

Model DFR 047 Rotary Actuator

Operation, Parts, and Instruction Manual



Figure 1 DFR 047
and 570 Control Valve

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NOTICE

These instructions are meant to be used with the Dyna-Flo DFR Technical Sales Bulletin as they refer to Figures and Tables therein. If you do not have the Technical Sales Bulletin, contact Dyna-Flo immediately, or visit www.dynaflo.com.

Each control valve is factory checked. Check the calibration for the specific application, before a valve or actuator is put into service.

It is the intention of this document to provide users with an accurate guide for safe installation and maintenance of the DFR Actuator. Revisions and updates are available at above mentioned website.

GENERAL

The following instructions are to be thoroughly reviewed and understood prior to installing, operating or performing maintenance on this equipment. Work on this equipment should be performed by experienced personnel. Throughout the manual, safety and caution notes appear and must be strictly followed to prevent serious injury or equipment malfunction.

SCOPE

The actuator configuration and construction materials were selected to meet particular pressure, temperature, operating medium, and process fluid conditions. Some material combinations are limited in their pressure and temperature ranges. Do not apply any other conditions to the actuator without first contacting your Dyna-Flo sales office.

This manual is written to be a practical and useful guide for maintaining the Dyna-Flo DFR Actuator.

PRINCIPLES OF OPERATION (For Top-Mounted Handwheels refer to Page 22)

The DFR actuator works by loading pressure on the top side of the diaphragm (Key 22), this loading pressure moves the actuator stem (Key 7) downwards. As the loading pressure is decreased, the spring (Key 6) forces the actuator stem upwards.

The spring and diaphragm have been selected to meet a specific application requirement, and while in service the actuator should produce full travel of the valve with the diaphragm pressure indicated on the nameplate (Key 36).

If there is no positioner being used with the control valve, a loading device (such as a 4-way switching valve) must be used. Loading devices do not come equipped standard with the actuator. Refer to appropriate positioner instruction manual as required.

SAFETY CAUTION

Only well trained experienced technicians should perform these procedures. Use safe work practices and lock out procedures when isolating valves and actuators. It is also important to wear the proper protective equipment when performing any installation or maintenance activity. Use only parts and materials rated for the process being used, operating conditions, and environmental conditions products will be used in.

To avoid personal injury or installation damage as a result of the sudden release of process pressure or damage to equipment, do not install the actuator assembly where service conditions could exceed the limits stated in this manual, sales bulletin or on the equipment nameplates. Use government codes, accepted industry standards and good piping practices, and select proper pressure-relieving equipment for protection of your installation. Always be aware of flammable process and instrument gas.

Always be aware of the hazards of actuators, especially spring-loaded actuators. Be sure that the actuator is de-energized or in the failed position before performing any maintenance procedure.

These actuators have dangerous pinch points. Never put your hands inside the valve or actuator unless you are certain that the valve or actuator will not suddenly move.

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SPECIFICATIONS

Actuator Size	Maximum Casing Pressure Psig (kPag)
047	65 (448)

Material Temperature Capabilities

Standard: -40 to 180 °F (-40 to 82 °C).

Construction Materials

See Parts list for construction materials.

Contact your Dyna-Flo sales office for more information and other options.

Valve Shaft Compatibility, inches (mm)

Size 047: 1/2 (12.7), 5/8 (15.9), 3/4 (19.1)

Actuator Dimensions

Refer to Figure 3 & 4 of Sales Bulletin.

Refer to Tables 2, 3, & 4 of Sales Bulletin.

Output Torque

Refer to Tables 5 to 7 of Sales Bulletin.

Actuator Mounting Orientation Valve Applications

Refer to Figure 9.

Refer to Table 2.

Standard Tubing Connection Size

All sizes, 1/4 inch NPT standard. Other sizes available.

Maximum Shaft Rotation

90 degrees.

Shaft Connection Types

The standard shaft connection is a splined shaft suitable for a Dyna-Flo 570 control valve.

Options

- Manual override
- Reduced rotation output
- Increased tubing connection size
- Travel stops

Diaphragm Casing Volume

Refer to Table 8 of Sales Bulletin.

For more information and other options contact your Dyna-Flo sales office.

Approximate Actuator Weights - lb. (Kg)			Table 1
Actuator Size	Standard Assembly	With Top Mounted Handwheel	
047	46 (21)	57 (26)	



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UNPACKING VALVE FROM SHIPPING CONTAINER

Special Tools Required:

- Properly Rated Lifting Straps (2 – 4 Straps) See Table 1 for actuator weights.
- Lifting Device (Example: Crane)

Check the packing list, verify that the list includes all the materials in the shipping container before unpacking. Valve information can be found on the nameplate (Key 36). Refer to Figure 11 for nameplate location.

When lifting the valve from shipping container, place properly rated lifting straps securely around the neck of the actuator, refer to Figure 2 for strape placement. Straps should be placed to avoid damage to tubing and other mounted accessories. Lift the valve/actuator assembly using proper lifting techniques.

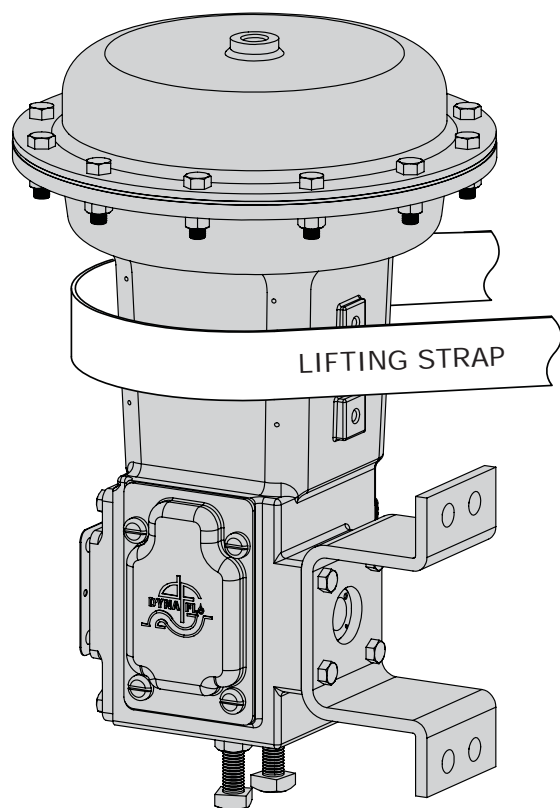


Figure 2 Suggested Lifting Strap Placement

INSTALLATION

Before You Begin:

- Read the General and Scope section of this manual (Page 2).
- Read Safety Caution (Page 2).
- Sudden movement of actuator can cause damage or injury. It helps to have the actuator de-energized as long as the valve installation will permit.
- Use safe work practices and lock out procedures before placing valve in-line.

Actuators are typically shipped from factory as an assembly already mounted to the valve. Follow the appropriate valve installation instructions to install the actuator / valve assembly. If the actuator was shipped separately, it will be necessary to mount the actuator on the valve prior to installation, refer to the Actuator Mounting section.

Operating medium must be controlled and directed, if a positioner was not ordered or unavailable, use a loading device such as a 4-way switching valve (not provided with the actuator). For more information on positioner installation and operation, refer to the appropriate positioner instruction manual for your positioner type.

AIR PIPING

WARNING:

Property damage, environmental harm, and personal injury can result from the use of supply gas other than clean, non-corrosive, oil and moisture free air. Do not exceed the supply pressure indicated on the nameplate (Key 36) located on the actuator.

Before You Begin:

Note: Standard actuators accept 1/4" (6 mm) NPT connections.

Piping Installation Steps:

- 1 Use 3/8" (10 mm) outside diameter SST tubing (or equivalent) for air lines. Keep length of tubing as short as possible to prevent transmission lag in the control signal.
- 2 Install the required line vents, valves, drains, seals, and filters to the actuator.

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ACTUATOR MOUNTING

Before You Begin:

- Read the General and Scope section of this manual (Page 2).
- Read Safety Caution (Page 2).
- Use safe work practices and lock out procedures.
- Disconnect supply lines (air or gas), electric power, or control signal to the actuator. Sudden movement of actuator can cause damage or injury, make sure actuator will not operate.
- Vent any pneumatic actuator loading pressure.
- Relieve process pressure and drain the process fluid from up and down stream of valve.
- Be aware of potentially hazardous process material that may be present in-line and in-valve. Isolate the valve from process pressure. Use a bypass or block valve if necessary, or completely shut off the process. Relieve internal valve pressure (refer to the appropriate valve instruction manual).

Lubricants Required:

- Permatex® Nickel Anti-Seize or equivalent (Key A)
- Fluid Film® (Key D)

- 1 Before mounting the actuator to a control valve, it is recommended to perform the Spring Compression Adjustment (Page 7). Spring Compression Adjustment must be performed while the actuator is removed from the valve.
- 2 If the valve has been removed from the pipeline, secure the valve assembly in place on a flat work surface that will support the weight of the combined valve and actuator assembly.
- 3 Remove any positioners and/or instrumentation installed on the actuator.
- 4 Remove the cover plate (Key 26) by removing the screws (Key 27).
- 5 Using a 5/16" socket bit, loosen the cap screw (Key 11) on the lever (Key 10).
- 6 Before placing the valve shaft (Key V) into the lever (Key 10), position the valve ball/disc as follows:

For push-down-to-close action (fail open):

Rotate the valve ball/disc into the fully open position.

For push-down-to-open action (fail closed):

Rotate the valve ball/disc into the fully closed position.

Note: Refer to the appropriate valve instruction manual.

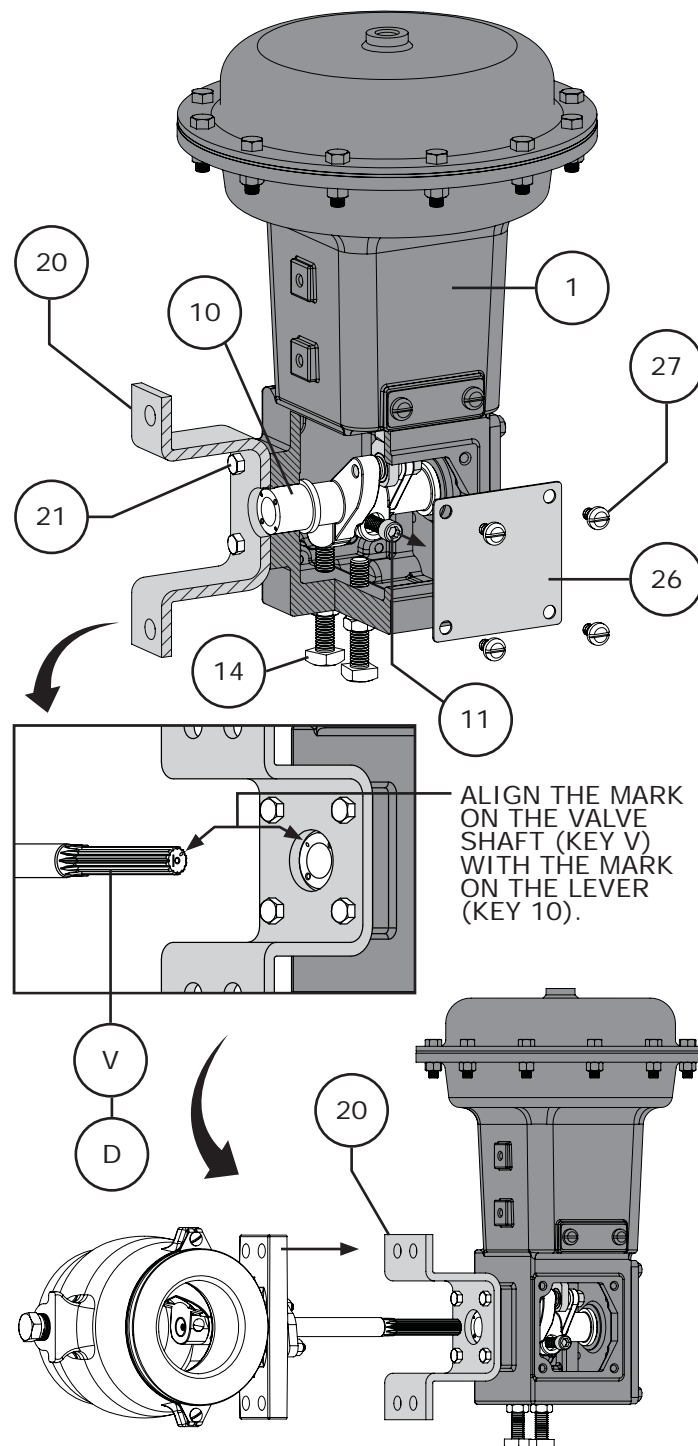


Figure 3 Actuator Mounting



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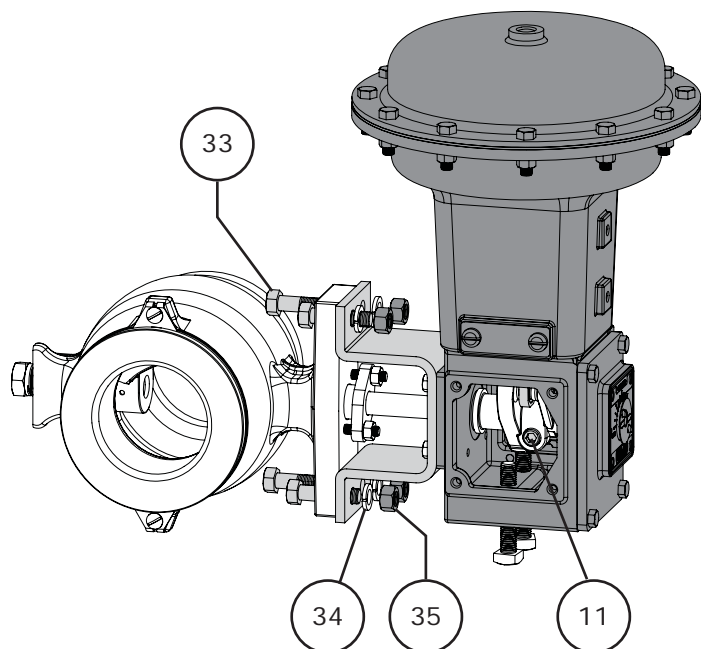


Figure 4 Actuator/Valve Body Bolting

ACTUATOR MOUNTING (Continued)

- 7 Apply Fluid Film® (Key D) to the teeth of the valve shaft (Key V).
- 8 Slide the actuator onto the valve shaft as shown in Figure 3. Refer to Figures 9 for actuator mounting positions and orientations. Align the mark on the valve shaft (Key V) with the appropriate mark on the lever (Key 10).

Note: The actuator is typically installed in a vertical orientation. Should the actuator be installed in a horizontal position, then it may be necessary to have external support for the actuator in this position.

- 9 Once the actuator is installed on the valve shaft in the proper orientation, secure the actuator in place using the mounting bolts (Key 33), lockwashers (Key 34), and hex nuts (Key 35). Refer to Figure 4, and Table 3 for torque values.
- 10 With a 5/16" socket bit, tighten the lever cap screw (Key 11) to secure the lever (Key 10) to the valve shaft (Key V).

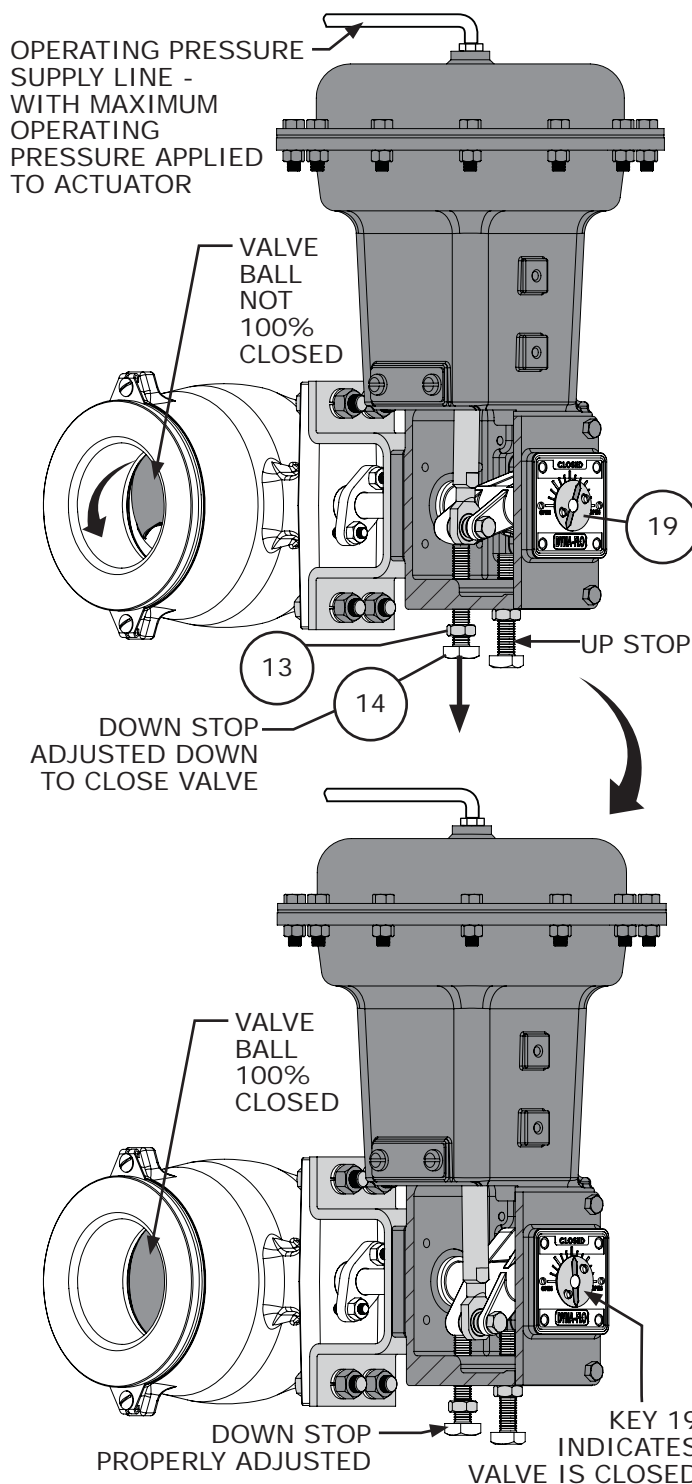


Figure 5 Mounting Adjustment for Push-Down-To-Close

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ACTUATOR MOUNTING (Continued)

- 11 Adjust the up travel stop (Key 14, Figure 5) until the valve ball/disc is in the desired position. **Note:** Refer to the appropriate valve instruction manual for information on valve travel and positions.
- 12 Slowly stroke the actuator until the maximum operating pressure is reached as indicated on the nameplate (Key 36). **Note:** Use caution when stroking the actuator, avoid dangerous pinch points and equipment damage by keeping appendages and tools away from moving actuator parts.
- 13 With operating pressure applied to the actuator, adjust the down travel stop (Key 14, Figure 5) until the travel indicator (Key 19) shows the valve ball/disc to be in the desired position. Refer to Figure 5 for a push-down-to-close valve configuration example.
- 14 Re-install the cover plate (Key 26) using the screws (Key 27).

SPRING ADJUSTMENT

Before You Begin:

- Read the General and Scope section of this manual (Page 2).
- Read Safety Caution (Page 2).
- Use safe work practices and lock out procedures.
- Disconnect supply lines (air or gas), electric power, or control signal to the actuator. Sudden movement of actuator can cause damage or injury, make sure actuator will not operate.
- Vent any pneumatic actuator loading pressure.
- Relieve process pressure and drain the process fluid from up and down stream of valve.
- Be aware of potentially hazardous process material that may be present in-line and in-valve. Isolate the valve from process pressure. Use a bypass or block valve if necessary, or completely shut off the process. Relieve internal valve pressure (refer to the appropriate valve instruction manual).

Special Tools Required:

- Flat-head screwdriver or flat-bladed tool.
- Regulated operating supply pressure and 1/4" NPT fittings.

INITIAL SET

Refer to the actuator nameplate (Key 36) for the Initial Set. The initial setting is the casing pressure at which the diaphragm (Key 22) begins to move the diaphragm plate (Key 8) and actuator stem (Key 7) away from the up travel stop when the actuator is not attached to the valve.

When the actuator is connected to a valve with pressure applied to that valve, a higher casing pressure will be required to begin actuator travel.

The initial setting was selected to meet a specific set of service condition requirements. Proper initial setting will ensure that once the actuator and valve are in service, the valve will seat properly and full travel will be achieved within the specified diaphragm casing pressure range.

Note: If the actuator has been disassembled and reassembled, or if service requirements have changed, it will be necessary to perform the following steps for Initial Setting.

- 1 If the actuator is mounted to a valve, remove the screws (Key 27) and cover plate (Key 26). With a 5/16" socket bit, loosen the lever cap screw (Key 11) holding the valve shaft (Key V) in the lever (Key 10). Remove the actuator from the valve by removing the mounting bolts (Key 33), hex nuts (Key 35), and washers (Key 34). Refer to Figure 4.
- 2 Disconnect any instrumentation attached to the actuator.
- 3 Remove the screws (Key 29) and the spring adjuster cover (Key 28).
- 4 Apply operating pressure to the diaphragm casing, when the spring is properly adjusted, the actuator stem (Key 7) will start to move when the Initial Set pressure (indicated on the nameplate (Key 36) or in Table 5) is reached. Make note whether the actuator stem started to move before or after the Initial Set value.
- 5 Relieve actuator casing pressure.

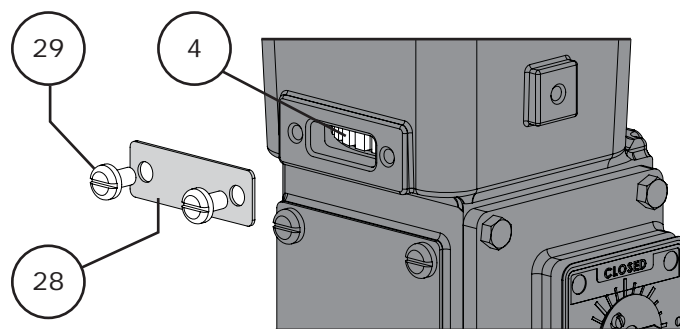
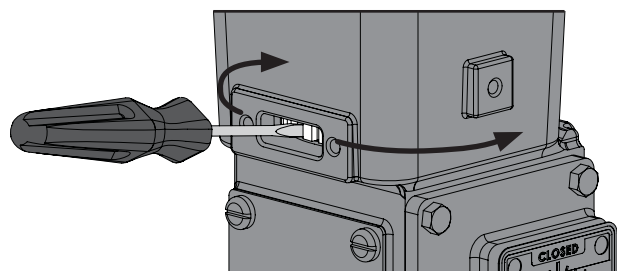


Figure 6 Spring Adjuster Cover Removal



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TURNING THE SPRING ADJUSTER (KEY 4) CLOCKWISE (TO THE LEFT) WILL INCREASE THE INITIAL SETTING.

TURNING THE SPRING ADJUSTER (KEY 4) COUNTER-CLOCKWISE (TO THE RIGHT) WILL DECREASE THE INITIAL SETTING.

Figure 7 Spring Adjustment

SPRING ADJUSTMENT (Continued)

INITIAL SET (Continued)

- 6 Using a flat-head screwdriver or a flat-bladed tool, adjust the spring adjuster (Key 4) accordingly:
 - To increase Initial Setting (increase spring compression)
 - Turn the spring adjuster to the left (clockwise when viewed from above).
 - To decrease Initial Setting (decrease spring compression)
 - Turn the spring adjuster to the right (counter-clockwise when viewed from above).
- 7 Repeat Steps 4 – 6 until the Initial Set pressure is reached.
- 8 Re-install the spring adjuster cover (Key 28) and screws (Key 29). Proceed to Actuator Mounting section.

STROKE RANGE

Should the desired stroking range be unachievable during normal operating conditions with the casing pressure used, it may be possible to adjust the stroking range by making a spring adjustment. A spring adjustment will shift the casing pressure span and either increase or decrease the casing pressure at which the actuator begins its stroke, this will affect the pressure at which the actuator reaches full travel.

Refer to the Initial Set section and adjust the spring adjuster (Key 4) as follows:

To shift the casing pressure span downward – rotate the spring adjuster to the right (counter-clockwise when viewed from above).

To shift the casing pressure span upward – rotate the spring adjuster to the left (clockwise when viewed from above).

CHANGING ACTUATOR STYLE

Refer to the Before You Begin section of the Actuator Mounting instructions (Page 5).

Mounting Styles A and D

Style A is right-hand mounted and **Style D** is left-hand mounted, in all other ways **Styles A** and **D** are identical. Refer to Figure 9.

Mounting Styles B and C

Style B is right-hand mounted and **Style C** is left-hand mounted, in all other ways **Styles B** and **C** are identical. Refer to Figure 9.

Note: To convert a **Style A** or **D** into a **Style B** or **C** actuator, the actuator must first be separated from the control valve. Refer to Steps 1 and 2 of the Initial Set section (Page 7).

Refer to Figure 8.

- 1 Remove the machine screws (Key 18) and travel indicator (Key 19).
- 2 Remove the machine screws (Key 18) and travel scale (Key 17).
- 3 Remove the cap screws (Key 21) and mounting yoke (Key 20).
- 4 Swap the position of the travel indicator (Key 19) and mounting yoke (Key 20) as shown in Figure 8. Install the travel scale on the opposite side of the actuator using the machine screws (Key 18). Install the travel indicator (Key 19) into the opposite side of the lever (Key 10) using the machine screws (Key 18).
- 5 Place the mounting yoke (Key 20) in the desired orientation (refer to Table 2 and Figure 9 for Mounting Positions) on the opposite side of the actuator. Secure the mounting yoke in place using the cap screws (Key 21), tighten the cap screws to the torque specification listed in Table 4.
- 6 Once an actuator has been converted to a different mounting style, the actuator must be re-adjusted. Refer to the Spring Adjustment section of this manual.

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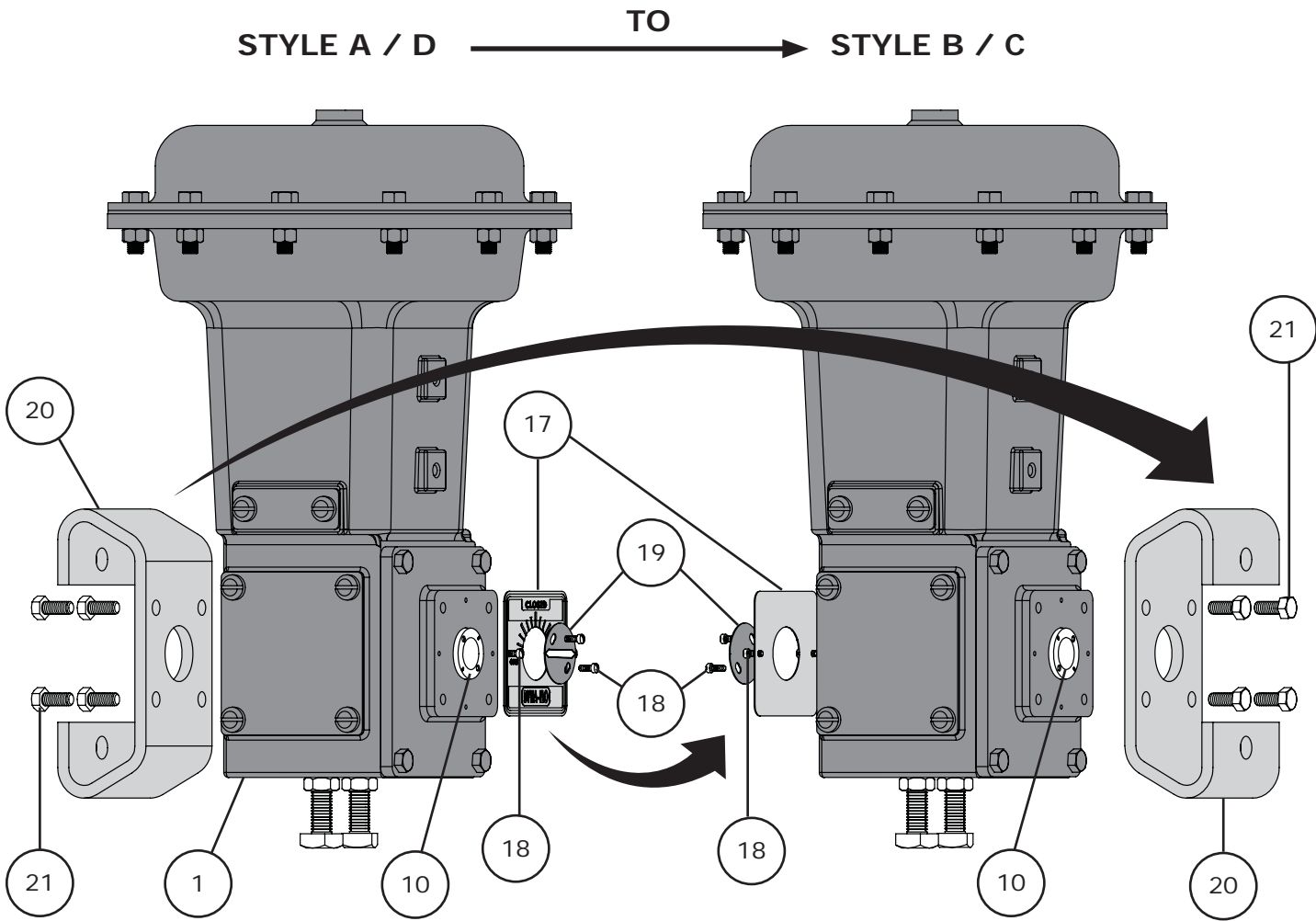


Figure 8 *Changing Actuator Style*

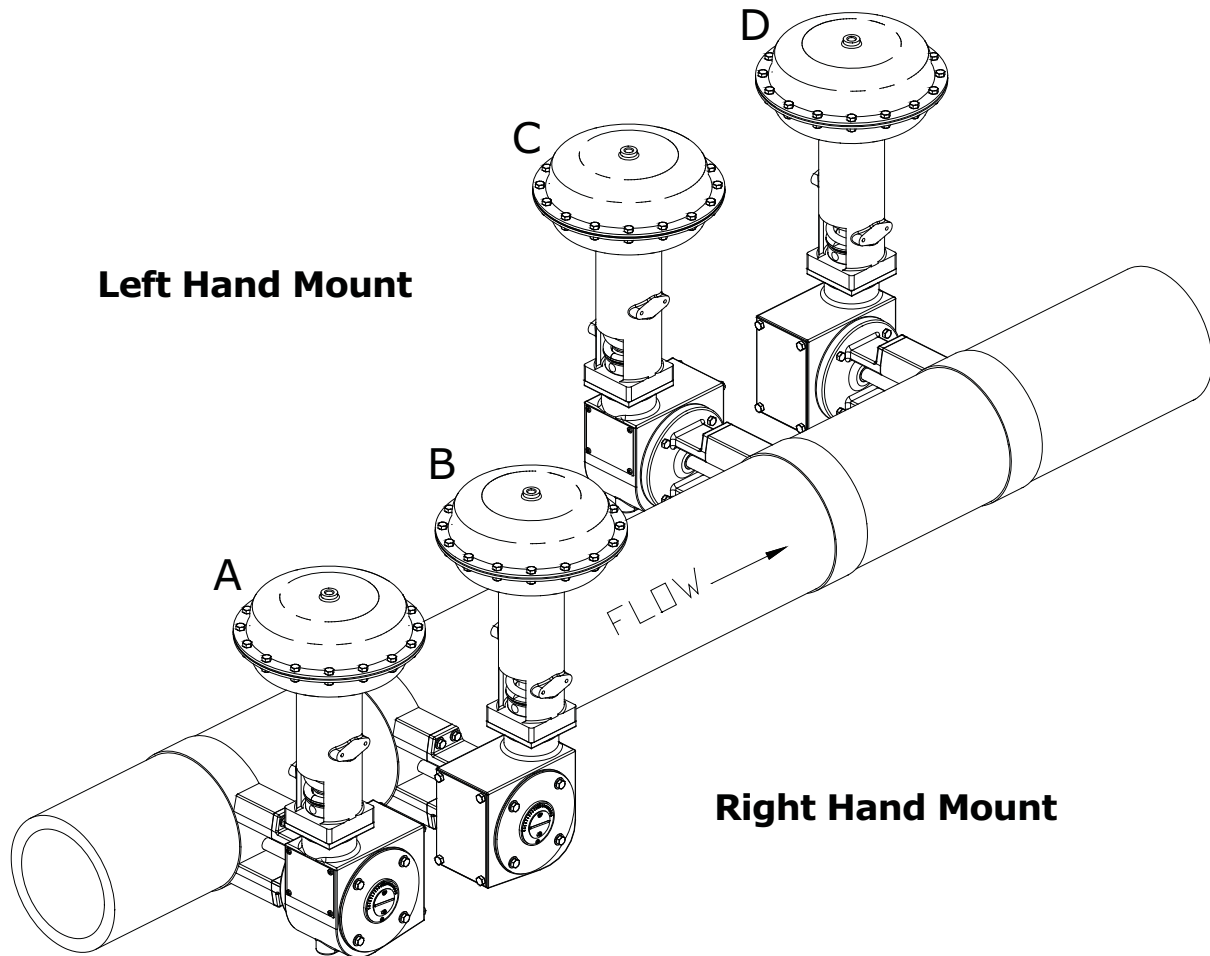
Model DFR Mounting Styles and Positions				Table 2
Mounting	Action	Model 570 Valve		Model 660 Butterfly Valve
Right Hand	Fail Open	Style A		Style B
Right Hand	Fail Close	Style B		Style A
Left Hand	Fail Open	Style C		Style C
Left Hand	Fail Close	Style D		Style D



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Left Hand Mount



Right Hand Mount

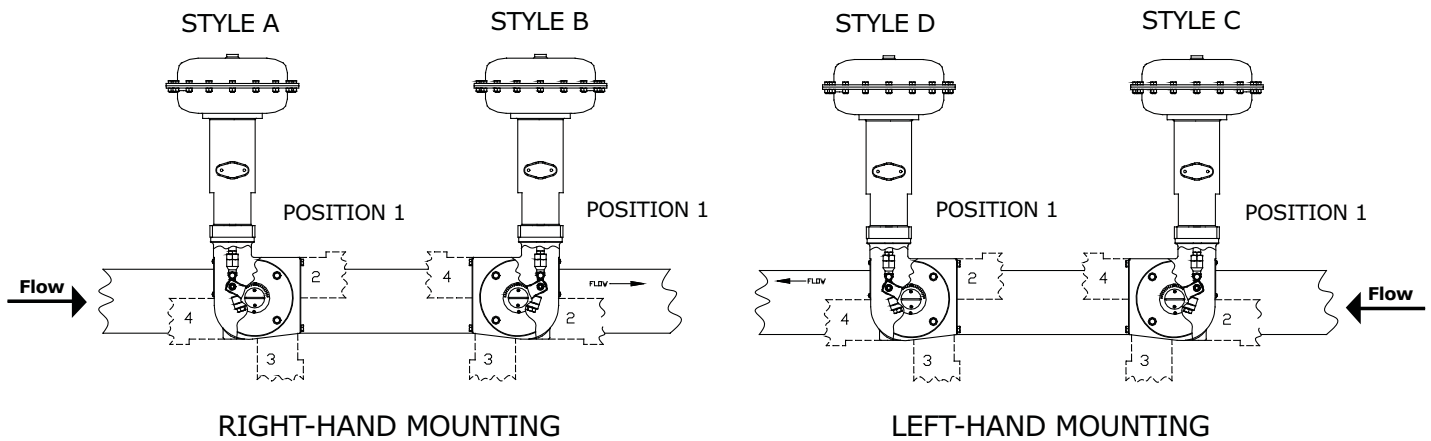


Figure 9 Mounting Orientation and Valve Applications

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ACTUATOR DISASSEMBLY

Before You Begin:

- Read the General and Scope section of this manual (Page 2).
- Read Safety Caution (Page 2).
- Use safe work practices and lock out procedures.
- Disconnect supply lines (air or gas), electric power, or control signal to the actuator. Sudden movement of actuator can cause damage or injury, make sure actuator will not operate.
- Vent any pneumatic actuator loading pressure.
- Relieve process pressure and drain the process fluid from up and down stream of valve.
- Be aware of potentially hazardous process material that may be present in-line and in-valve. Isolate the valve from process pressure. Use a bypass or block valve if necessary, or completely shut off the process. Relieve internal valve pressure (refer to the appropriate valve instruction manual).

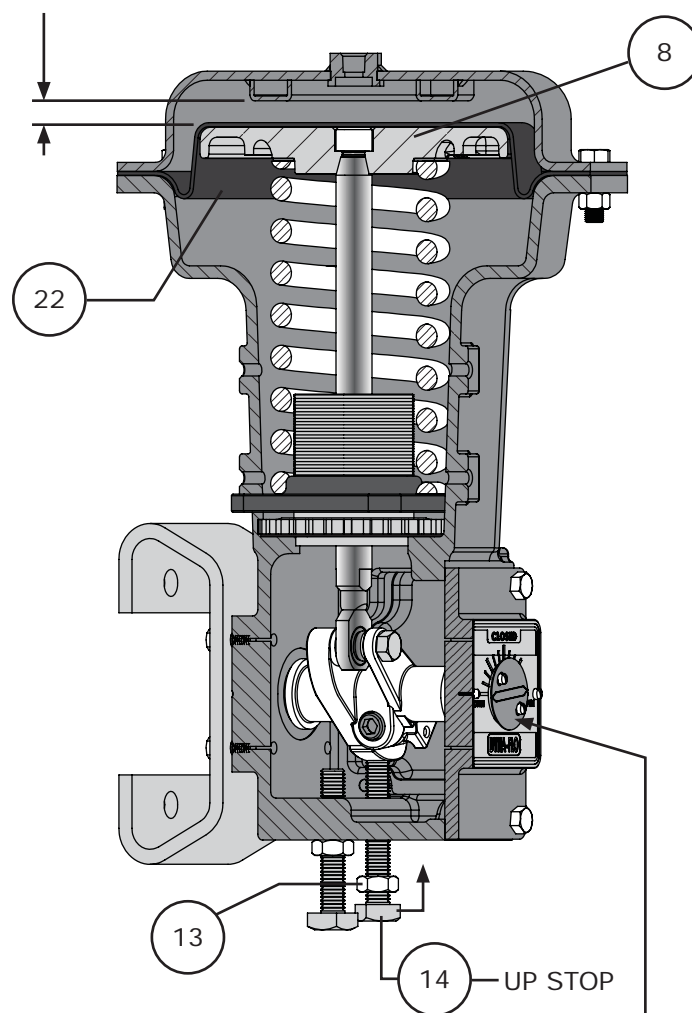
Special Tools Required:

- Soft tip felt marker.
- Flat-head screwdriver or flat-bladed tool.

CASING DISASSEMBLY

- 1 If the actuator has been removed from the valve and pipeline, secure the actuator assembly in place on a flat work surface that will support the weight.
- 2 Remove any positioners installed on the actuator.
- 3 Observe the position and movement of the travel indicator (Key 19). Using a soft tip felt marker, mark the position of the travel indicator on the travel scale (Key 17).
- 4 **Note:** There are two methods for removing spring tension before disassembling the actuator casing. Method A can be used for maintenance purposes to replace the diaphragm (Key 22), Method B is quicker to use when completely disassembling the actuator.
 - A Remove all spring tension by first loosening the jam nut (Key 13) on the up travel stop (refer to Figure 10), and then adjusting the up travel stop clockwise (into the housing) until the travel indicator (Key 19) begins to move. Stop adjusting the up travel stop at this point as the spring tension resting against the upper diaphragm casing (Key 23) will have been removed.

TURN THE UP TRAVEL STOP (KEY 14) CLOCKWISE UNTIL THE DIAPHRAGM (KEY 22) AND DIAPHRAGM PLATE (KEY 8) NO LONGER MAKE CONTACT WITH THE DIAPHRAGM CASE (KEY 23).



THE TRAVEL INDICATOR (KEY 19) WILL BEGIN TO MOVE WHEN THERE IS NO LONGER ANY CONTACT BETWEEN THE DIAPHRAGM CASE AND THE DIAPHRAGM.

Figure 10 Method A - Spring Tension Removal



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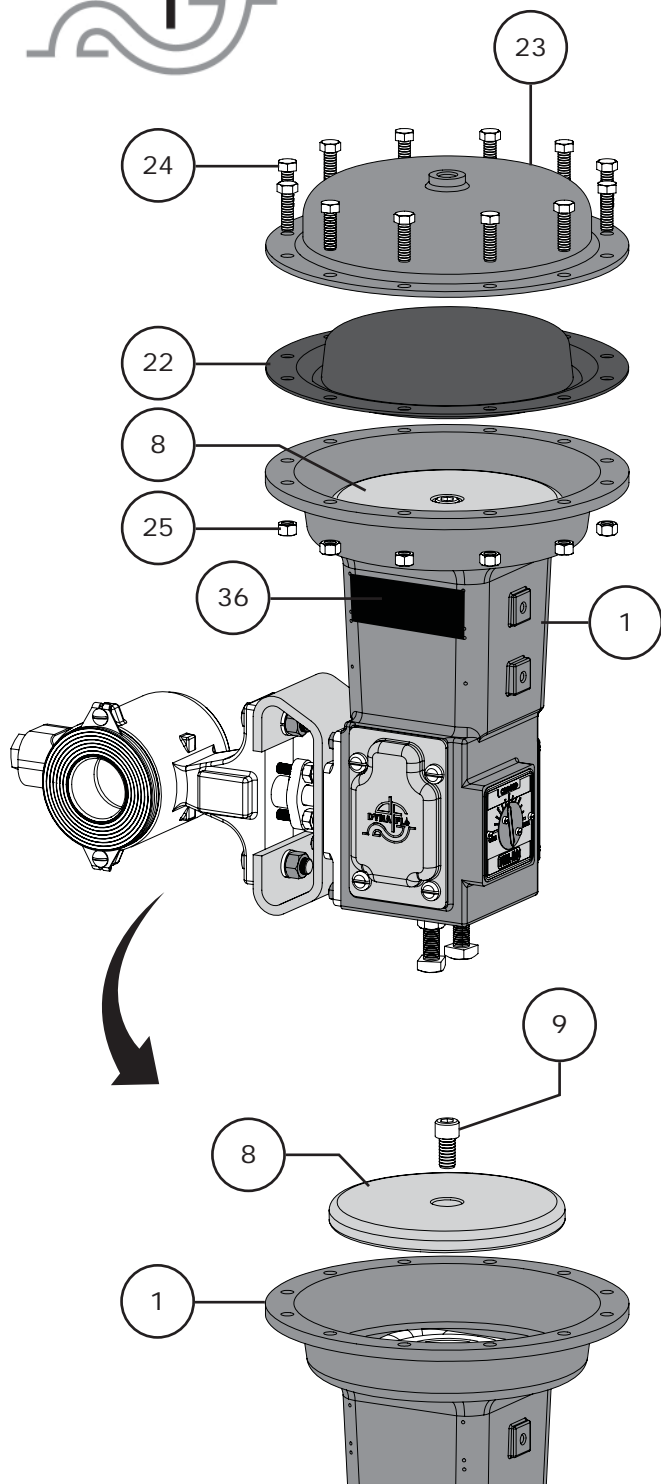


Figure 11 Diaphragm Casing Disassembly

ACTUATOR DISASSEMBLY (Continued)

4 (Continued)

B Remove the screws (Key 29) and spring adjuster cover (Key 28). Using a flat-head screw driver or flat-bladed tool, turn the spring adjuster (Key 4) to the right (counter-clockwise when viewed from above) until the spring seat (Key 5) makes contact with the spring adjuster. Refer to Figures 6 and 7.

5 Remove the cap screws (Key 24) and hex nuts (Key 25) from the diaphragm casing (Key 23).

6 Remove the upper diaphragm casing (Key 23) and diaphragm (Key 22).

7 Inspect all parts for damage or wear, replace or repair parts as necessary. All soft parts such as diaphragm should be replaced.

SPRING / ADJUSTER / SEAT DISASSEMBLY

1 Using a 3/8" socket bit, remove the socket head cap screw (Key 9) from the actuator stem (Key 7).

2 Remove the diaphragm plate (Key 8).

3 Remove the upper thrust washer (Key 3).

4 Remove the spring (Key 6).

5 Remove the spring seat (Key 5) and spring adjuster (Key 4).

6 Remove the lower thrust washer (Key 3).

7 Inspect all parts for damage or wear, replace or repair parts as necessary.

LEVER REMOVAL

Note: For Styles **B** and **C** actuators, the actuator must be removed from the control valve to be able to remove the actuator stem (Key 7) by disconnecting it through the housing cover (Key 15). Refer to the Spring Adjustment - Initial Set Section, Steps 1 and 2 for actuator/valve separation instructions.

1 For Styles **A** and **D** actuator configurations:

A Remove the machine screws (Key 18) and travel indicator (Key 19).

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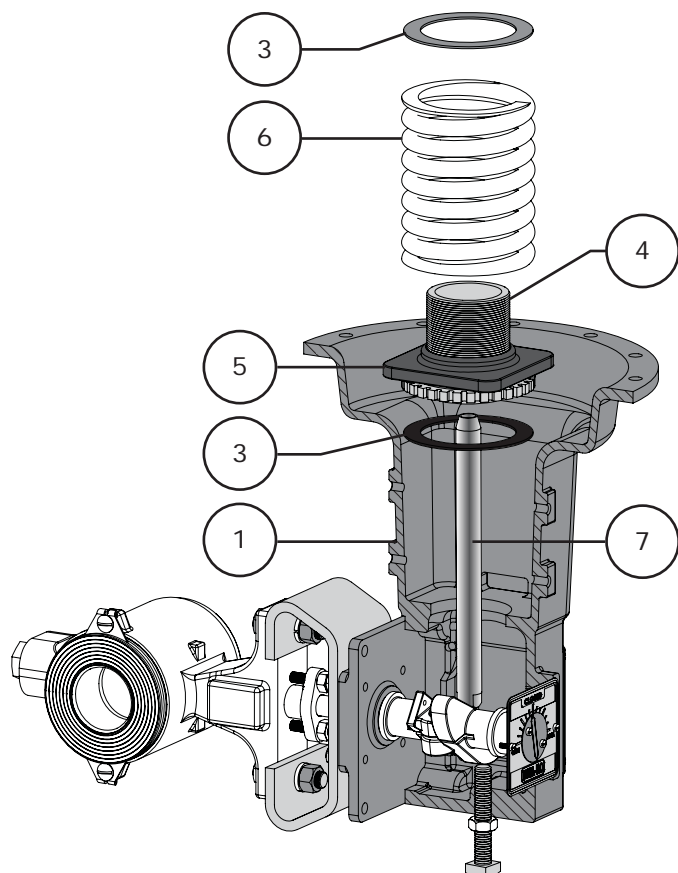


Figure 12 Spring / Adjuster / Seat Disassembly

ACTUATOR DISASSEMBLY (Continued)

LEVER REMOVAL (Continued)

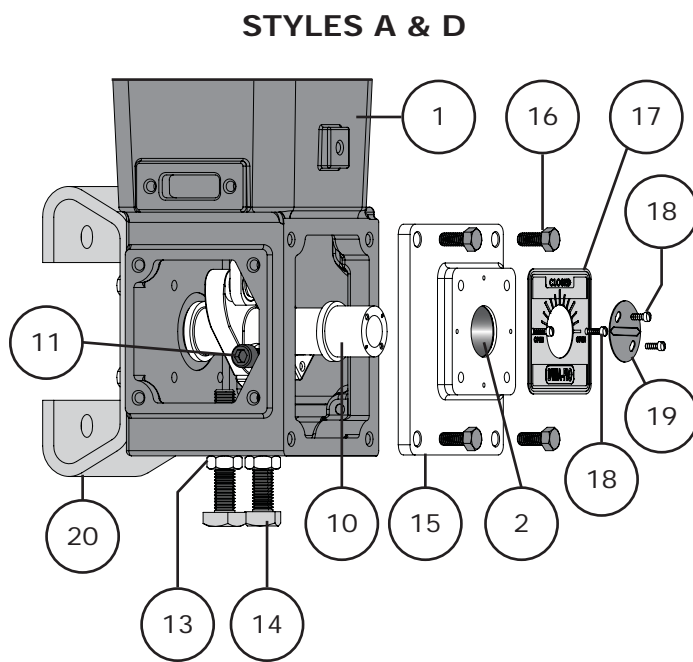
1 For Styles A and D actuator configurations (Continued):

- B** Remove the machine screws (Key 18) and travel scale (Key 17) if necessary.
- C** Remove the cap screws (Key 16) and housing cover assembly (Key 15).

For Styles B and C actuator configurations:

- A** Remove the cap screws (Key 21) and mounting yoke (Key 20).
- B** Remove the cap screws (Key 16) and housing cover assembly (Key 15).

- 2** Remove the bolt (Key 12) from the lever/actuator stem connection (Keys 10 and 7).



STYLES B & C

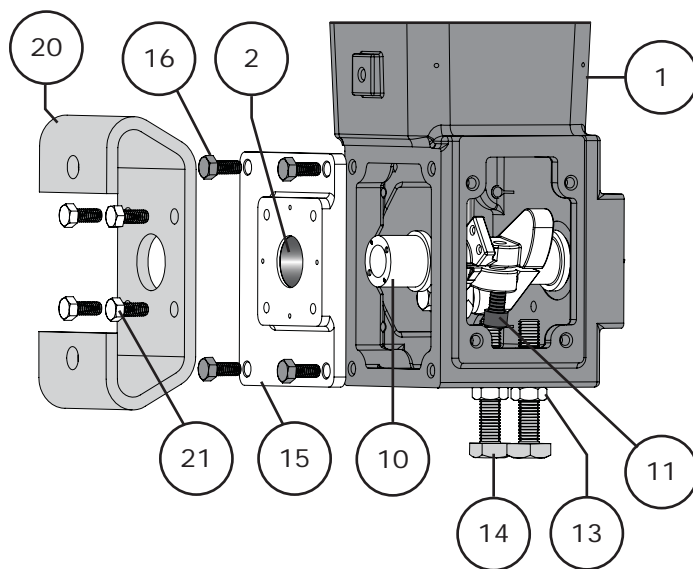


Figure 13 Housing Cover / Yoke Removal



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ACTUATOR DISASSEMBLY (Continued)

LEVER REMOVAL (Continued)

- 3 Remove the actuator stem (Key 7).
- 4 Remove the lever (Key 10).
- 5 For Styles B and C actuator configurations, if not already removed, remove the machine screws (Keys 18), travel indicator (Key 19), and travel scale (Key 17).
- 6 Remove the travel stops (Keys 14 and 13) if necessary.
- 7 Inspect all parts for damage or wear, replace or repair parts as necessary.

BEARING TAPE REMOVAL

- 1 Inspect the bearing tape (Key 2) in the housing and housing cover (Keys 1 and 15) for damage and wear. If the bearing tape needs to be replaced, remove them using a mechanic pick set or carefully with a flat-head screwdriver.

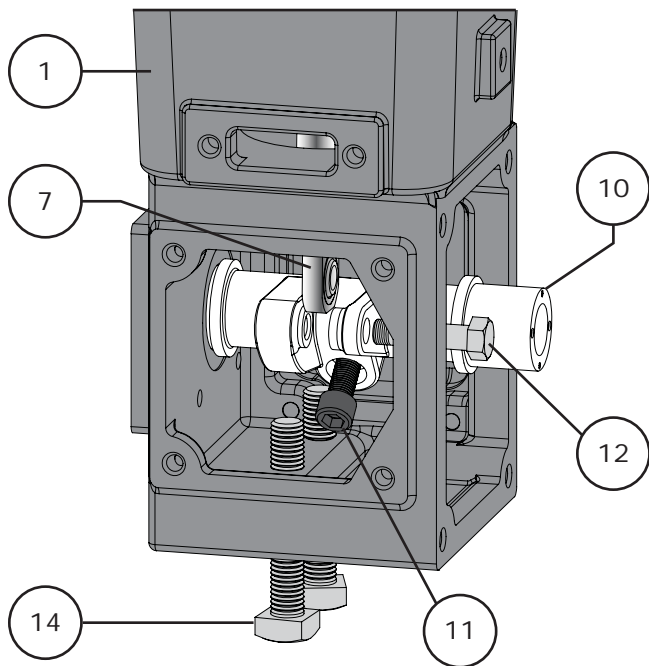


Figure 14 *Lever Removal 1*

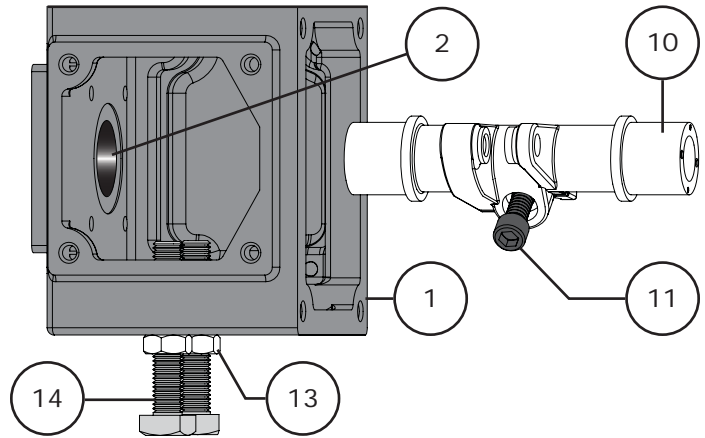


Figure 15 *Lever Removal 2*

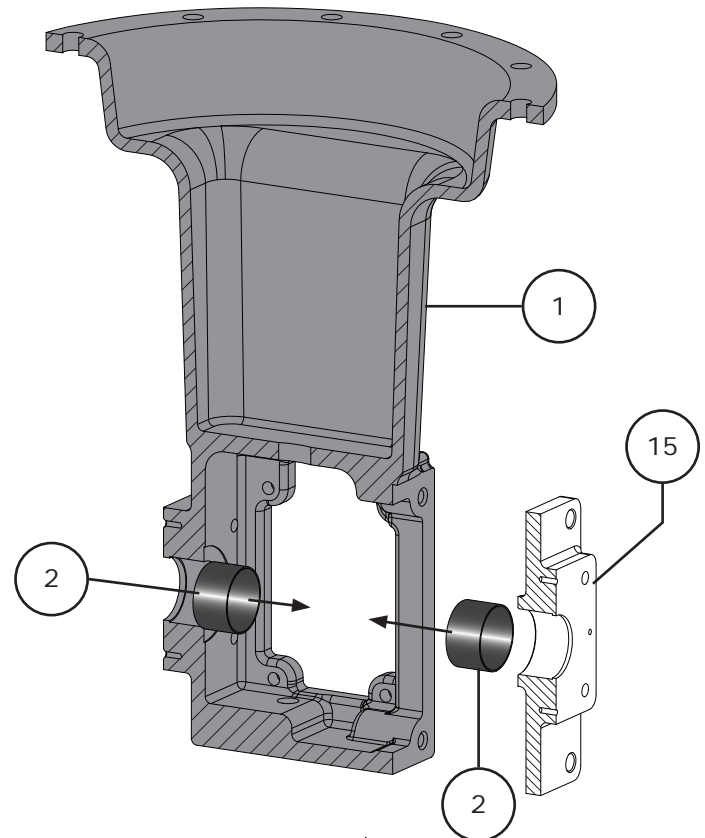


Figure 16 *Bearing Tape Removal*

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ACTUATOR ASSEMBLY

Before You Begin:

- The Assembly section of this manual assumes that the actuator has been completely disassembled prior to assembly.
- Read the General and Scope section of this manual (Page 2).
- Read Safety Caution (Page 2).
- Use safe work practices and lock out procedures.

Special Tools Required:

- Flat-head screwdriver or flat-bladed tool.
- Regulated air supply (to stroke the actuator).
- Vise grips.
- Regulated operating supply pressure and 1/4" NPT fittings.

Lubricants Required:

- Permatex® Nickel Anti-Seize or equivalent (Key A)
- Lubriplate® No. 105 Grease or equivalent (Key C)
- Fluid Film® (Key D)
- Loctite® 242® (Key E)
- Mobil Unirex™ Lotemp Grease or Equivalent (Key F)

Note: These assembly instructions assume that the control valve is still installed in the pipeline. If the control valve has been removed from the pipeline, make sure that the valve is placed securely on a flat work surface or clamping device that can support the combined weight of the control valve/actuator assembly.

BEARING TAPE INSTALLATION

- 1 If the bearing tape (Key 2) was removed from the housing (Key 1) and/or the housing cover (Key 15), insert new bearing tape. Refer to Figure 17.
- 2 Make sure that the cut ends of the bearing tape (Key 2) do not overlap each other.

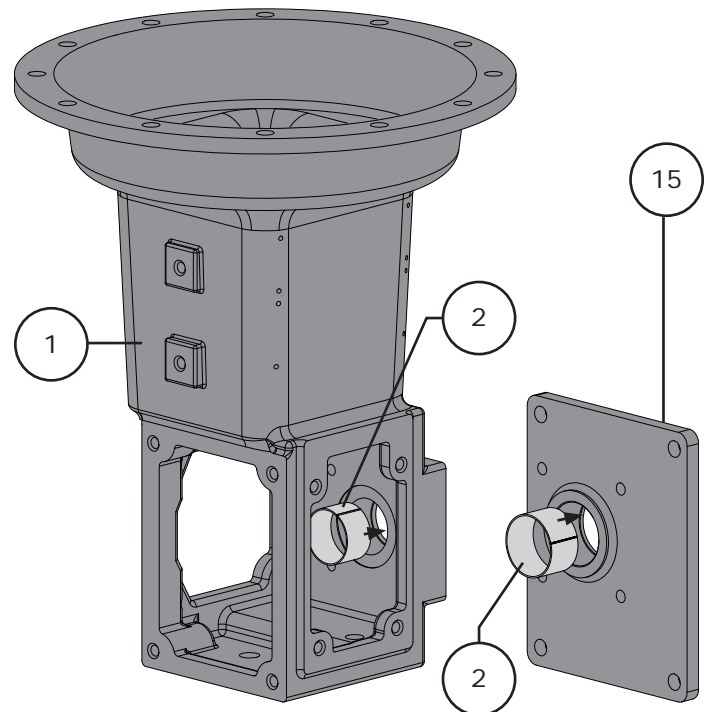


Figure 17 Bearing Tape Installation

SPRING / ADJUSTER / SEAT ASSEMBLY

- 1 Apply Lubriplate® No. 105 Grease (Key C) to both sides of the lower thrust washer (Key 3) and set it into the actuator housing (Key 3) as shown in Figure 19.
- 2 Apply Permatex® Nickel Anti-Seize (Key A) to the threads of the spring adjuster (Key 4).
- 3 Thread the spring seat (Key 5) completely onto the spring adjuster (Key 4).
- 4 Apply Lubriplate® No. 105 Grease (Key C) to the bottom surface of the spring adjuster (Key 4). Set the spring adjuster/spring seat assembly (Keys 4 and 5) inside the actuator housing (Key 1) so that it sits on top of the lower thrust washer (Key 3).
- 5 Place the spring (Key 6) onto the spring seat (Key 5).
- 6 Apply Lubriplate® No. 105 Grease (Key C) to both sides of the upper thrust washer (Key 3). Set the upper thrust washer on top of the spring (Key 6).

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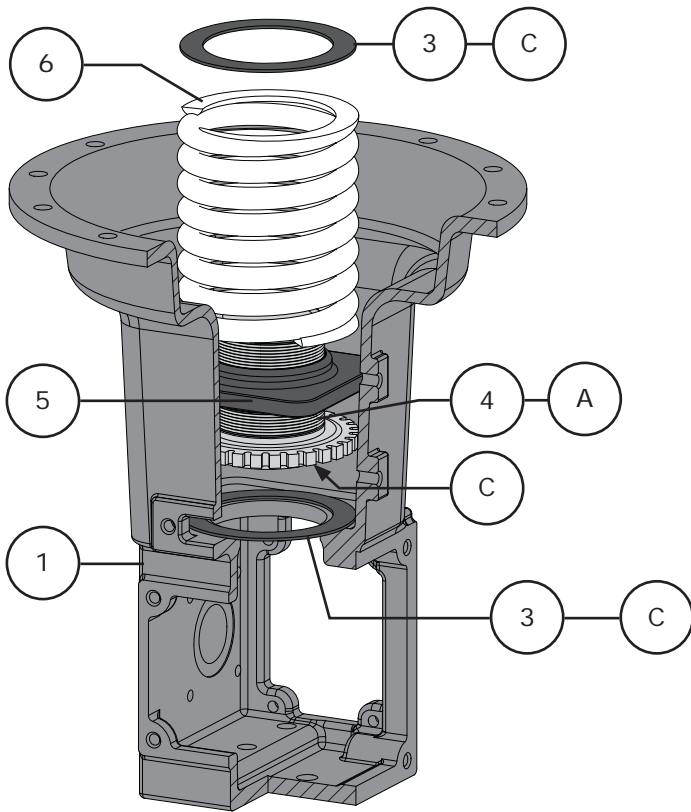


Figure 19 *Spring Barrel Assembly*

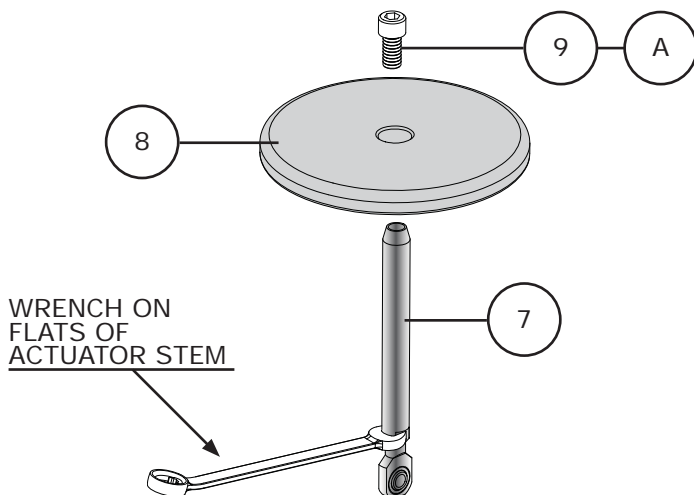


Figure 20 *Diaphragm Plate Assembly*

ACTUATOR ASSEMBLY (Continued)

DIAPHRAGM PLATE ASSEMBLY

- 1 Apply Permatex® Nickel Anti-Seize (Key A) to the threads of the socket-head cap screw (Key 9).
- 2 Place the diaphragm plate (Key 8) onto the tapered end of the actuator stem (Key 7). Thread the cap screw (Key 9) through the diaphragm plate and into the actuator stem, tighten the cap screw finger tight.
- 3 Place a wrench on the flats of the actuator stem (Key 7), or place the actuator stem into a vice with jaw softeners. Finish tightening the cap screw (Key 9) to the torque specifications listed in Table 4.
- 4 Slide the diaphragm plate assembly (Keys 7, 8, and 9) into the actuator housing (Key 1) so that the bottom of the diaphragm plate (Key 8) rests on top of the upper thrust washer (Key 3). Position the bearing of the actuator stem (Key 7) so that it will fit properly into the lever (Key 10) once it is installed.

DIAPHRAGM CASING ASSEMBLY

- 1 Place the diaphragm (Key 22) over the diaphragm plate (Key 8), align the holes in the diaphragm with the holes in the actuator housing (Key 1).
- 2 Set the upper diaphragm casing (Key 23) on top of the actuator housing (Key 1), align the holes. **Note:** If a Top-Mounted Handwheel is being used, it is advised that the position of the stem (Key 103) be adjusted so that the device will place no downward pressure on the actuator spring (Key 6).
- 3 Install the cap screws (Key 24) through the diaphragm casing (Keys 23 & 1).
- 4 Install the hex nuts (Key 25) and tighten them evenly in an alternating crisscross pattern to the torque specification listed in Table 4.

LEVER INSTALLATION

- 1 Refer to Figure 21 and slide the proper end of the lever (Key 10) into the hole in the actuator housing (Key 1). Refer to Figure 22.
- 2 Rotate and align the lever (Key 10) so that the connection on the lever straddles the bearing of the actuator stem (Key 7). Refer to Figure 22.

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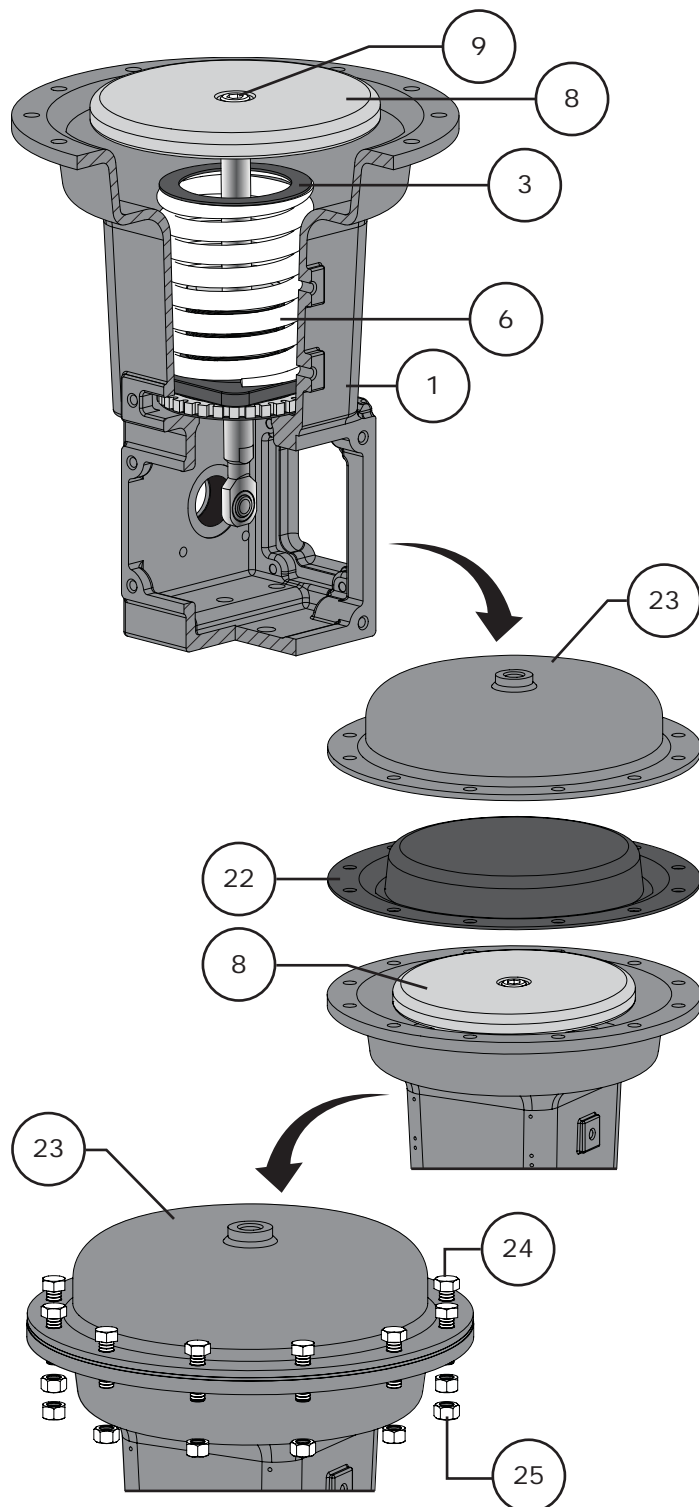


Figure 21 *Diaphragm Plate Installation*

ACTUATOR ASSEMBLY (Continued)

LEVER INSTALLATION (Continued)

- 3 Apply operating pressure to the diaphragm casing until the actuator stem (Key 7) begins to move. Continue to apply operating pressure until the connection between the actuator stem and the lever (Key 10) can be made.
- 4 Insert the end of the actuator stem into the lever and thread the bolt (Key 12) through both. Tighten the cap screw (Key 12) to the torque specification listed in Table 4.
- 5 Install the housing cover assembly (Keys 15 and 2) using the cap screws (Key 16).
- 6 Relieve actuator casing pressure.
- 7 **For Style A and D actuator configurations:**
 - A Install the travel scale (Key 17) onto the housing cover (Key 15) using the machine screws (Key 18) as shown in Figure 23.
 - B Install the travel indicator (Key 19) onto the lever (Key 10) using the machine screws (Key 18). Position the travel indicator to point to the closest desired fail position. Refer to Figure 23 and 24.
 - C Determine desired mounting orientation (Figure 9). Install the mounting yoke (Key 20) onto the actuator housing (Key 1) using the cap screws (Key 21). Tighten the cap screws to the torque specification listed in Table 4. Refer to Figure 23.
- For Style B and C actuator configurations:**
 - A Determine desired mounting orientation (Figure 9). Install the mounting yoke (Key 20) onto the housing cover (Key 15) using the cap screws (Key 21). Tighten the cap screws to the torque specification listed in Table 4. Refer to Figure 23.
 - B Install the travel scale (Key 17) onto the actuator housing (Key 15) using the machine screws (Key 18). Refer to Figure 23.
 - C Install the travel indicator (Key 19) onto the lever (Key 10) using the machine screws (Key 18). Position the travel indicator to point to the closest desired fail position. Refer to Figure 23 and 24.
- 8 Install the up and down travel stop (Keys 13 and 14) if not already installed.
- 9 Adjust the up travel stop (Keys 13 and 14) until the travel indicator (Key 19) is pointing to the desired fail position indicated on the travel scale (Key 17). Lock the up stop (Key 14) in place using the jam nut (Key 13).



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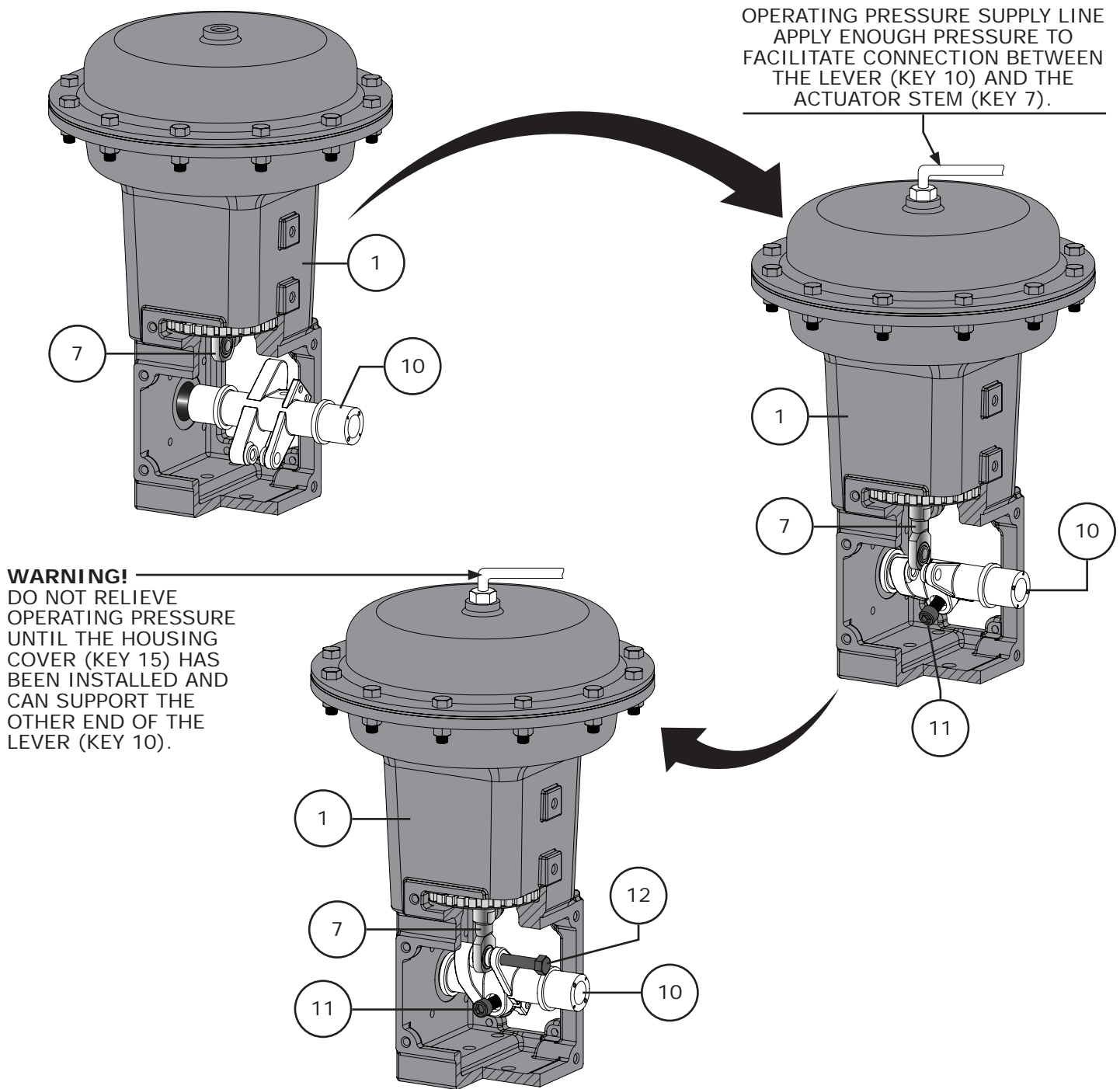


Figure 22 Lever Installation

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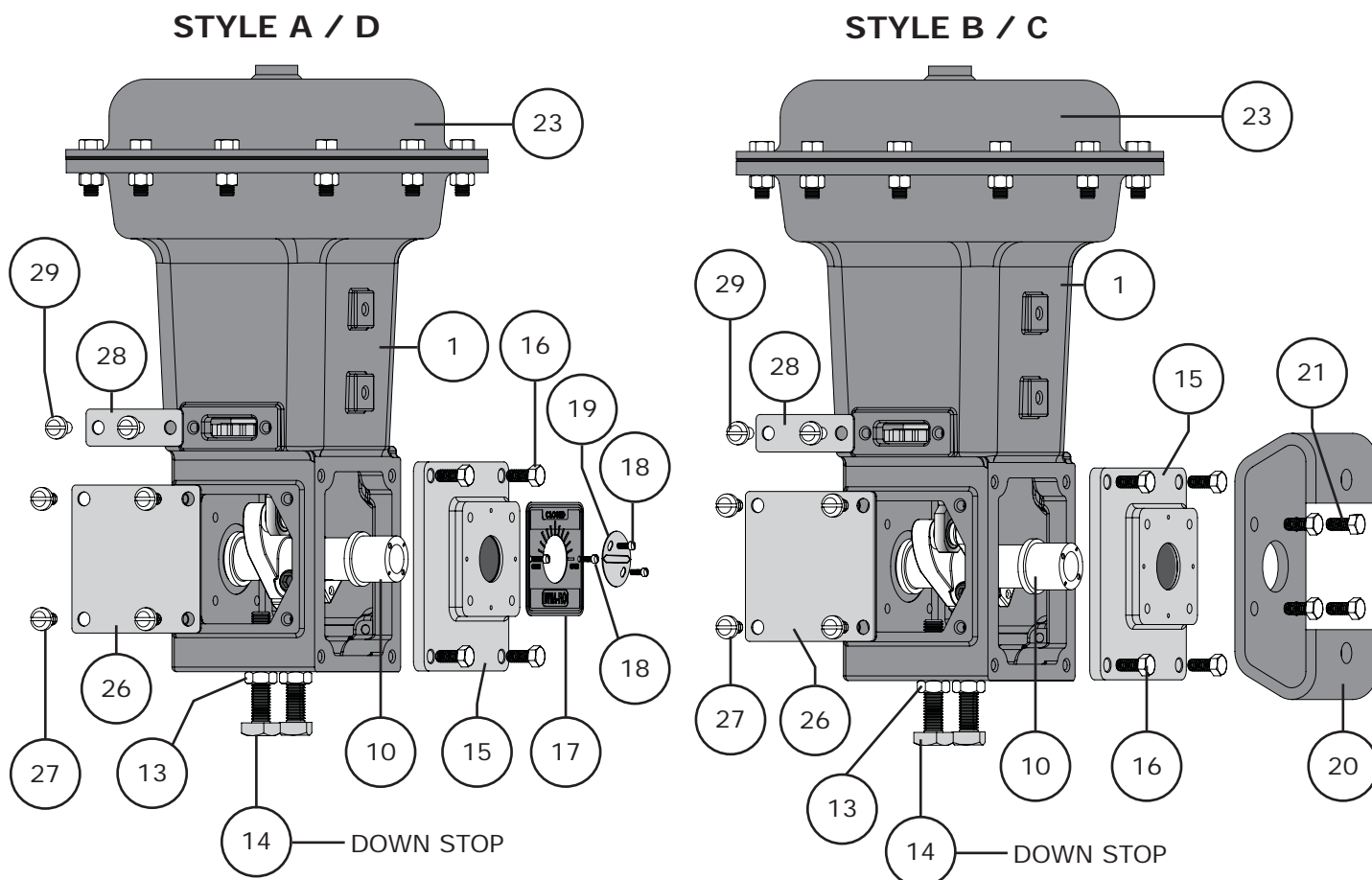


Figure 23 Housing Cover / Mounting Yoke Installation

ACTUATOR ASSEMBLY (Continued)

LEVER INSTALLATION (Continued)

- 10** Apply operating pressure to the diaphragm casing until the lever (Key 10) rotates the travel indicator (Key 19) to the desired position on the travel scale (Key 17). Refer to Figure 24. **Warning:** Do not stroke the actuator when the lever (Key 10) is not supported at each end, make sure that the housing cover (Key 15) is installed.
- 11** Adjust the down travel stop (Keys 13 and 14) to make contact with the lever (Key 10) and lock the down stop (Key 13) in place using the jam nut (Key 13). Refer to Figure 24.

- 12** Install the elbow vent (Key 32) if not already installed, Refer to Figure 24.
- 13** Proceed to the Spring Adjustment – Initial Set section of this manual (Page 7). Once the spring adjustment has been completed, install all the cover plates (Keys 26, 28, & 30). Refer to Figures 23 & 24.



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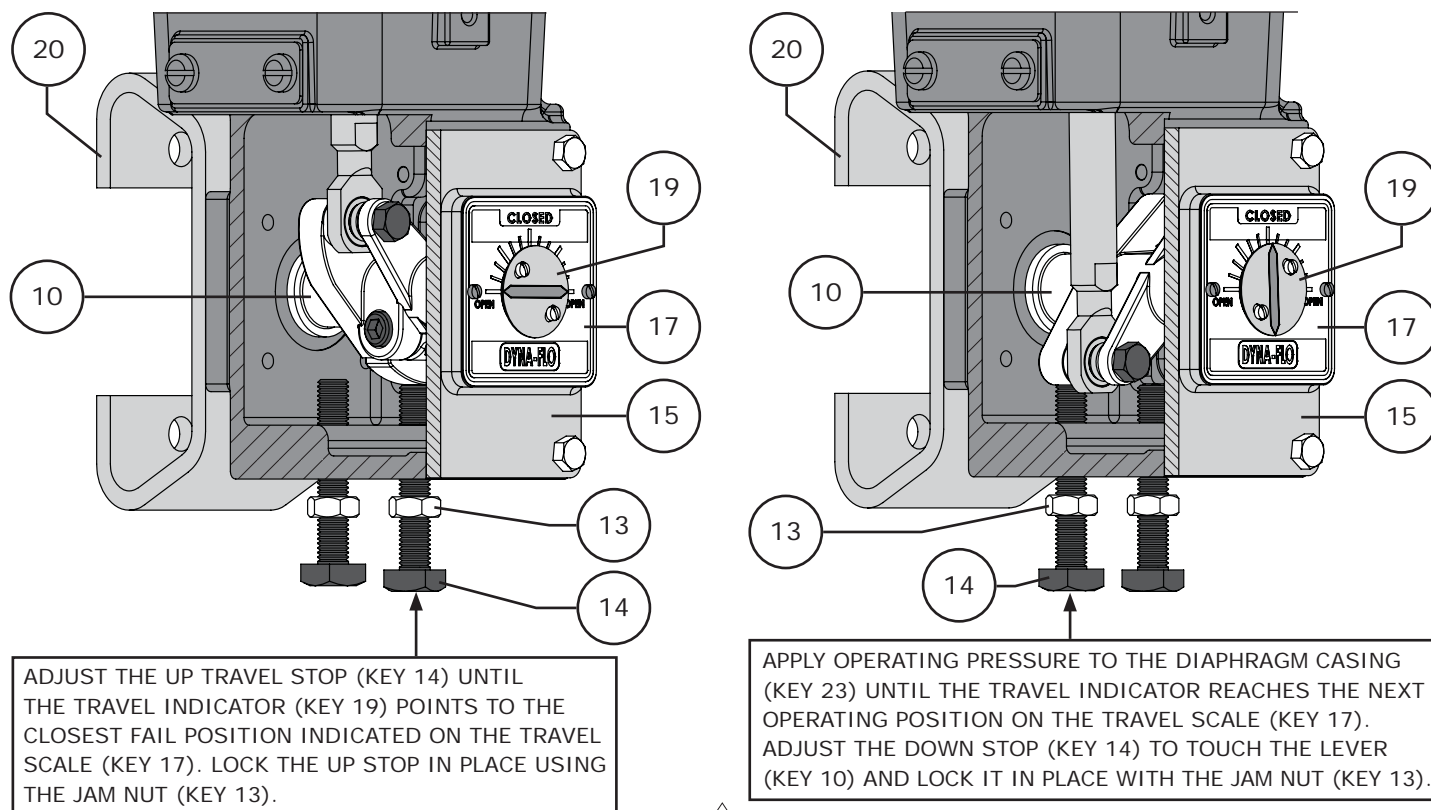


Figure 24 Travel Stop Adjustment - Fail Open Style A/D Example

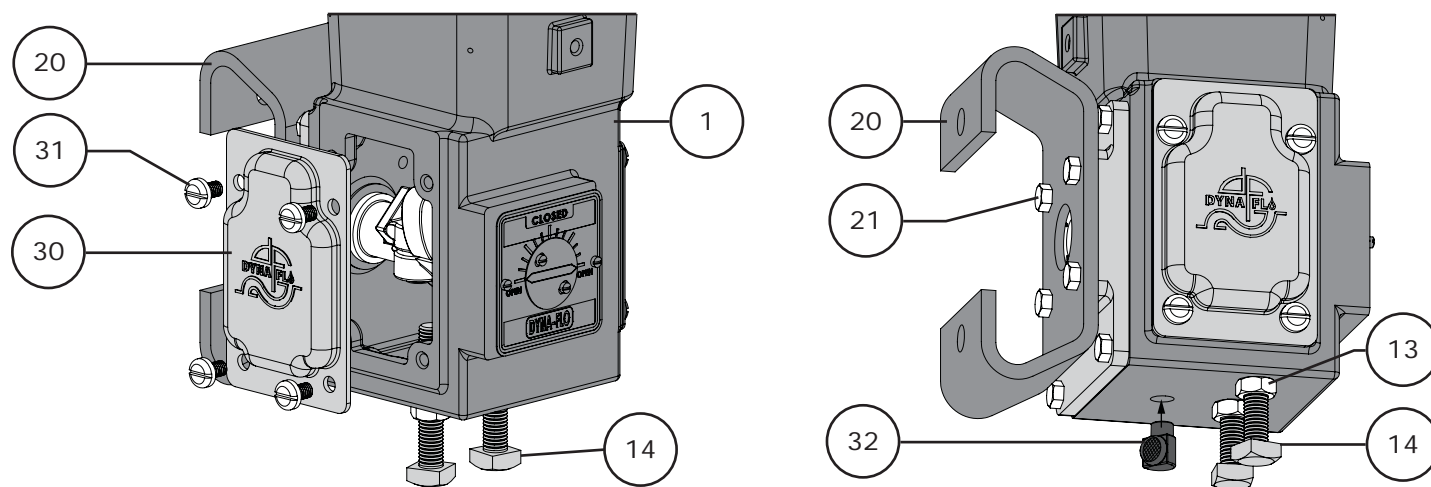


Figure 25 Positioner Plate and Vent Installation

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PRINCIPLES OF OPERATION AND ADJUSTMENT – HANDWHEELS

TOP-MOUNTED HANDWHEELS

DFR Top-Mounted Handwheel assemblies are attached to a modified upper diaphragm casing (Key 23A) using cap screws (Key 109). To lock the handwheel in position, tighten the lock nut (Key 104) into the body (Key 105) of the handwheel.

To compress the spring (Key 6) and move actuator stem (Key 7) down:

Turning the handwheel (Key 102) clockwise into the upper diaphragm casing (Key 23A) forces the pusher plate (Key 112) onto the diaphragm (Key 22) and diaphragm plate (Key 8) to compress the spring.

To decompress the spring (Key 6) and allow actuator stem (Key 7) to move up:

Turning the handwheel (Key 102) counterclockwise away from the upper diaphragm casing (Key 23A) allows the actuator spring to decompress which moves the diaphragm plate (Key 8) and actuator stem (Key 7) upward.

Note: If the valve is push-down-to-close, full valve opening can be restricted by adjusting the handwheel to the desired position.

If the valve is push-down-to-open, full valve closing can be restricted by adjusting the handwheel to the desired position.

MAINTENANCE - TOP-MOUNTED HANDWHEELS

Maintenance should be performed if actuator loading pressure appears to be leaking from either the handwheel or travel stop. It is possible that either of the o-rings (Keys 107 & 108) need to be replaced.

Before disassembling the handwheel or travel stop to replace o-rings, perform the following steps:

- Lubricate the threads of the stem (Key 103) with white petroleum grease, stroke the device a couple times after application.

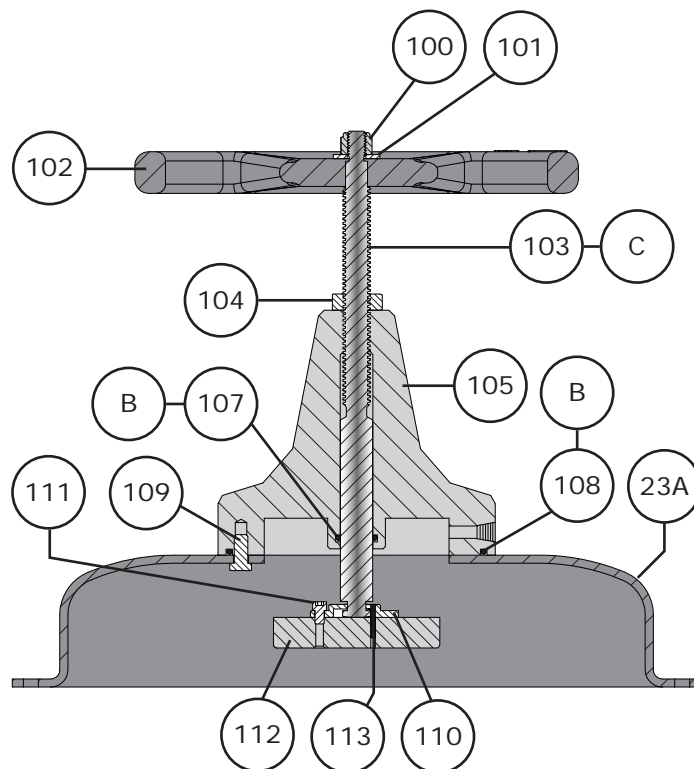


Figure 26 DFR Top-Mounted Handwheel

MAINTENANCE - TOP-MOUNTED HANDWHEELS O-RING REPLACEMENT

Before You Begin:

- Read the General and Scope section of this manual (Page 2).
- Read Safety Caution (Page 2).
- Use safe work practices and lock out procedures.
- Disconnect supply lines (air or gas), electric power, or control signal to the actuator. Sudden movement of actuator can cause damage or injury, make sure actuator will not operate.
- Vent any pneumatic actuator loading pressure.
- Relieve process pressure and drain the process fluid from up and down stream of valve.
- Be aware of potentially hazardous process material that may be present in-line and in-valve. Isolate the valve from process pressure. Use a bypass or block valve if necessary, or completely shut off the process. Relieve internal valve pressure (refer to the appropriate valve instruction manual).



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MAINTENANCE - TOP-MOUNTED HANDWHEELS O-RING REPLACEMENT

(Continued)

Special Tools Required:

- Flat-head screwdriver or flat-bladed tool.

Lubricants Required:

- Dow Corning Molykote® 111 or equivalent (Key B)
- Lubriplate® No. 105 Grease or equivalent (Key C)

- 1 Rotate the handwheel counterclockwise and remove any spring tension applied by the handwheel.
- 2 Relieve any actuator spring (Key 6) compression by turning the spring adjuster (Key 4) clockwise until it stops turning. Refer to Step 4 of the Casing Disassembly Section.
- 3 Refer to the Actuator Disassembly – Casing Disassembly Steps 5 – 6 and remove the upper diaphragm casing (Key 23A).
- 4 Separate the handwheel assembly from the upper diaphragm casing (Key 23A) by removing the cap screws (Key 109).
- 5 Loosen the lock nut (Key 104).
- 6 Remove the hex nut (Key 100), flat washer (Key 101), and handwheel (Key 102).
- 7 Rotate the stem (Key 103) clockwise out of the body (Key 105).
- 8 Remove and replace the o-rings (Keys 107 & 108). Lubricate the new o-rings with Dow Corning Molykote® 111 (Key B).
- 9 Re-assemble the handwheel and diaphragm casing. Refer to the Actuator Assembly section (Page 16).
- 10 Perform spring adjustment.

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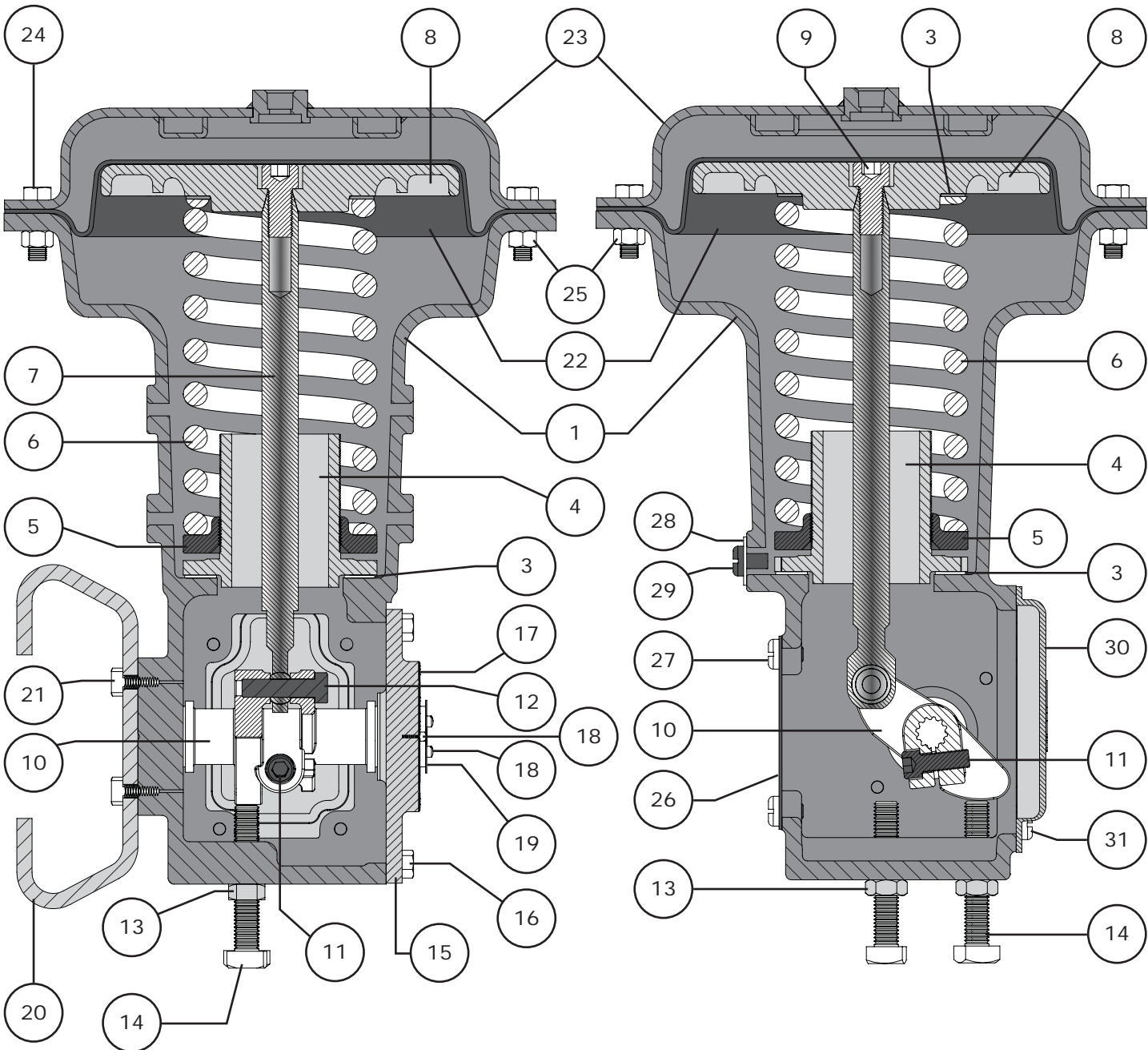


Figure 27 Actuator Cross Section



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Table 3

Torque Specifications for Valve Mounting Bolts (Key 33)

Valve Shaft Diameter	Mounting Bolts	
	lbf-ft	N•m
1/2 Inch to 3/4 Inch	65	88

Table 4

DFR Torque Specifications

Key	Bolt Size	Torque	
		lbf-ft	N•m
9	1/2"-20	40	54
11	3/8"-16	40	54
12	3/8"-16	40	54
13	7/16"-14	20	27
16	5/16"-18	30	41
21	5/16"-18	30	41
24	3/8"-24	20	27

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Parts

Key	Description	Part Number
1	Housing Assembly , Cast Iron Includes Bearing Tape (Key 2)	DFR0470030D
2	Bearing Tape , CPTFE, 2 Required	DFR0470021D
3	Thrust Washer , Nylon 2 Required	10B1526X01D
4	Spring Adjuster , Cast Iron	20B1509X01D
5	Spring Seat , Cast Iron	20B1507X01D
6	Spring	Refer to Table 5
7	Actuator Stem Assembly	DFR0470010D
8	Diaphragm Plate , Cast Iron	DFR047X001D
9	Socket Head Cap Screw , Diaphragm Plate Steel	1E76043299D
10	Lever , Cast Iron 1/2 inch shaft 5/8 inch shaft 3/4 inch shaft	30B3576X01D 30B3575X01D 30B3572X01D
11	Socket Head Cap Screw , Lever Clamp Steel	DFR0690021D
12	Cap Screw , Lever/Actuator Stem Zinc Plated Steel	H5CZ38.112
13	Jam Nut , Travel Stop, Zinc Plated Steel 2 Required	DFR0690002D
14	Travel Stop , Zinc Plated Steel 2 Required	DFR0690016D
15	Housing Cover , Cast Iron Includes Bearing Tape (Key 2)	DFR0470020D
16	Cap Screws , Housing Cover, Zinc Plated Steel 4 Required	H5CZ516.034
17	Travel Scale , SST	20B1518X01D
18	Machine Screws , Travel Scale & Travel Indicator SST, 4 Required	1V74353522D
19	Travel Indicator , SST	28A4426X01D
20	Mounting Yoke , Steel 1/2 inch shaft 5/8 inch shaft 3/4 inch shaft	30B1514X01D 30B1514X01D 30B1513X01D
21	Cap Screws , Mounting Yoke, Zinc Plated Steel 4 Required	H5CZ516.034
22	Diaphragm , Nitrile	2E79190220D
23	Upper Diaphragm Casing , Steel	2J71382899D
24	Cap Screws , Diaphragm Casing, Zinc Plated Steel 12 Required	H5FZ38.114

Key	Description	Part Number
25	Nut , Diaphragm Casing, Zinc Plated Steel 12 Required	NHFZ38
26	Cover Plate , Front Cover plate, Steel	10B1516X01D
27	Screws , Front Cover Plate, Zinc Plated Steel 4 Required	SBRZ516.038
28	Cover Plate , Spring Adjuster, Steel	10B1517X01D
29	Screws , Spring Adjuster Cover Plate, Zinc Plated Steel 2 Required	SBRZ516.038
30	Positioner Plate , Plastic	20B1515X01D
31	Screws , Positioner Plate, Zinc Plated Steel 4 Required	SBRZ516.038
32	Elbow Vent	Y602-12D
33	Mounting Bolt , Actuator / Valve, Zinc Plated Steel Mounting bolts are included with the valve assembly.	
34	Lockwasher , Actuator / Valve, Zinc Plated Steel lockwashers are included with the valve assembly.	
35	Hex Nut , Mounting Bolt, Zinc Plated Steel Hex nuts are included with a 570 valve assembly.	
36	Nameplate	NAMEXSRACTD



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PARTS - DFR Handwheel Parts List

KEY	PART DESCRIPTION	PART NUMBER
100	NYLOCK HEX NUT	DFO30109X1D
101	FLAT WASHER	DF060110X1D
102	HANDWHEEL	DFO40106X1D
103	STEM	DFR40102X1D
104	LOCK NUT	DFO60107X1D
105	BODY	DFR40201X1D
107	O-RING, STEM	1D23750699D
108	O-RING, BODY/CASING	1D26730699D
109	CAP SCREW, BODY/CASING (6 REQUIRED)	1A36842405D
110	PUSHER PLATE RETAINER	DFO60111X1D
111	SOCKET HEAD CAP SCREW, PUSHER PLATE RETAINER (3 REQUIRED)	DFO20114X1D
112	PUSHER PLATE	DFO60103X1D
113	SPRING PIN	DFO60115X1D
23A	UPPER DIAPHRAGM CASING	2E79222506D

Table 5

DFR Spring (Key 6) Information

Casing Pressure		Initial Spring Compression				Part Number
Psig	kPag	Push-Down-To-Open (Fail Closed)		Push-Down-To-Close (Fail Open)		
		Psig	kPag	Psig	kPag	
0 - 18	0 - 124	4.9	34	3.0	21	10B1524X01D
0 - 33	0 - 228	4.9	34	4.9	34	10B1524X01D
		6.3	43	3.0	21	10B1525X01D
3 - 27	21 - 186	4.9	34	4.0	28	10B1524X01D
		6.3	43	3.1	21	10B1525X01D

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Parts Ordering

Whenever corresponding with Dyna-Flo about a DFR actuator, refer to the nameplate (Key 36) for the serial number of the unit. Please order by the complete part number (as given in the following parts list) of each part required.



Model DFR 047 Rotary Actuator

MODEL NUMBERING SYSTEM

SAMPLE PART NUMBER: DFR-047-C-06S1-C-RA1

ACTUATOR						070		
047	SIZE 047							
FAIL POSITION						C		
C	FAIL CLOSED	O	FAIL OPEN	N	NOT APPLICABLE			
PAINT						-		
-	DFPS-01 (STANDARD PAINT)			2	DFPS-02 (SEVERE SERVICE PAINT)			
3	DFPS-03 (HI-TEMP PAINT)							
SHAFT CONNECTION SIZE						06		
04	1/2 INCH	05	5/8 INCH	06	3/4 INCH			
SHAFT CONNECTION TYPE						S		
S	SPLINED (STANDARD)							
OPERATING PRESSURE RANGE / CASING NPT CONNECTION SIZE						1		
1	0-18 PSIG / 1/4" NPT	6	0-18 PSIG / 1/2" NPT	5	0-18 PSIG / 3/4" NPT		3	0-33 PSIG / 1/4" NPT
9	0-33 PSIG / 1/2" NPT	7	0-33 PSIG / 3/4" NPT	0	3-27 PSIG / 1/4" NPT		A	3-27 PSIG / 1/2" NPT
B	3-27 PSIG / 3/4" NPT							
OPTIONS						-		
-	STANDARD			S	SST BOLTING			
SPRING (REFER TO TABLES 5-7 OF SALES BULLETIN FOR RANGE AND FAIL POSITION)						C		
C	10B1524X01D			H	10B1525X01D			
HANDWHEELS / TRAVEL STOPS						-		
-	NONE (STANDARD)			T	TOP-MOUNTED HANDWHEEL			
MOUNTING						RA1		
R	RIGHT HAND MOUNT			L	LEFT HAND MOUNT			
A	STYLE A, B, C, D - REFER TO FIGURE 12							
1	POSITION A, B, C, D - REFER TO FIGURE 12 (RIGHT HAND POSITION 1 IS STANDARD)							
N	NOT APPLICABLE							

DFR -

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