintenance Manual

Advantage[®] Actuator



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APPLIED TECHNOLOGIES

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Table Of Contents

Introduction and Safety	2
Safety message levels.....	2
Warning.....	2
Safety.....	2
Product Description	4
Advantage actuator model number.....	4
Identification tag.....	4
Non-sealed and sealed bonnet description.....	4
Valve diaphragm identification.....	5
Maintenance	6
Safety statements for all maintenance procedures.....	6
Inspect the advantage actuator.....	6
Replace valve diaphragm.....	6
Replace valve diaphragm for fail open actuator.....	6
Replace valve diaphragm for double acting actuator.....	7
Replace valve diaphragm for fail close actuator.....	7
Install diaphragm.....	8
Tighten the bonnet fasteners.....	10
Fastener torque table for valve body to actuator.....	10
Adjust the travel (closing) stop.....	11
Replace spindle o-rings.....	11
Lubricate the actuator.....	12
Replace actuator diaphragm and spring.....	12
Replace actuator diaphragm and spring for fail open actuator.....	12
Replace actuator diaphragm and spring for fail open with fixture.....	13
Replace actuator diaphragm and spring for fail close actuator.....	14
Replace actuator diaphragm and spring for fail close with fixture.....	15
Replace actuator diaphragm for double acting actuator.....	16
Tighten the actuator cover to cover fasteners.....	17
Reference	18
Advantage actuator series 3, 5, 8, and 16 parts.....	18
Advantage actuator series 33 parts.....	20
Advantage actuator series 47 parts.....	22
Parts for fixture	24

Introduction and Safety

Safety message levels

Table 1: Definitions

Safety message level	Indication
 Danger:	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
 Warning:	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
 Caution:	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
 Electrical Hazard:	Indicates the possibility of electrical risks if instructions are not followed in a proper manner.
Note:	Indicates a potential situation which, if not avoided, may result in undesirable results or state. Indicates a practice not related to personal injury.

Warning



Warning:

This valve 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 a company engineer.

Misapplication of this product can result in injury or property damage. It is important to select valves and valve components of the proper material and that are consistent with the particular performance requirements for your needs. Misapplication of this product includes use in an application in which the pressure/temperature rating for the product is exceeded, failure to maintain this product or any related products as recommended, or use of this product or any related products to handle caustic and/or hazardous substances that they are not designed to handle.

If the product exhibits any indication of leakage, do not operate. Isolate the valve and either repair it or replace it.

Safety

Qualifications and training of personnel

The personnel responsible for operation, maintenance, inspection and assembly must be appropriately qualified. The operating company must precisely define the responsibilities, competence and supervision of the personnel. If the personnel lack the necessary knowledge, they are to be trained and instructed. If required this can be carried out by the manufacturer/supplier of the product by order of the operating company. Furthermore, the operating company is to ensure that the contents of the operating instructions have been fully understood by the personnel. The latest edition of this manual can be found on the web site listed within this manual.

Dangers through non observance of the safety precautions

The non observance of the safety precautions can result in the endangering of lives as well as the environment and the product. The non observance of the safety precautions can lead to the loss of all claims for damages. Non observance can result in the following:

- Failure of important functions of the product/plant.
- Endangering of lives by electrical, mechanical and chemical influences.
- Endangering the environment through leakage of dangerous materials.
- Personal injury or property damage.

Safety awareness at work

Attention must be paid to the safety precautions in these operating instructions, the current national regulations concerning the prevention of accidents as well as any labor, company and safety-regulations of the operating company.

Safety precautions for the operating company/individual operator

- If hot or cold components of the product are a source of danger, these components must be secured against contact by operating company.
- Contact guard for moving parts may not be removed when product is in operation.
- Do not hang items off 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 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.

Safety precautions for maintenance, inspection and assembly

Work on externally actuated valves should only be carried out when the valve is removed from service. Product that has been exposed to harmful media such as caustic chemicals must be decontaminated. On completion of work, all safety and protective equipment must immediately be fitted again or reactivated. Before the re-operation, attention should be paid to the points in the following sections.

Unauthorized reconstruction, manufacture and use of spare parts

Reconstruction or modification of the product is only admissible after consultation with the manufacturer. Genuine spare parts and accessories authorized by the manufacturer serve to maintain safety. The use of diaphragms other than genuine IIT diaphragms violates diaphragm valve industry standard MSS SP88. Valve pressure, temperature and overall performance can not be guaranteed. Use of non-genuine IIT diaphragms or parts can annul all liability for the consequences. Manufacturer's parts are not to be used in conjunction with products not supplied by the manufacturer. The use of manufacturer's parts with products not supplied by the manufacturer can annul all liability for the consequences.

Inadmissible modes of operation

The operational reliability of the product supplied is only guaranteed when 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 manufacturer at the address listed within this manual for specific instructions.

Product Description

Advantage actuator model number

The Advantage actuator is a spring or double acting pneumatic actuator. The actuator model number is located on the ITT identification tag. The model number is a four digit number defining the actuator as follows:

A = Advantage Actuator

Mode of Operation

- 1 = Fail Open (spring to open, air to close) (Direct Acting)
- 2 = Fail Close (spring to close, air to open) (Reverse Acting)
- 3 = Double Acting (air to open, air to close)

Actuator Series Size

- 3 (03, 04)
- 5 (05, 06)
- 8 (08, 09)
- 16 (15, 16, 17)
- 33 (32, 33, 34, 35)
- 47 (47, 48)

Values in parentheses are specific spring combinations for fail close actuators.

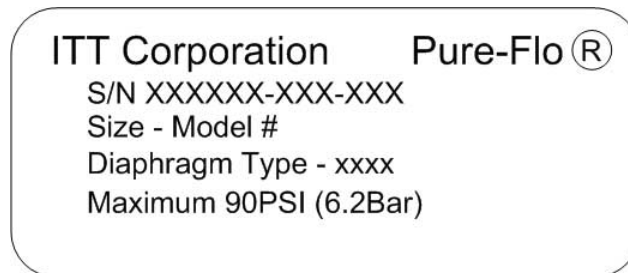
Series size 3, 5, 8, etc. equates to diaphragm effective area.

Examples:

Model # A308 = double acting actuator series 8

Model # A232 = fail close actuator series 33 with a 32 spring set

Identification tag



Line 1 — Valve serial number

Line 2 — Valve size and model number

Line 3 — Valve diaphragm type

Line 4 — Maximum recommended actuation pressure

Non-sealed and sealed bonnet description

The non-sealed bonnet has a weep hole that permits leakage of the process fluid if the diaphragm ruptures. The sealed bonnet uses a special “v-notch” vent plug, which permits inspection for diaphragm rupture.

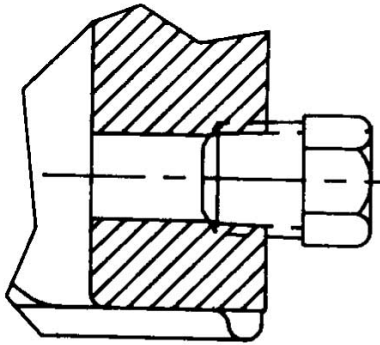
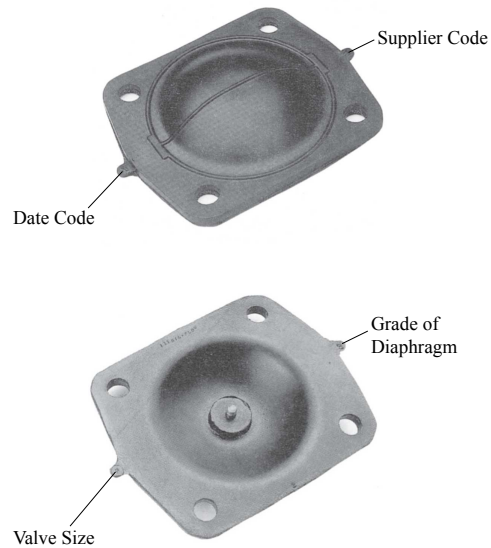


Figure 1: V-notch vent plug

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.



Maintenance

Safety statements for all maintenance procedures


Warning:

All maintenance 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.



Caution: Remove electrical, pneumatic, or hydraulic power before servicing actuator or automation components.

Inspect the advantage actuator

1. For sealed bonnet valves:
 - a) Loosen the v-notch vent plug 2-3 turns.
 - b) Fluid weeping from the plug indicates a diaphragm failure. Replace diaphragm according to **Replace valve diaphragm** steps for proper mode of operation (fail open, fail close, or double acting).
2. For non sealed bonnet valves:
 - a) Fluid leakage through the weep hole indicates a diaphragm failure. Replace diaphragm according to **Replace valve diaphragm** steps for proper mode of operation (fail open, fail close, or double acting).
3. Periodically inspect condition of external valve parts. All parts showing excessive wear or corrosion should be replaced. Contact manufacturer at the address listed within this manual in order to obtain replacement parts or for specific instructions.
4. Air pressure from the lower cover or bonnet weep hole may indicate o-ring failure. Follow steps in **Replace spindle o-ring**.
5. Inspect actuator for spindle binding, excessive noise, or dried lubricant. If present, follow steps in **Lubricate the actuator**.
6. If leakage occurs between the diaphragm and body, follow steps in **Tighten the bonnet fasteners**.

Replace valve diaphragm

Determine which task to follow by locating the model number on the identification tag and comparing with the table below.

1. See **Product description** to determine actuator model number, which includes the mode of operation.

Mode of Operation	Task Title
1	Replace valve diaphragm for fail open actuator
2	Replace valve diaphragm for fail close actuator
3	Replace valve diaphragm for double acting actuator

2. Follow the appropriate task below for the proper mode of operation.

Replace valve diaphragm for fail open actuator

To replace the valve diaphragm disassemble valve, replace diaphragm and reassemble valve.

Disassemble valve

1. Remove all line pressure.
2. Load the upper cover of the actuator with sufficient air to partially close valve. This will ease the spring tension pushing the valve diaphragm from the body weir.
3. Remove bonnet fasteners.
4. Lift actuator assembly from valve body.
5. Pressurize actuator by applying air to upper cover, extending compressor and diaphragm.

Replace diaphragm

1. Follow steps in **Install diaphragm**.
2. Reduce air pressure until back of diaphragm is flat against bonnet.

Reassemble valve

1. Replace actuator assembly on body and follow steps in **Tighten the bonnet fasteners**.
2. Release air and permit the valve to open.
3. Travel stop, if equipped, must be reset at this time to ensure proper closure. See section **Adjust the travel (closing) stop**.

Replace valve diaphragm for double acting actuator

To replace the valve diaphragm disassemble valve, replace diaphragm and reassemble valve.

Disassemble valve

1. Remove all line pressure.
2. Remove the bonnet fasteners.
3. Lift the actuator assembly from the valve body.

Replace diaphragm

Follow steps in **Install diaphragm**.

Reassemble valve

1. Replace the actuator assembly on the body and follow steps in **Tighten the bonnet fasteners**.
2. The travel stop, if equipped, must be reset at this time to ensure proper closure. See section **Adjust the travel (closing) stop**.

Replace valve diaphragm for fail close actuator

To replace the valve diaphragm disassemble valve, replace diaphragm and reassemble valve.

Disassemble valve

1. Remove all line pressure.
2. Load the bottom cover of the actuator with sufficient air to partially open valve. This will ease the spring tension holding the valve diaphragm to the body weir.
3. Remove the bonnet fasteners.
4. Lift actuator assembly from valve body.
5. Release air and disconnect air line.

Replace diaphragm

1. Follow steps in **Install diaphragm**.
2. Connect air line to lower air cover and load 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.

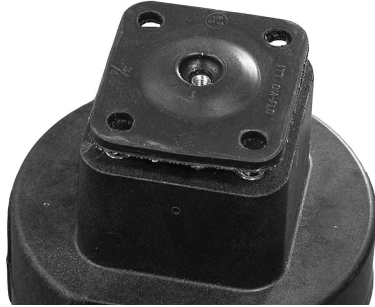
Reassemble valve

1. Replace actuator assembly on body and follow steps in **Tighten the bonnet fasteners**.
2. Travel stop, if equipped, must be reset at this time to ensure proper closure. See section **Adjust the travel (closing) stop**.

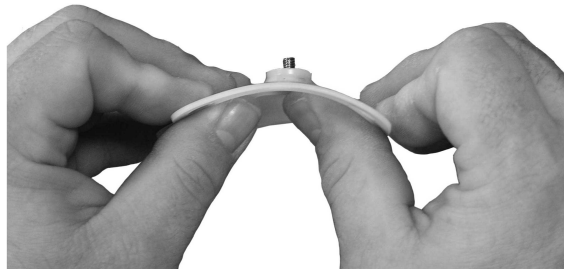
Install diaphragm

1. Unscrew the diaphragm from the compressor by turning counterclockwise.
 - a) Periodically inspect the valve compressor pin for excessive wear. Replace the pin or compressor if excessive wear or axial pin movement is found.

The replacement diaphragm should be identical in size and grade to the original diaphragm.
2. For PTFE assemblies only:
 - 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.



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



4. For PTFE assemblies only reinvert diaphragm.



5. Back off (no more than 1/2 turn) until the bolt holes in diaphragm and the bonnet flange align.



Tighten the bonnet fasteners



Caution: Do not tighten fasteners while the system is pressurized or at elevated temperatures ($> 100^{\circ}\text{F} / 38^{\circ}\text{C}$).

1. Depressurize the system.
2. Use regulated air pressure to position diaphragm so that valve is slightly open. It may be necessary to use air pressure to actuate the valve.
3. Tighten the bonnet fasteners in a crisscross pattern in accordance with the **Fastener torque table for valve body to actuator**.
4. Make multiple criss-cross passes to build up torque to the final table value. Make additional criss-cross 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 ...	then ...
leakage occurs at the body/bonnet flange sealing area	depressurize the system and retighten the bonnet fasteners as noted above.
leakage continues	follow the steps in Replace valve diaphragm .

Fastener torque table for valve body to actuator

Valve Size		Bolt Size		PTFE Diaphragm		Elastomer Diaphragm	
Inch	DN	Imperial	Metric	in-lb	N-m	in-lb	N-m
Bio-Tek (1/4, 3/8, 1/2")	Bio-Tek (8, 10, 15)	#6	M4	20-25	2.3-2.8	20-25	2.3-2.8
1/2"	15	1/4"	M6	25-60	2.8-6.8	20-40	2.3-4.5
3/4"	20	1/4"	M6	50-65	5.7-9.1	20-50	2.3-5.7
1"	25	5/16"	M8	65-90	7.4-11.3	45-70	5.1-7.9

Valve Size		Bolt Size		PTFE Diaphragm		Elastomer Diaphragm	
Inch	DN	Imperial	Metric	in-lb	N-m	in-lb	N-m
1 1/2"	40	3/8"	M10	200-225	23-25	75-130	8.5-14.7
2"	50	7/16"	M12	225-275	25-31	100-180	11-20
3"	80	5/8"	M16	750-1000	85-113	300-420	34-48
4"	100	1/2"	M12	540-600	61-83	190-230	22-26

Values given are for lubricated fasteners.

Minimum values given will provide 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 (< 100°F/ 38°C).

Adjust the travel (closing) stop

The travel stop is designed to prevent overloading of the diaphragm, thus prolonging diaphragm life. Travel stops are factory set and do not require routine adjustment. However, travel stop adjustment is recommended when replacing a valve diaphragm.

A travel stop is standard on series 47 actuators and is optional on series 3, 5, 8, and 16 actuators. A travel stop is not available on series 33 actuators.

1. Release the air pressure in the actuator covers.
2. Remove the clear plastic cap or switch package, if equipped.
3. Loosen the jam nuts and back off one turn.
4. If the actuator is a double acting or fail open actuator, apply enough pressure in the upper cover to close the valve.
5. For all modes of operation, turn the lower nut clockwise while preventing the adjusting bushing from rotating until the valve begins to leak.
6. Turn the lower nut counterclockwise while continuing to prevent the adjusting bushing from rotating until the valve stops leaking.
7. Tighten the jam nuts together.
8. Replace the clear plastic cap or switch package, if equipped.

Replace spindle o-rings

To replace the spindle o-rings disassemble valve and actuator, replace and lubricate spindle o-rings, and reassemble valve and actuator.

1. Disconnect air lines.
2. Follow **Disassemble valve** steps in **Replace valve diaphragm**.
3. Follow **Disassemble actuator** steps in **Replace actuator diaphragm and/or spring**.
4. Withdraw valve diaphragm, compressor and spindle assembly from the bonnet.
5. Replace o-rings and lubricate new o-rings following steps in **Lubricate the actuator**.
6. Replace valve diaphragm, compressor and spindle assembly to the bonnet.
Care must be used on the Bio-Tek to align the compressor T-slot with molded tabs in lower cover.
7. Follow **Reassemble actuator** steps in **Replace actuator diaphragm and/or spring**.
8. Follow **Reassemble valve** steps in **Replace valve diaphragm**.
9. Reconnect air lines.

Lubricate the actuator



Warning:

Standard lubricants are as outlined below. Special lubricants may be required for oxygen or other unique services. Contact ITT for evaluation of non-standard lubricants.

To lubricate the actuator remove grease and re-lubricate with proper lubricant.

1. If re-lubrication is necessary remove residual grease prior to re-lubrication.
2. Lubricate the spindle, o-rings, and mating surfaces whenever the actuator is disassembled.
Chevron FM ALC EP 2 (FDA Compliant) is the standard lubricant.
3. For the Series 47 unit, apply Never-Seez on the adjusting bushing/spindle threaded joint and on the travel stop nuts/adjusting bushing threaded joint.

Replace actuator diaphragm and spring

Determine which task to follow by locating the model number on the identification tag and comparing with the table below.

1. See **Product description** to determine actuator model number, which includes the mode of operation and actuator series size.

Mode of Operation	Actuator Series Size	Task Title
1	33, 47	Replace actuator diaphragm and spring for fail open actuator
1	3, 5, 8, 16	Replace actuator diaphragm and spring for fail open with fixture
2	33, 47	Replace actuator diaphragm and spring for fail close actuator
2	3, 5, 8, 16	Replace actuator diaphragm and spring for fail close with fixture
3	3, 5, 8, 16, 33, 47	Replace actuator diaphragm for double acting actuator

2. Follow the appropriate task below for the proper mode of operation and actuator series size.

Replace actuator diaphragm and spring for fail open actuator

To replace the actuator diaphragm, replace the spring, or replace the actuator diaphragm and spring, prepare actuator, disassemble actuator, replace actuator diaphragm and spring, and reassemble actuator.

Prepare actuator

1. If present, remove switch package.
2. Disconnect air lines.
3. It is recommended that the following steps be performed on a bench with the body removed from the actuator.
 - a) Follow **Disassemble valve** steps in **Replace valve diaphragm for fail open actuator**.
 - b) Unscrew diaphragm from compressor by turning counterclockwise.

Disassemble actuator

1. If series 47 actuator, remove clear plastic cap, travel stop nuts and roller bearing/races.
2. Remove actuator fasteners and lift off top cover.
3. Remove actuator diaphragm, spring, and actuator plates.

If the actuator series is ...	then remove ...
33	extension spindle and both nuts (under load due to spring force).
47	adjusting bushing and spindle nut (under load due to spring force).

Replace actuator diaphragm and spring

1. If series 33 or 47 actuator, install new actuator diaphragm (top hat up).
2. If the spring needs to be replaced, install new spring.
3. If the spring does not need to be replaced, install old spring.

Reassemble actuator

1. Replace actuator plates.

If the actuator series is ...	then ...
33	prepare spindle nut surface with Loctite 7649 Primer N, apply Blue Loctite #242 on the spindle nut and replace extension spindle and both nuts (under load due to spring force).
47	replace adjusting bushing and spindle nut (under load due to spring force). Set the adjusting bushing at the correct location (4.06" (10.31 cm) from top of the spindle nut to bottom of adjusting bushing). See Advantage actuator series 47 parts .

2. Replace upper cover.
3. If series 47 actuator, replace clear plastic cap, travel stop nuts and roller bearing/races.
4. Follow steps in **Tighten the actuator cover to cover fasteners**.

Replace actuator diaphragm and spring for fail open with fixture

One fixture exists for the series 3, 5, and 8 actuators and one for the series 16 actuator.



Caution: Actuator plates are under load. Series 3, 5, 8, and 16 fail open actuators contain powerful springs and should not be disassembled unless properly fixtured.

To replace the actuator diaphragm, replace the spring, or replace the actuator diaphragm and spring, prepare actuator, disassemble actuator with fixture, replace actuator diaphragm and spring, and reassemble actuator with fixture.

Prepare actuator

1. Follow **Prepare actuator** steps in **Replace actuator diaphragm and spring for fail open actuator**.
2. Remove actuator fasteners and lift off top cover.

Disassemble actuator with fixture

1. Place actuator in fixture.
2. Loosen the indicator spindle two turns.
3. Place actuator centrally in the fixture, locating the compressor over the correct spacer, dependent on valve size, in the fixture lower plate.
4. Place the support plate and spacer plate on the actuator top plate.
5. Turn the fixture handwheel clockwise to remove the load from the indicator spindle.
6. Remove the spindle and turn the fixture handwheel counterclockwise until the spring load is relieved. Use care, as the spindle thread may pinch the actuator diaphragm and restrict spring extension.

Replace actuator diaphragm and spring

1. Place the spring in the lower cover and set an actuator plate, concave side down, over the valve spindle.
2. Position actuator in the fixture over the spacer.
3. Place the support plate on the actuator plate.
4. Set the spacer plate on top.

5. Turn the fixture handwheel clockwise and compress the spring until the actuator plate shoulders on the spindle. Use care to ensure the spindle goes through the actuator plate center hole.
6. Slide the actuator diaphragm over the valve spindle using care to ensure the top hat is in the upper cover.
7. Position the actuator diaphragm so the bolt clearance holes line up with threaded inserts in lower cover.

Reassemble actuator with fixture

1. Place an actuator plate, concave side up, over the valve spindle.
2. Prepare spindle nut surface with Loctite 7649 Primer N.
3. Apply Blue Loctite #242 and thread the indicating spindle on the valve spindle by hand.
4. Turn the fixture handwheel counterclockwise to remove the load and remove the actuator from the fixture.
5. Clamp the slotted plate in a vise and pull so the actuator slips free.
6. Tighten the indicator spindle with a wrench using care to ensure the actuator diaphragm remains properly aligned.
7. Position the upper actuator cover so the 1/8" NPT inlets in the upper and lower covers are in line.
8. Follow steps in **Tighten the actuator cover to cover fasteners**.

Replace actuator diaphragm and spring for fail close actuator

The series 33 actuator has a new and old version, which vary in the spring area. In the old version, the springs are contained within the adjusting bushing. In the new version, the springs are contained within a spring pack assembly. Once the actuator cover is removed, if you can pull out the spring pack assembly, you have a new version of the series 33.

To replace the actuator diaphragm, replace the spring, or replace the actuator diaphragm and spring, prepare actuator, disassemble actuator, replace actuator diaphragm and spring, and reassemble actuator.

Prepare actuator

1. If present, remove switch package.
2. Disconnect air lines.
3. It is recommended that the following steps be performed on a bench, with the body removed from the actuator.
 - a) Follow **Disassemble valve** steps in **Replace valve diaphragm for fail close actuator**.
 - b) Unscrew diaphragm from compressor by turning counterclockwise.

Disassemble actuator

1. If series 47 actuator:
 - a) Remove clear plastic cap, travel stop nuts and roller bearing/races.
 - b) Turn adjusting bushing clockwise until contact is made with spring package. Record the number of turns.
2. Remove actuator fasteners and lift off upper cover.

If the actuator series is ...	then ...
Old series 33	unthread adjusting bushing to relieve the spring load.
New series 33	lift out spring package and set aside.
47	unscrew spring pack from valve spindle by turning counterclockwise.

3. Remove actuator diaphragm and springs or spring pack.

If the actuator series is ...	then remove ...
33	adjusting bushing, spring plate, spindle nut, and top actuator plate.
47	coupling nut, spindle nut and actuator top plate.

Replace actuator diaphragm and spring

1. Install new actuator diaphragm (top hat up). Be sure the diaphragm is positioned so the diaphragm bolt holes line up with the actuator cover bolt holes with no stretching of the diaphragm.
2. If the springs need to be replaced, install new springs or spring pack.
3. If the springs do not need to be replaced, install old springs or spring pack.

Reassemble actuator

1. If Old series 33, reassemble actuator by following the steps below.
 - a) Prepare spindle nut surface with Loctite 7649 Primer N.
 - b) Apply Blue Loctite #242 on the spindle nut.
 - c) Install springs and spring plate.
 - d) Thread the adjusting bushing down until it shoulders. A gap will exist between the covers until they are properly bolted together.
 - e) Replace actuator upper cover.
 - f) Use three long fasteners to pull down the upper cover and pinch the actuator diaphragm.
 - g) Replace actuator fasteners and follow steps in **Tighten the actuator cover to cover fasteners**.
2. If New series 33, reassemble actuator by following the steps below.
 - a) Prepare spindle nut surface with Loctite 7649 Primer N.
 - b) Apply Blue Loctite #242 on the spindle nut.
 - c) Reinstall spring pack assembly.
 - d) Replace actuator upper cover.
 - e) Replace actuator fasteners and follow steps in **Tighten the actuator cover to cover fasteners**.
3. If series 47, reassemble actuator by following the steps below.
 - a) Prepare spindle nut surface with Loctite 7649 Primer N.
 - b) Apply Blue Loctite #242 on the spindle nut and coupling nut.
 - c) If a new spring pack was installed, thread the new spring pack onto the valve spindle.
 - d) Replace actuator upper cover.
 - e) Replace actuator fasteners and follow steps in **Tighten the actuator cover to cover fasteners**. A gap will exist between the covers until they are properly bolted together.
 - f) If the old spring pack was installed, turn the adjusting bushing counterclockwise the number of turns recorded above.
 - g) Replace clear plastic cap, travel stop nuts and roller bearing/races.

Replace actuator diaphragm and spring for fail close with fixture

One fixture exists for the series 3, 5, and 8 actuators and one for the series 16 actuator.



Caution: Series 3, 5, 8, and 16 fail close actuators contain powerful springs and should not be disassembled unless properly fixtured.

To replace the actuator diaphragm, replace the spring, or replace the actuator diaphragm and spring, prepare actuator, disassemble actuator with fixture, replace actuator diaphragm and spring, and reassemble actuator with fixture.

Prepare actuator

1. Follow **Prepare actuator** steps in **Replace actuator diaphragm and spring for fail close actuator**.
2. Apply air to lower cover to simplify disassembly from body, then release air.
3. Remove valve diaphragm and plastic indicator spindle plug (found on the spindles) by turning counterclockwise.

Disassemble actuator with fixture

1. Position actuator centrally in fixture, locating the compressor over the correct spacer in the fixture lower plate.

2. Drop the stem guide through center of fixture handwheel and position in actuator indicator spindle #10-24 UNC tapped hole (former plug location).
3. Turn fixture handwheel clockwise until stem rests on actuator top cover.
4. Remove all cover to cover caps, fasteners, and washers.
5. Turn fixture handwheel counterclockwise until spring load is relieved.
6. Remove actuator upper cover, lift out spring(s), and unthread indicator spindle.
7. Remove top actuator plate and actuator diaphragm.

Replace actuator diaphragm and spring

1. Install new actuator diaphragm (top hat up). Be sure the diaphragm is positioned so the diaphragm bolt holes line up with the actuator cover bolt holes with no stretching of the diaphragm.
2. If the spring need to be replaced, install new spring.
3. If the spring do not need to be replaced, install old spring.

Reassemble actuator with fixture

The series 16 actuators require four threaded rod guides in the lower cover prior to assembly.

1. Place the correct spacer, dependent on valve size, over the pin in the fixture lower plate.
2. Position the actuator sub-assembly, including spring(s) and upper cover, over the spacer (the compressor rests on the spacer).
3. Drop the stem guide through center of the fixture handwheel, actuator upper cover, and locate in the actuator indicator.
4. Position the actuator upper cover so the 1/8" NPT inlets in the upper and lower covers are in line and the rod guides slide through the clearance holes.
5. Turn the handwheel clockwise to compress the spring(s) until the covers almost touch.
6. Remove the four threaded rod guides.
7. Start tightening the actuator cover fasteners and continue to compress the spring(s) until the covers touch.
8. Place remaining washers and fasteners in top cover.
9. Follow steps in **Tighten the actuator cover to cover fasteners**.

Replace actuator diaphragm for double acting actuator

To replace the actuator diaphragm prepare actuator, disassemble actuator , replace actuator diaphragm, and reassemble actuator.

Prepare actuator

1. If present, remove switch package
2. Disconnect air lines.
3. It is recommended that the following steps be performed on a bench, with the body removed from the actuator.
 - a) Follow **Disassemble valve** steps in **Replace valve diaphragm for double acting actuator**.

Disassemble actuator

1. If series 47 actuator, remove clear plastic cap, travel stop nuts and roller bearing/races.
2. Remove actuator fasteners and lift off upper cover.
3. Remove actuator top plate and actuator diaphragm.

If the actuator series is ...	then remove ...
3, 5, 8, or 16	the indicating spindle
33	the extension spindle and both nuts
47	the adjusting bushing and the spindle nut

Replace actuator diaphragm

Install new actuator diaphragm (top hat up). Be sure the actuator diaphragm is positioned so the diaphragm bolt holes line up with the cover bolt holes with no stretching of the diaphragm.

Reassemble actuator

1. Replace actuator top plate and actuator diaphragm.

If the actuator series is ...	then ...
3, 5, 8, or 16	prepare spindle nut surface with Loctite 7649 Primer N, apply Blue Loctite #242 on the indicating spindle and replace indicating spindle.
33	prepare spindle nut surface with Loctite 7649 Primer N, apply Blue Loctite #242 on the spindle nut and replace extension spindle and both nuts.
47	replace adjusting bushing and spindle nut. Set the adjusting bushing at the correct location (4.06" (10.31 cm) from top of the spindle nut to bottom of adjusting bushing). See Advantage actuator series 47 parts .

2. Assemble upper cover using care to keep the air fitting in line with the lower cover air fitting.
3. If series 47 actuator, replace clear plastic cap, travel stop nuts and roller bearing/races.
4. Follow steps in **Tighten the actuator cover to cover fasteners**.

Tighten the actuator cover to cover fasteners

Tighten the bonnet fasteners in a crisscross pattern with proper torque.

1. Tighten the bonnet fasteners in a crisscross pattern in accordance with **Fastener torque table for actuator cover to cover**.
2. Make multiple crisscross passes to build up torque to final table values.

Fastener torque table for actuator cover to cover

Actuator series	Bolt size	Torque	
		in-lb	N-m
	Imperial		
Series 3, 5, 8	#10	20	2.3
Series 16	1/4"	35	4.0
Series 33	5/16"	96	11
Series 47	3/8"	120	14

Values given are for lubricated fasteners.

Torques should be applied at near ambient conditions (<100°F/38°C).

Reference

Advantage actuator series 3, 5, 8, and 16 parts

Drawings

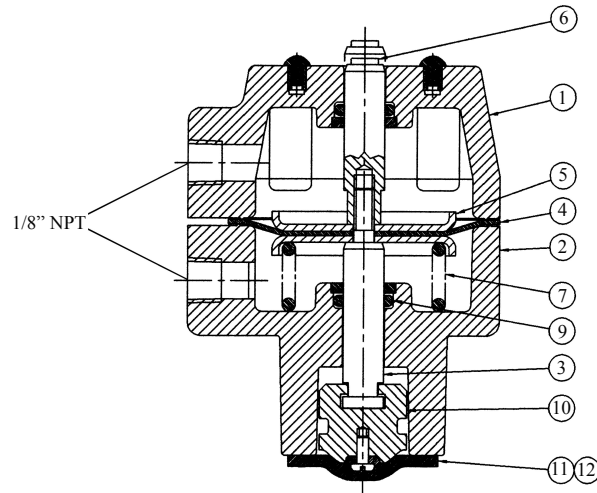


Figure 2: Drawing for fail open and double acting actuator

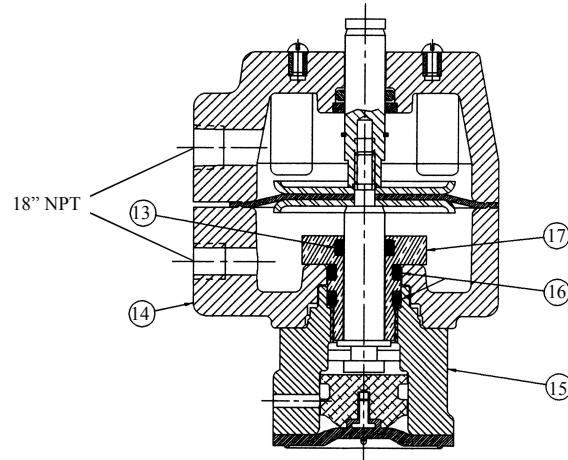


Figure 3: Drawing for low profile actuator

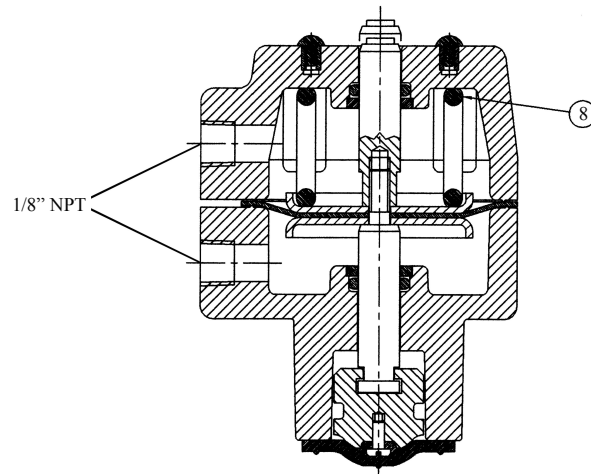


Figure 4: Drawing for fail close actuator

List of parts

Item	Description	Material	Quantity
1	Upper Actuator Cover	Plastic	1
2	Lower Actuator Cover	Plastic	1
3	Valve Spindle	Stainless Steel	1
4 ¹	Diaphragm, Actuator	Buna-N	1
5	Plate, Actuator	Stainless Steel or Carbon Steel Nickel Plated	2
6	Spindle, Indicating	Stainless Steel	1
7 ²	Spring	Steel	1
8	Spring	Steel	1
9 ¹	O-Ring	FKM	2
10	Compressor	Stainless Steel, Cast Iron, Zinc or Bronze	1
11 ¹	Diaphragm	As required	1
12 ¹	Backing Cushion	EPDM	1
13 ¹	O-Ring	FKM	1
14	Lower Actuator Cover	Plastic	1
15	Bonnet	Stainless Steel	1
16 ¹	O-Ring	FKM	2
17	Bushing	Brass	1

¹ Recommended spare parts

² Only for fail open actuators

Advantage actuator series 33 parts

Drawings

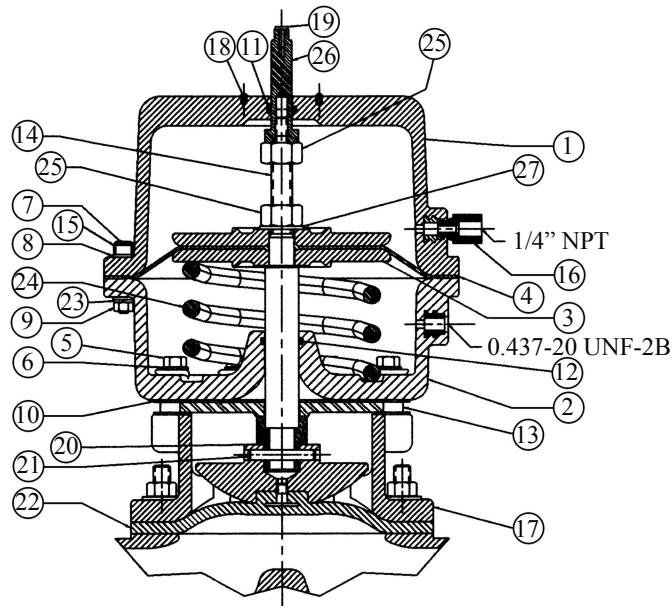


Figure 5: Drawing for fail open and double acting actuator

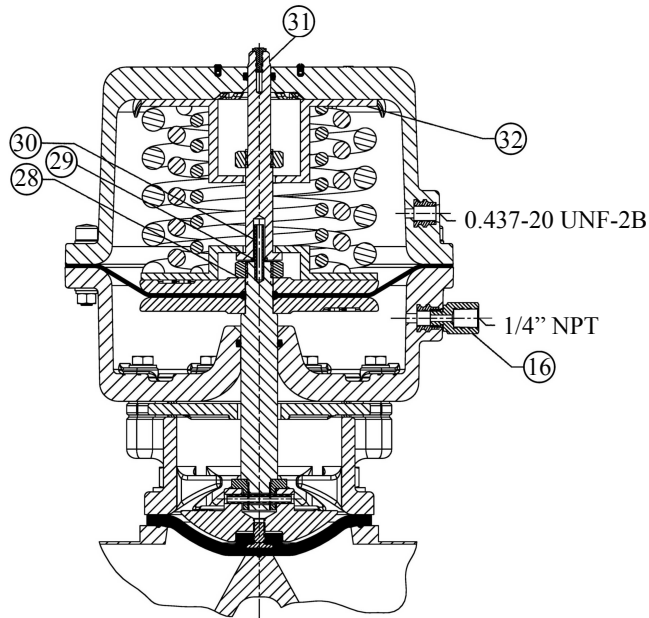


Figure 6: Drawing for fail close actuator

List of parts

Item	Description	Material	Quantity
1	Upper Cover	Plastic	1
2	Lower Cover	Plastic	1
3	Actuator Plate	Ductile Iron	2

Item	Description	Material	Quantity
4 ³	Actuator Diaphragm	Buna-N	1
5	Cap Screw	Steel	8
6	Washer	Steel	8
7	Cap Screw	Stainless Steel	12
8	Washer	Stainless Steel	24
9	Nut	Stainless Steel	12
10 ³	Gasket	EPDM	2
11 ³	O-ring	Buna-N	1
12 ³	O-ring	Buna-N	1
13 ⁴	Support Plate	Stainless Steel	1
14	Spindle	Stainless Steel	1
15	Cap	Plastic	12
16	Adapter	Stainless Steel	As required ⁵
17	Bonnet	Ductile Iron	1
18	Machine Screw	Stainless Steel	4
19	Plug	Plastic	1
20	Compressor	Cast Iron or Bronze	1
21	Pin	Stainless Steel	1
22 ³	Diaphragm	As required	1
23	Lock Washer	Stainless Steel	12
24 ⁶	Spring	Steel	1
25	Nut	Steel	2
26	Extension Spindle	Stainless Steel	1
27	Washer	Steel	1
28	Nut	Steel	1
29	Spring Pin	Stainless Steel	1
30	Wave Spring	Steel	1
31	Adjusting Bushing	Stainless Steel	1
32	Spring Pack Assembly	As required	1

Items 1-23 are common parts

Items 24-27 are for double acting and fail open actuators only

Items 28-32 are for fail close actuators only

³ Recommended spare parts

⁴ Not furnished on 4 inch series 33 actuator

⁵ Two required for double acting actuator, One required for fail open actuator and fail close actuator

⁶ Only furnished with fail open actuator

Advantage actuator series 47 parts

Drawings

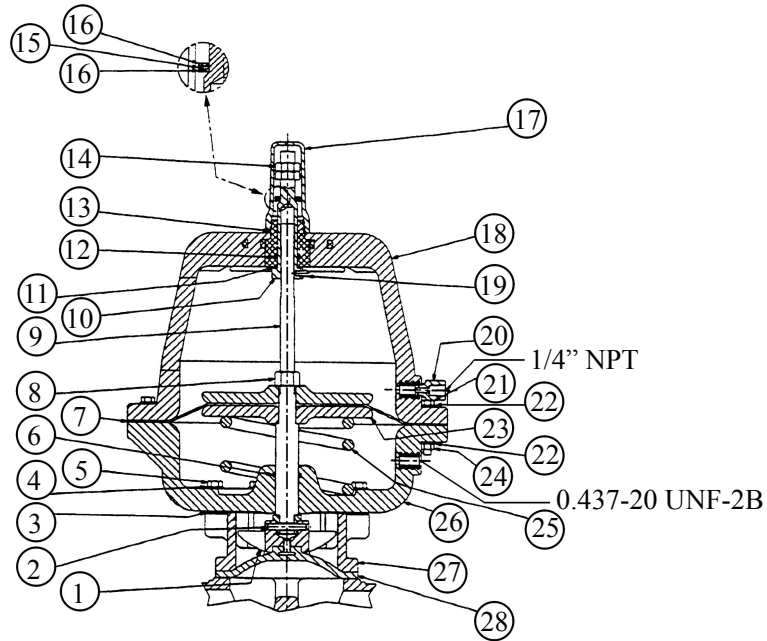


Figure 7: Drawing for fail open and double acting actuator

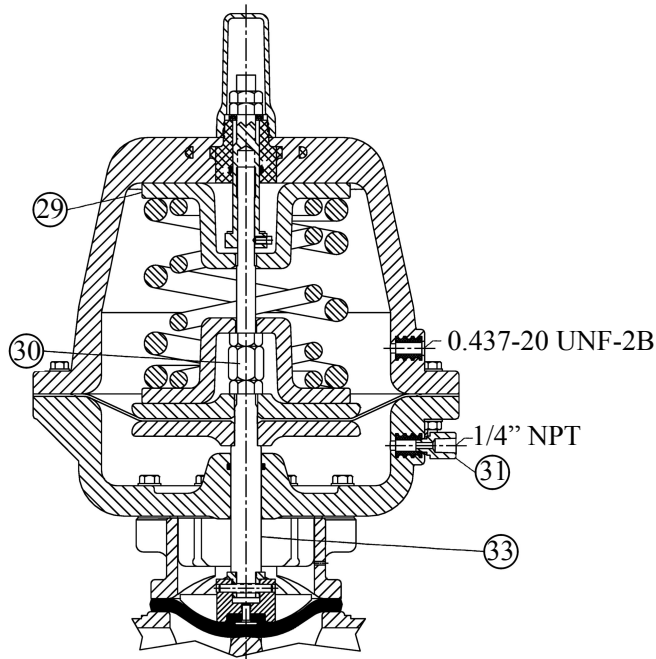


Figure 8: Drawing for fail close actuator

List of parts

Item	Description	Material	Quantity
1	Compressor	Cast Iron or Bronze	1

Item	Description	Material	Quantity
2	Pin	Stainless Steel	1
3	Gasket	EPDM	1
4 ⁷	Washer	Stainless Steel	8
5	Cap Screw	Steel	1
6	O-ring	Buna-N	1
7 ⁷	Actuator Diaphragm	Buna-N	1
8 ⁷	Hex Nut (Spindle Nut)	Steel	1
9	Spindle (Fail Open, Double Acting)	Stainless Steel	1
10	Adjusting Bushing	Stainless Steel	1
11	Thrust Washer	Nylon	1
12	O-ring	Buna-N	1
13 ⁷	O-ring	Buna-N	1
14 ⁷	Jam Nut	Stainless Steel	2
15	Thrust Bearing	Steel	1
16	Thrust Race	Steel	2
17	Cap	Plastic	1
18	Upper Cover	Plastic	1
19	Spring Plunger	Stainless Steel	1
20	Adapter	Stainless Steel	As required ⁸
21	Cap Screw	Stainless Steel	16
22	Washer	Stainless Steel	32
23	Actuator Plate	Ductile Iron	2
24	Hex Nut	Brass	16
25	Spring	Steel	1
26	Lower Cover	Plastic	1
27 ⁹	Bonnet	Ductile Iron	1
28	Diaphragm	As required	1
29	Spring Pack Assembly (Fail Close)	As required	1
30 ⁷	Coupling Nut	Stainless Steel	1
31	Adapter	Stainless Steel	1
32	Spindle (Fail Close)	Stainless Steel	1

⁷ Recommended spare parts

⁸ One for fail open actuator, two for double acting actuator.

⁹ Only furnished with fail open actuator

Parts for fixture

Drawings

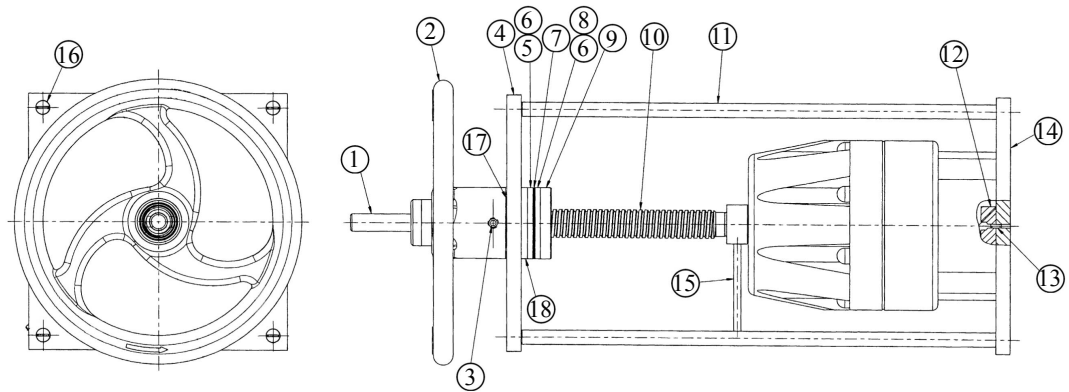


Figure 9: Fixture drawing

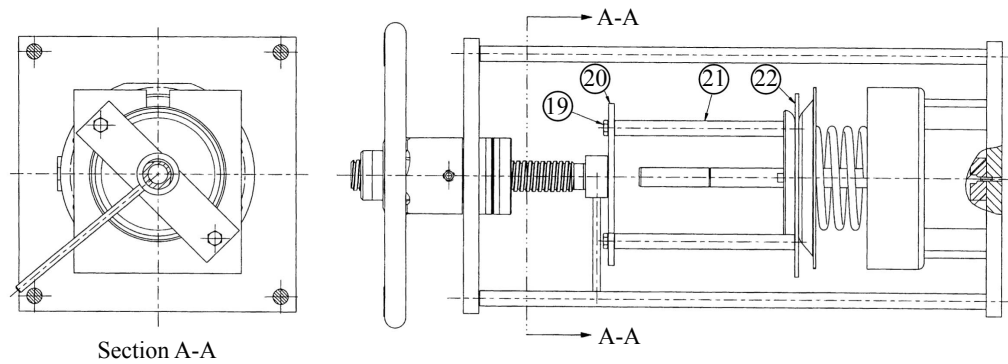


Figure 10: Fixture drawing for fail open actuators

List of parts

Item	Description	Quantity
1 ¹⁰	Centering Rod	1
2	Handwheel	1
3	Set Screw	2
4	Upper Plate	1
5	Thrust Washer	2
6	Thrust Race	2
7	Thrust Bearing	1
8	Thrust Race	1
9	Bushing	1
10	Stem	1
11	Outer Column	4

¹⁰ Not used with Fail open actuators

Item	Description	Quantity
12 ¹¹	Spacer	1
13	Spring Pin	1
14	Lower Plate	1
15	Rod	1
16	Machine Screw	4
17	Shim Washer	As required
18	Spacer Plate	1
19 ¹²	Cap Screw	2
20 ¹²	Bar	1
21 ¹²	Inner Column	2
22 ¹²	Support Plate	1

¹¹ One spacer for each size

¹² Only for Fail open actuators



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