

Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual



Figure 1 DFR 156

TABLE OF CONTENTS

General	2
Scope	2
Principles of Operation	2
Safety Caution	2
Specifications	3
Unpacking	4
Installation	4
Air Piping	4
Actuator Mounting	5
Actuator Adjustment	8
Spring Adjustment	10
Actuator Conversion	11
Changing Actuator Style	12
Actuator Disassembly	14
Cover Plate Disassembly	15
Lever Removal	15
Diaphragm Casing Disassembly	15
Spring Barrel Disassembly	16
Yoke Removal	17
Plate Removal	18

Actuator Assembly	18
Bushing / Yoke Assembly	18
Spring Barrel Assembly	18
Diaphragm Plate Assembly	20
Diaphragm Casing Assembly	21
Lever Installation	22
Cover Plate Assembly	23
Cover Plate Installation	23
Plate Installation	23
Actuator Cross Section - Figure 26	24
Principles of Handwheel & Travel Stop Operation	25
Maintenance - Handwheels & Travel Stops	25
Mounting Bolt Torques - Table 3	29
DFR Torque Specifications - Table 4	29
Open-End Wrench Sizes - Table 5	29
Parts	30
Model Builder	36



Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

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 and Travel Stops refer to Page 25)

The DFR actuator works by loading pressure on the top side of the diaphragm (Key 21), this loading pressure moves the diaphragm rod (Key 20) downwards. As the loading pressure is decreased, the spring (Key 19) forces the diaphragm rod 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 50).

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.

Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual



SPECIFICATIONS

Actuator Size	Maximum Casing Pressure Psig (kPag)
070	75 (517)
156	50 (345)
220	65 (448)

Material Temperature Capabilities

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

Construction Materials

Refer to Parts list for construction materials.

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

Valve Shaft Compatibility, inches (mm)

Size 070:	1/2 (12.7), 5/8 (15.9), 3/4 (19.1), 7/8 (22.2), 1 (25.4)
Size 156:	3/4 (19.1), 7/8 (22.2), 1 (25.4), 1-1/4 (31.8), 1-1/2 (38.1)
Size 220:	1-1/4 (31.8), 1-1/2 (38.1), 1-3/4 (44.5), 2 (50.8)

* 7/8" shaft only available for a 4" 570.

Actuator Dimensions

Refer to Figures 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 12.

Refer to Table 2.

Other Applications

Please specify with a sketch.

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. A square stub or keyed connection is also available.

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.

Table 1

Approximate Actuator Weights - lb. (Kg)

Actuator Size	Standard Assembly	With Top Mounted Handwheel
070	99 (45)	115 (52.3)
156	203 (92)	227 (103)
220	272 (123)	319 (144)



Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

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 50). Refer to Figure 3 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 strap placement. Straps should be placed to avoid damage to tubing and other mounted accessories.

Lift the valve/actuator assembly using proper lifting techniques.

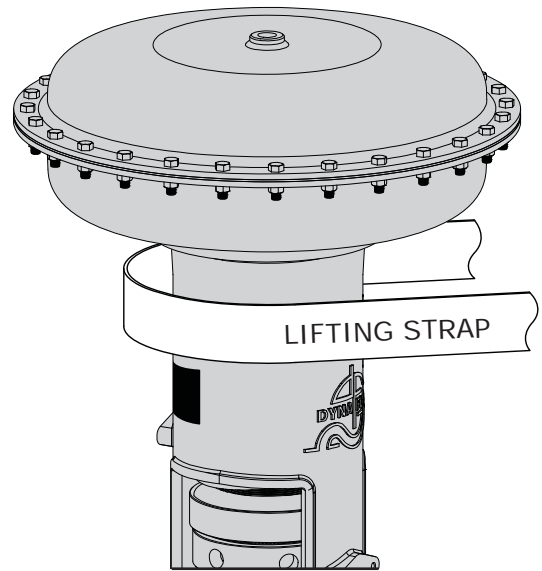


Figure 2 Suggested Lifting Strap Placement

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 53) located on the actuator.

Before You Begin:

Note: Standard actuators accept 1/4" (6 mm) NPT connections. Size 220 actuators have a threaded reducer bushing (Key 25) that reduces the casing (Key 24) NPT connection from 1/2" (12.7 mm) to 1/4" (6 mm), the bushing fitting is removable (refer to Figure 9).

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.

Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual



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:

- Anti-Seize Compound (Key A)
- Refined Petroleum Oil (Key E)

- 1 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.
- 2 Remove any positioners and/or instrumentation installed on the actuator.
- 3 Remove the cover plate cap screws (Key 45) and washers (Key 44).
- 4 Remove the cover plate/bushing assembly (Keys 36, 37, 38, 39, 40, 41, 42, and 43).
- 5 If the lever (Key 32) is attached to the rod end bearing (Key 31), disconnect the lever from the rod end bearing by removing the cap screw (Key 34) and hex nut (Key 35). Remove the lever.
- 6 Slide the actuator onto the valve shaft as shown in Figure 5. Refer to Figures 6 and 12 for actuator mounting positions and orientations. **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.

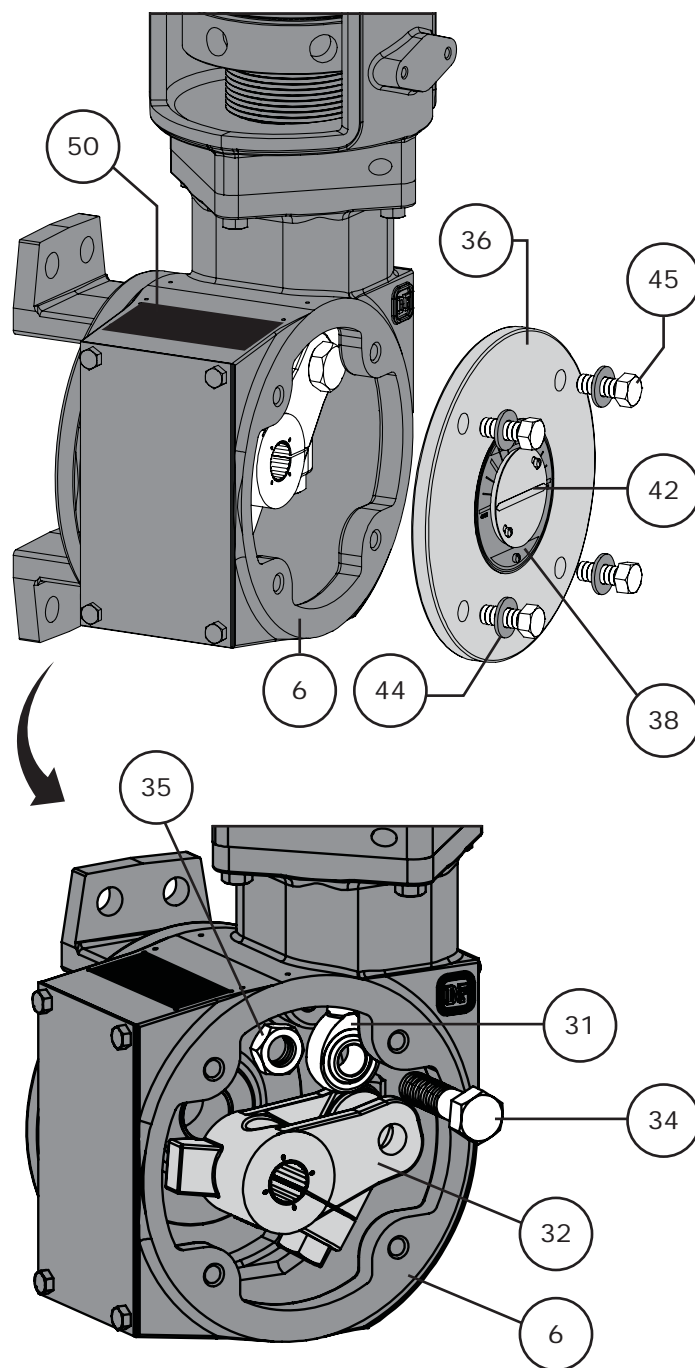


Figure 3 Cover Plate Assembly Removal



Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

ACTUATOR MOUNTING (Continued)

- 7 Once the actuator is installed on the valve shaft in the proper orientation, secure the actuator in place using the mounting bolts (Key 3) and lockwashers (Key 4) for Model 590 valves (refer to Figure 5. Mounting to Model 570 valves will require a hex nut (Key 5). Refer to Table 3 for torque values.

Note: See Table 5 for required wrench sizes for turnbuckle assembly adjustment for Steps 8 - 11.

- 8 Turn the hex nut (Key 28) until it reaches the top of the threaded portion of the diaphragm rod (Key 20). Leave the hex nut finger tight, it will be re-adjusted later.
- 9 Turn the turnbuckle (Key 29) until it makes contact with the hex nut (Key 28) at the top of the diaphragm rod (Key 20). Leave the turnbuckle finger tight, it will be re-adjusted later.
- 10 Turn the lower hex nut (Key 30) down onto the rod end bearing (Key 31) as far as it will go. Leave the hex nut finger tight, it will be re-adjusted later.
- 11 Thread the rod end bearing (Key 31) into the turnbuckle (Key 29) as far as it will go. Leave the rod end bearing finger tight, it will be adjusted later.
- 12 Lubricate the teeth of the valve shaft spline with refined petroleum oil (Key E).
- 13 Loosen the lever clamp cap screw (Key 33).
- 14 Install the lever onto the valve shaft (Key V). Refer to Figures 6 and 12, and the appropriate valve instruction manual for proper lever orientation.
- 15 Adjust the position of the lever (Key 32) so that the rod end bearing (Key 31) will be in alignment between the cap screw holes of the lever. **Note:** Refer to Figure 7 for lever operating clearance. It may be necessary to remove the positioner plate (Key 46) or the access plate (Key 48) in order to verify the lever operating clearance.
- 16 Connect the lever (Key 32) to the rod end bearing (Key 31). Refer to Figure 6:
 - A Install the cap screw (Key 34) through the lever (Key 32) and rod end bearing (Key 31). **Note:** It may be necessary to adjust the turnbuckle (Key 29) in order to meet alignment.

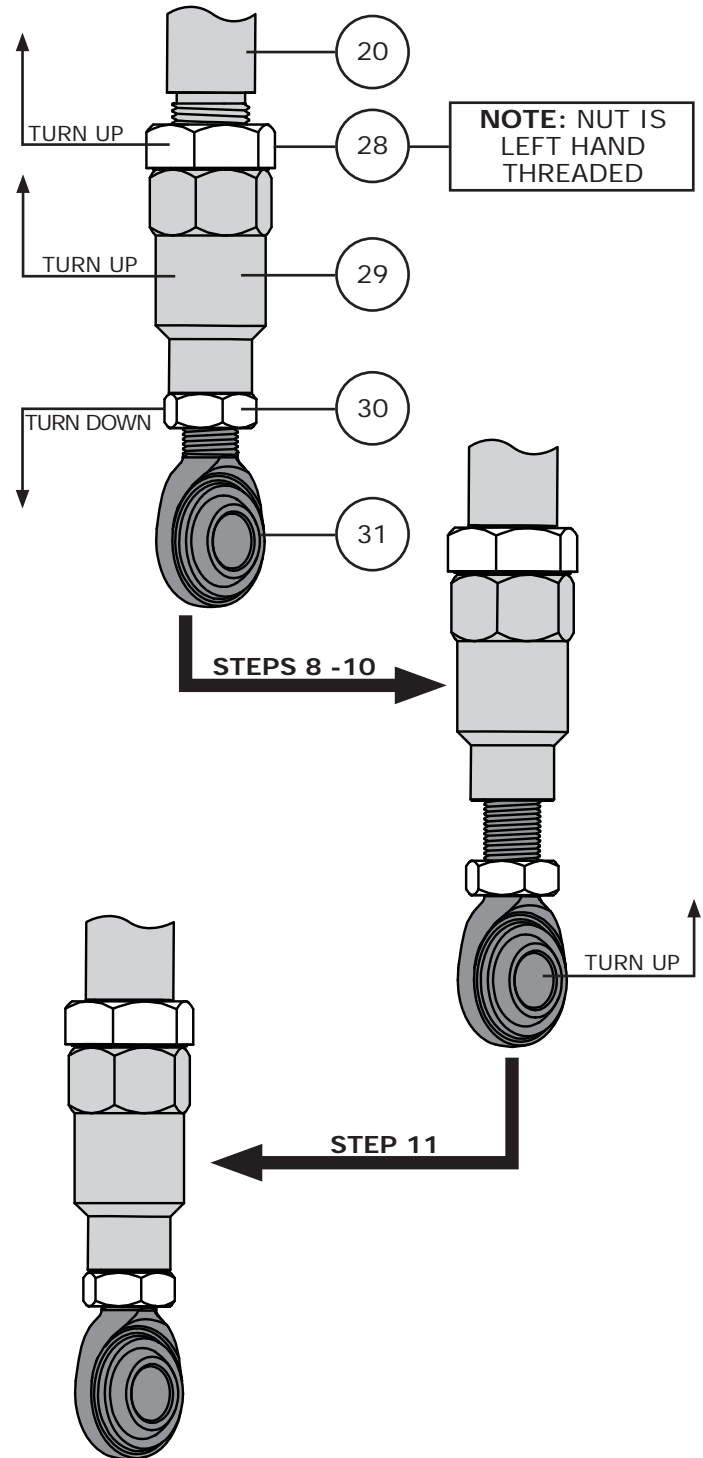


Figure 4 Turnbuckle Assembly Adjustment

Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

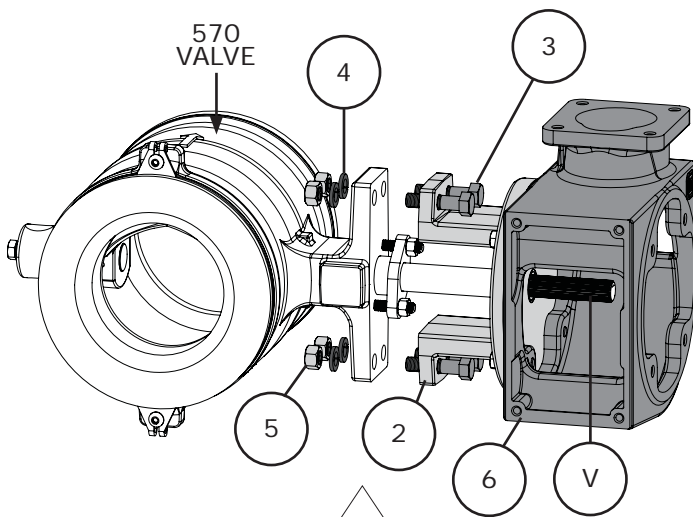
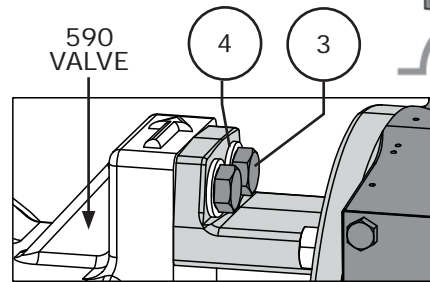


Figure 5 Valve/Actuator Mounting



MOUNTING
VIEW EXAMPLE
FOR A DFR TO
590 VALVE

ACTUATOR MOUNTING (Continued)

- 16** Connect the lever (Key 32) to the rod end bearing (Key 31). (Continued)
- B** Thread the hex nut (Key 35) onto the cap screw (Key 34) and tighten to the torque value specified in Table 4.

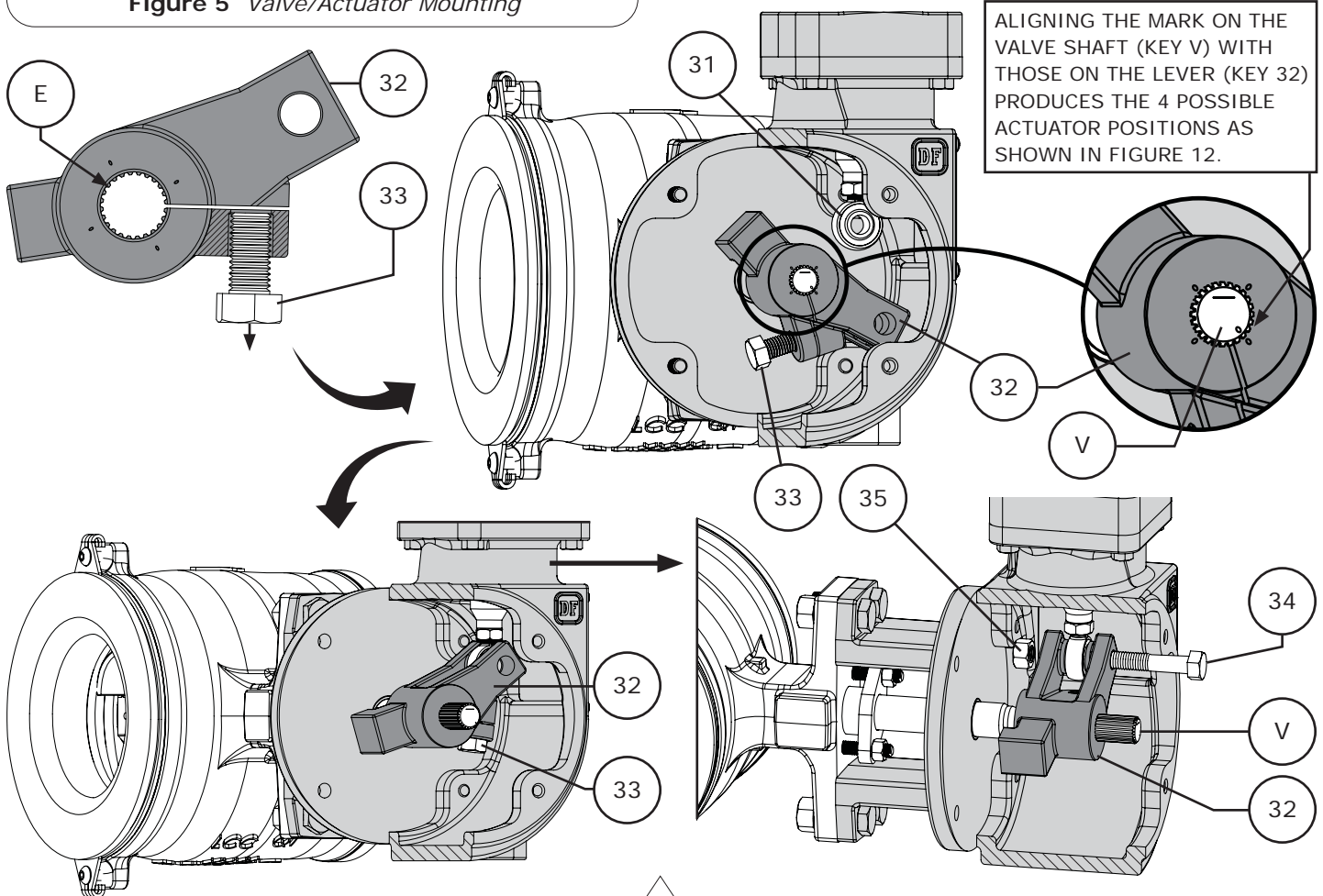


Figure 6 Lever Installation and Orientation Options



Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

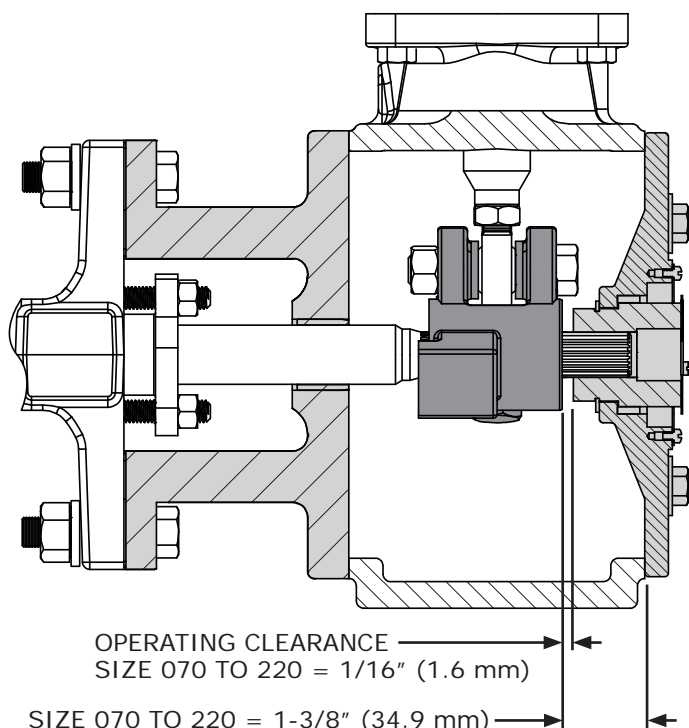


Figure 7 *Lever Operating Clearance*

ACTUATOR MOUNTING (Continued)

- 15 Check the position of the valve ball or disk and note the direction of rotation for valve operation.

For actuators without a handwheel:

- A** Re-install the cover plate assembly (Keys 36, 37, 38, 39, 40, 41, 42, and 43). Position the cover plate assembly so that the travel indicator (Key 42) will rotate according to the position of the valve ball/disk and direction of valve operation as determined above.
- B** Apply anti-seize compound (Key A) to the threads of the cap screws (Key 45) and secure the cover plate (Key 36) in place using the washers (Key 44) and cap screws. Torque the cap screws to the recommend torque value listed in Table 4.

Note: If the holes of the actuator housing (Key 6) and the cover plate (Key 36) are out of alignment, it may be necessary to loosen the mounting yoke cap screws (Key 7) and reposition the actuator housing. DO NOT stroke the actuator while the cover plate is removed.

For actuators with a manual handwheel:

- A** Refer to the Top Mounted Handwheel section of this manual (Page 25).

- 16 Refer to the Actuator Adjustment section for instructions on re-adjusting the turnbuckle assembly.

ACTUATOR 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:

- Regulated air supply (to stroke the actuator).
- Wrenches (See Table 5 for open-end wrenches required for turnbuckle adjustment).

Note: When the turnbuckle (Key 29) is properly adjusted, the valve will be completely closed or open when the actuator is against its travel stops (Keys 17 & 18). For accurate zero-degree valve ball or disk position adjustment, the control valve must be removed from the pipeline and the actuator may also need to be removed from the valve (Refer to the appropriate valve instruction manual).

Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual



ACTUATOR ADJUSTMENT (Continued)

- 1 Remove the cap screws (Key 49) and access plate (Key 48). **Note:** DO NOT remove the cover plate assembly (Keys 36, 37, 38, 39, 40, 41, 42, 43, 44, & 45) during actuator adjustment. The cover plate assembly supports the valve shaft (Key V) and should never be removed when stroking the actuator. Refer to Figure 8.
- 2 Loosen the lower hex nut (Key 30) through the access plate opening (where Key 48 was removed in Step 1).
- 3 Apply enough operating pressure to the diaphragm casing to stroke the actuator until the left-hand threaded hex nut (Key 28) can be accessed through the access plate opening. Loosen the hex nut. Refer to Figure 8.
- 4 **For Push-Down-to-Close Actuator/Valve Configurations:**
Refer to the appropriate valve instruction manual in order to determine the closed position of the valve.
 - A Slowly stroke the actuator down until the maximum operating pressure is reached. Make note of the valve ball/disk position. Refer to Figure 8 & 9.
 - B Adjust the turnbuckle (Key 29) as needed until the valve reaches the closed position, indicated on the travel scale (Key 38). Refer to Figure 8.
 - C Check the thread engagement of the rod end bearing (Key 31) into the turnbuckle (Key 29). Adequate thread engagement will be approximately equal to the diameter of the threads of the rod end bearing.
 - D Lock the turnbuckle (Key 29) in place using the left-hand threaded hex nut (Key 28), do not overtighten.
 - E Slowly remove operating pressure until the actuator reaches mid-travel position. Fully tighten the locknut (Key 30) to the torque value indicated in Table 4.

For Push-Down-to-Open Actuator/Valve Configurations:
Refer to the appropriate valve instruction manual in order to determine the closed position of the valve.

- A Release all operating pressure from the diaphragm casing, make sure that the diaphragm (Key 21) is resting against the up travel stop. Refer to Figure 9.

Note: If the actuator is equipped with a top mounted handwheel, adjust the handwheel to its topmost position. Adjusting the handwheel will ensure that the zero position of the actuator and valve can be reached simultaneously.

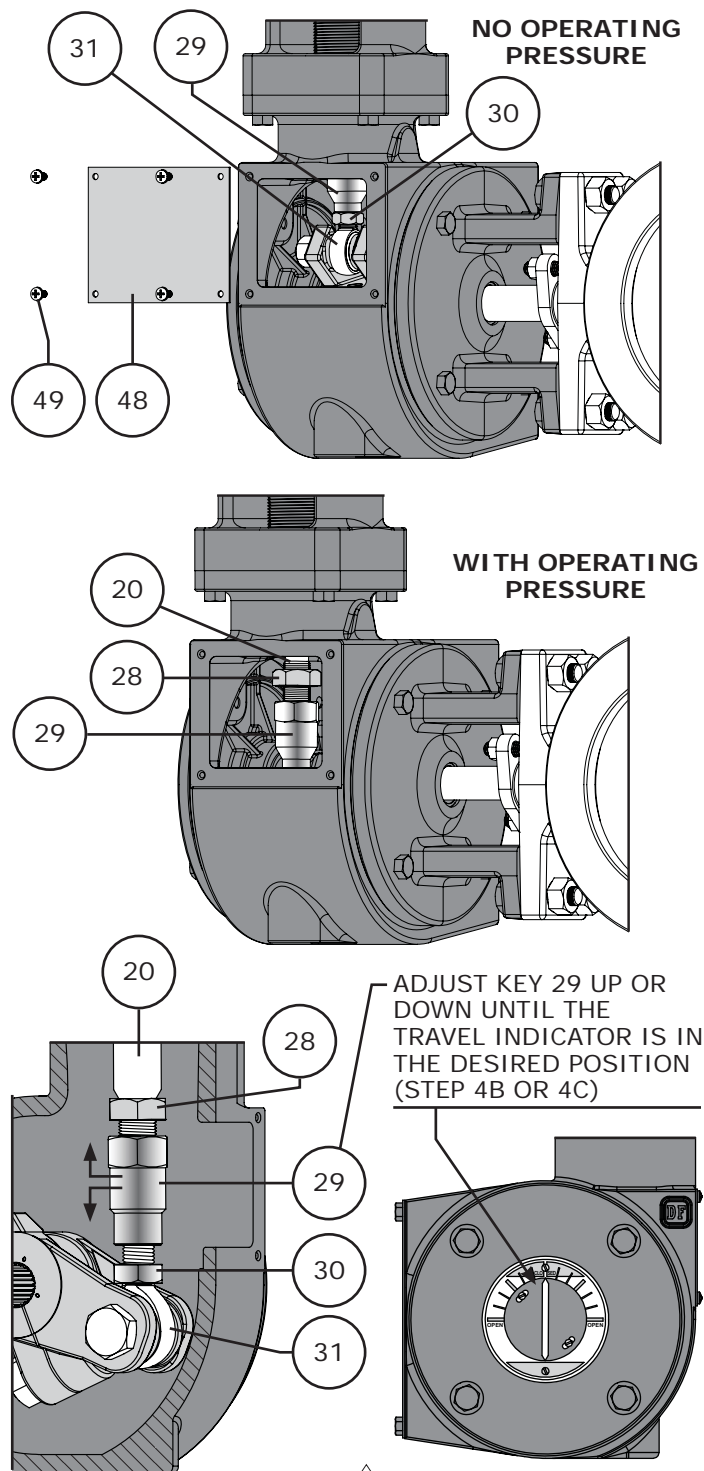


Figure 8 Turnbuckle Adjustment



Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

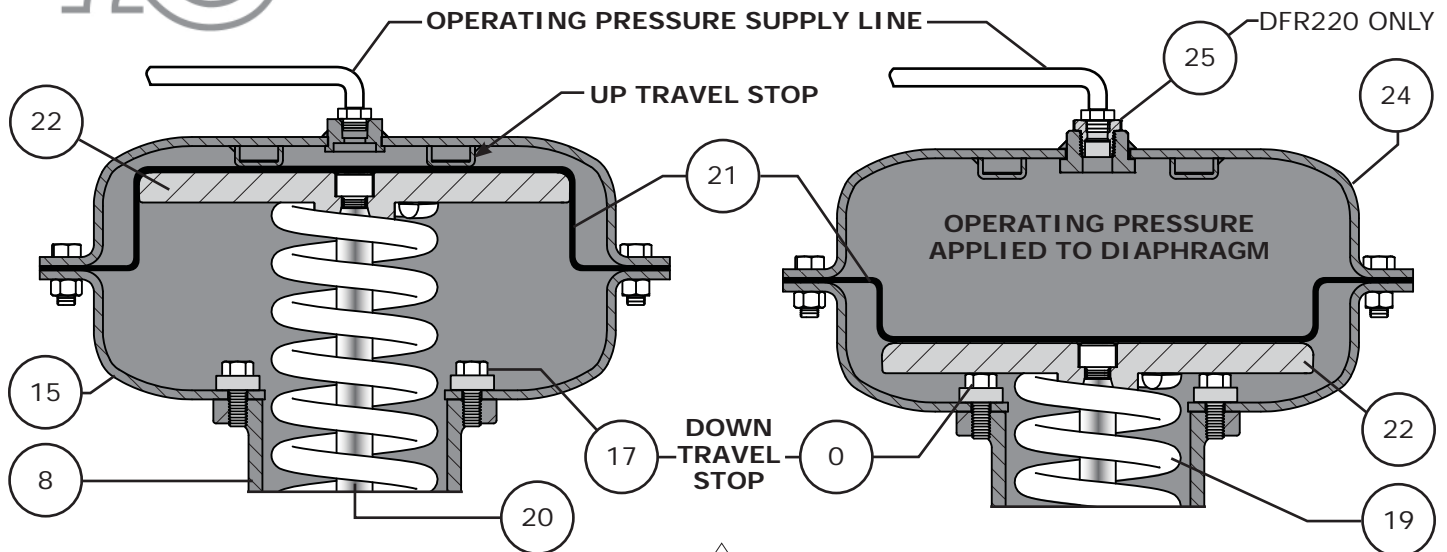


Figure 9 Actuator Operation

ACTUATOR ADJUSTMENT (Continued)

4 For Push-Down-to-Open Actuator/Valve Configurations: (Continued)

- B** Make note of the valve ball/disk position.
- C** Apply operating pressure to the actuator until the turnbuckle (Key 29) is accessible through the access plate (Key 48) opening. Adjust the turnbuckle, valve ball/disk should visibly rotate accordingly. Refer to Figure 8.
- D** Release all operating pressure from the diaphragm casing and check the new adjusted position.
- E** Again, apply operating pressure to the diaphragm casing until the turnbuckle (Key 29) is accessible through the access plate (Key 48) opening. Repeat Steps B to D until the control valve is in its closed position when the diaphragm (Key 21) is resting against its up travel stop (Key 24). Refer to Figure 9.
- F** Slowly apply operating pressure until the actuator reaches mid-travel position. Fully tighten the locknut (Key 30) against the turnbuckle (Key 29) to the torque value indicated in Table 4.
- E** Stroke the actuator until the left-hand threaded locknut (Key 28) is accessible through the access plate (Key 48) opening. Fully tighten the locknut against the turnbuckle (Key 29) to the torque value indicated in Table 4.

- 5** Re-install the access plate (Key 48) using the 4 cap screws (Key 49). Refer to Figure 8.
- 6** If necessary, re-adjust the actuator travel indicator (Key 42) appropriately by loosening the screws (Key 43) and re-tightening them once the travel scale is repositioned.

SPRING ADJUSTMENT - INITIAL SET

Before You Begin:

- Read Before You Begin of the Actuator Adjustment section (Page 8).

Special Tools Required:

- Regulated air supply (to stroke the actuator).
- Metal rod for adjusting the spring adjuster (Key 14):
 - For Size 070 Actuators - 3/8" (9.5 mm) diameter rod.
 - For Size 156 Actuators - 5/8" (15.9 mm) diameter rod.
 - For Size 220 Actuators - 3/4" (19.1 mm) diameter rod.

Refer to the actuator nameplate (Key 50) for the Initial Set. The initial setting is the casing pressure at which the diaphragm (Key 21) begins to move the diaphragm plate (Key 22) and diaphragm rod (Key 20) 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.

Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual



SPRING ADJUSTMENT - INITIAL SET

(Continued)

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 Disconnect the lever (Key 32) from the rod end bearing (Key 31) by removing the cap screw (Key 34) and hex nut (Key 35).
- 2 Apply operating pressure to the diaphragm casing, when the spring is properly adjusted, the diaphragm rod (Key 20) will start to move when the Initial Set pressure (indicated on the nameplate (Key 50) or in Table 7) is reached. Make note whether the diaphragm rod started to move before or after the Initial Set value. Be careful that the rod end bearing (Key 31) does not hit the lever (Key 32) when the diaphragm rod (Key 20) begins to move.
- 3 Relieve actuator casing pressure.
- 4 Using the metal adjusting rod (refer to Special Tools Required), adjust the spring adjuster (Key 14) accordingly:
 - To increase Initial Setting – Turn the spring adjuster up towards the diaphragm casing (Key 15).
 - To decrease Initial Setting – Turn the spring adjuster down towards the actuator housing (Key 6)
- 5 Repeat Steps 2 – 4 until the Initial Set pressure is reached.

CONVERSION FROM PUSH-DOWN-TO-CLOSE TO PUSH-DOWN-TO-OPEN

The Initial Setting listed on the actuator nameplate (Key 50) has been determined to be the optimum spring setting for the listed operation of that actuator. It is not recommended that the spring be adjusted to another other setting than the Initial Setting.

If the actuator is to be converted from one action to another (push-down-to-close into push-down-to-open for example), the Initial Setting will also change. Refer to Table 6 to determine the proper Initial Setting for action and spring (Key 19), and then adjust the actuator accordingly (refer to the Spring Adjustment – Initial Setting section for adjustment instructions).

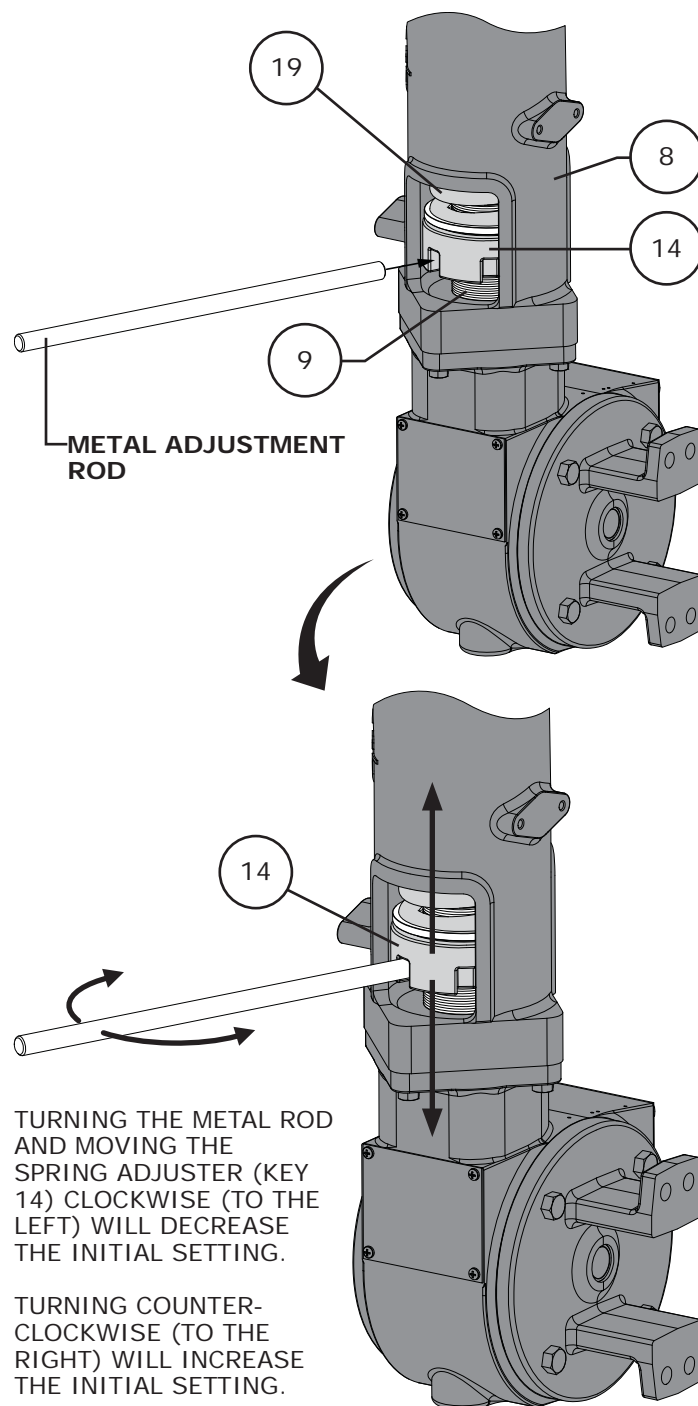


Figure 10 *Spring Adjustment*



Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

CHANGING ACTUATOR STYLE

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 11.

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 11.

Note: To convert a Style A or D into a Style B or C actuator, the cover plate assembly (Keys 36, 37, 38, 39, 40, 41, 42, 43, 44, and 45) and the mounting yoke (Key 2) will need to be swapped. The lever (Key 32) will also need to be removed and re-installed during the conversion process. Refer to Actuator Disassembly and Assembly instructions and Figure 11 as needed.

Once an actuator has been converted to a different mounting style, the actuator must be re-adjusted.

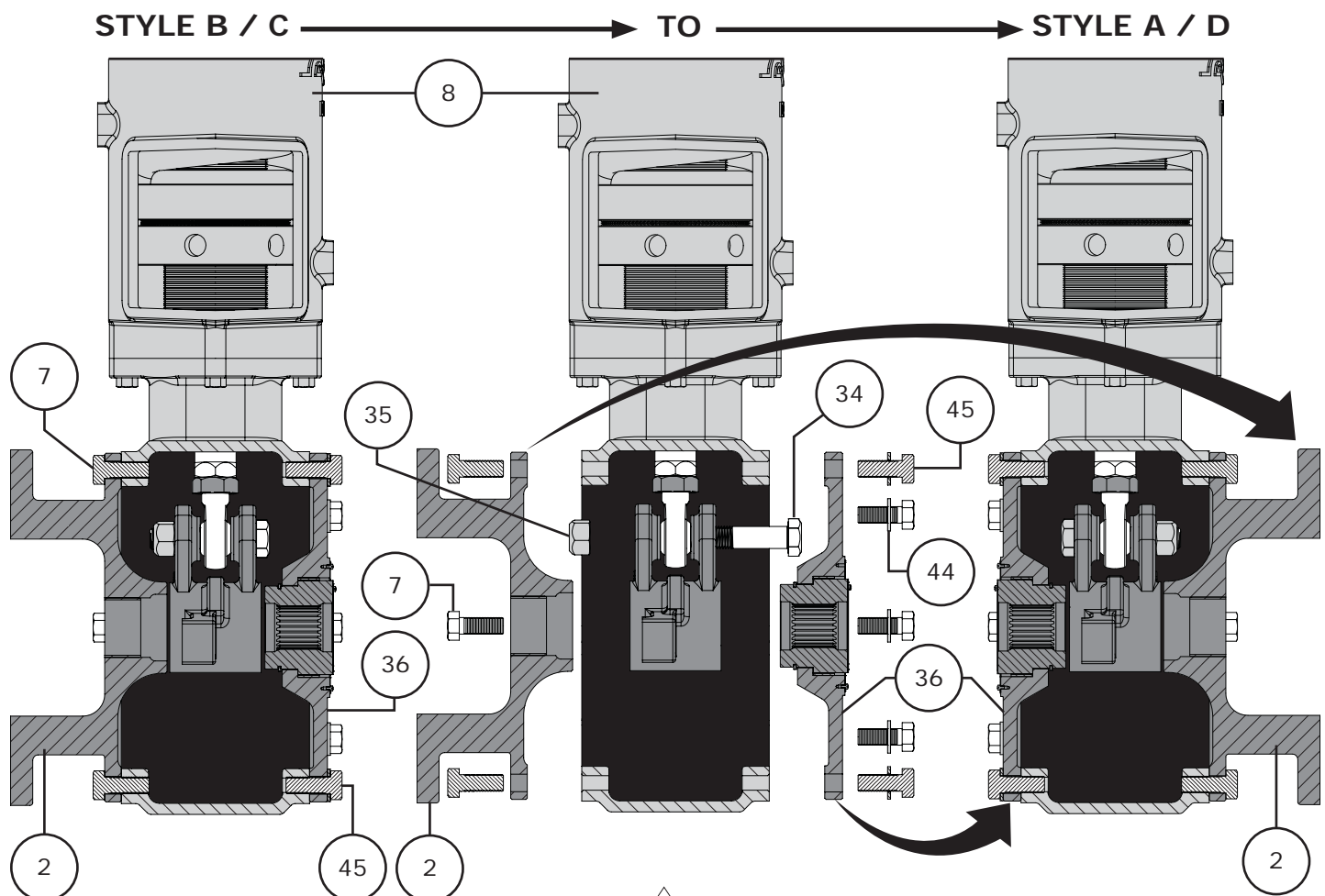


Figure 11 Changing Actuator Style

Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

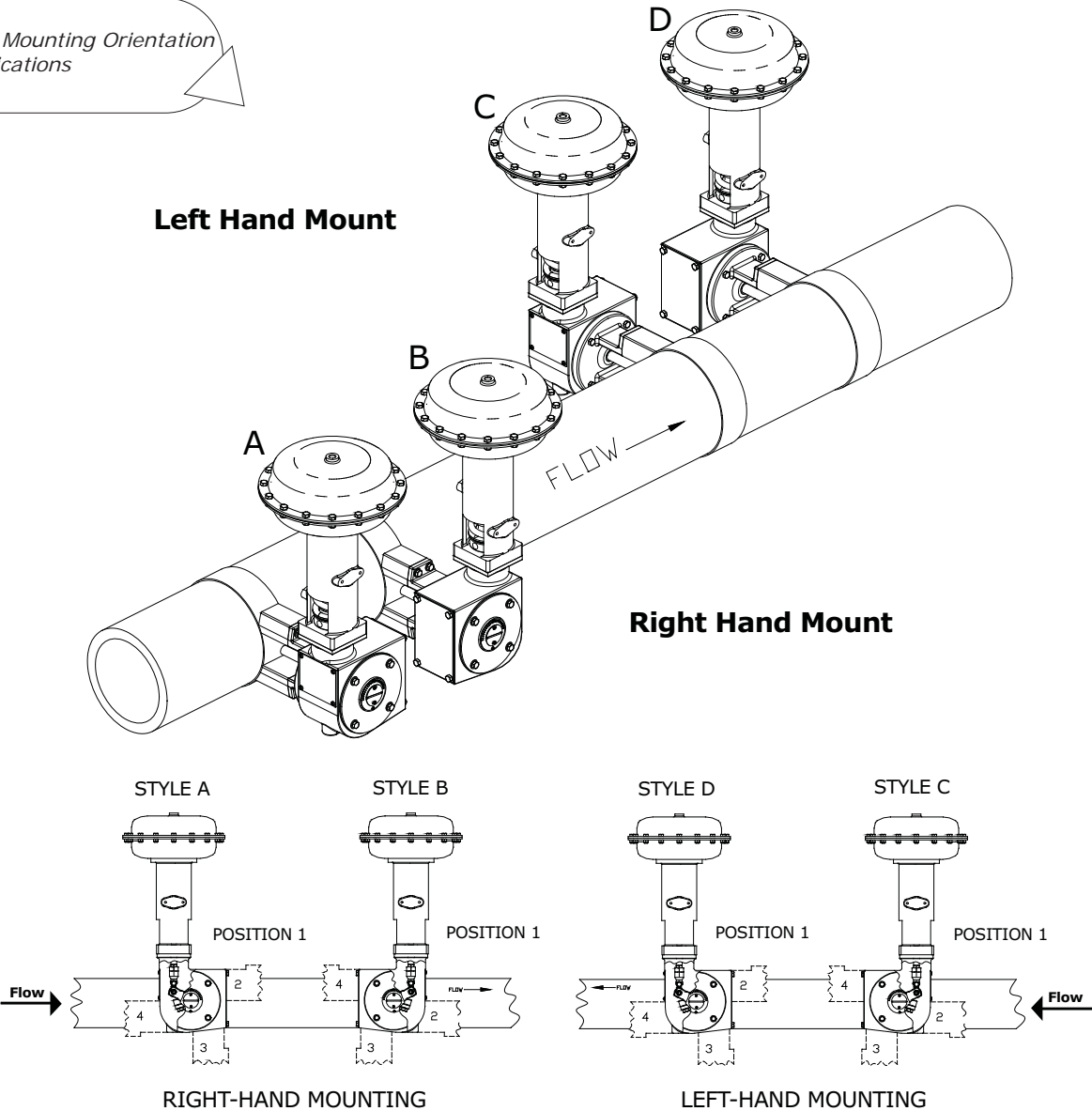


Table 2

Model DFR Mounting Styles and Positions

Mounting	Action	Model 560 / 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

Figure 12 Mounting Orientation Valve Applications





Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

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:

- Split ring pliers.
- Soft tip felt marker.
- Regulated air supply (to stroke the actuator).
- Wrenches (See Table 5 for open-end wrenches required for turnbuckle adjustment).
- Metal rod for adjusting the spring adjuster (Key 14):
 - For Size 070 Actuators - 3/8" (9.5 mm) diameter rod.
 - For Size 156 Actuators - 5/8" (15.9 mm) diameter rod.
 - For Size 220 Actuators - 3/4" (19.1 mm) diameter rod.

- 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 Remove the cover plate cap screws (Key 45) and washers (Key 44).
- 4 Remove the cover plate/bushing assembly (Keys 36, 37, 38, 39, 40, 41, 42, and 43).
- 5 Inspect all parts for damage or wear, replace or repair parts as necessary. All soft parts such as diaphragm and bushings should be replaced.

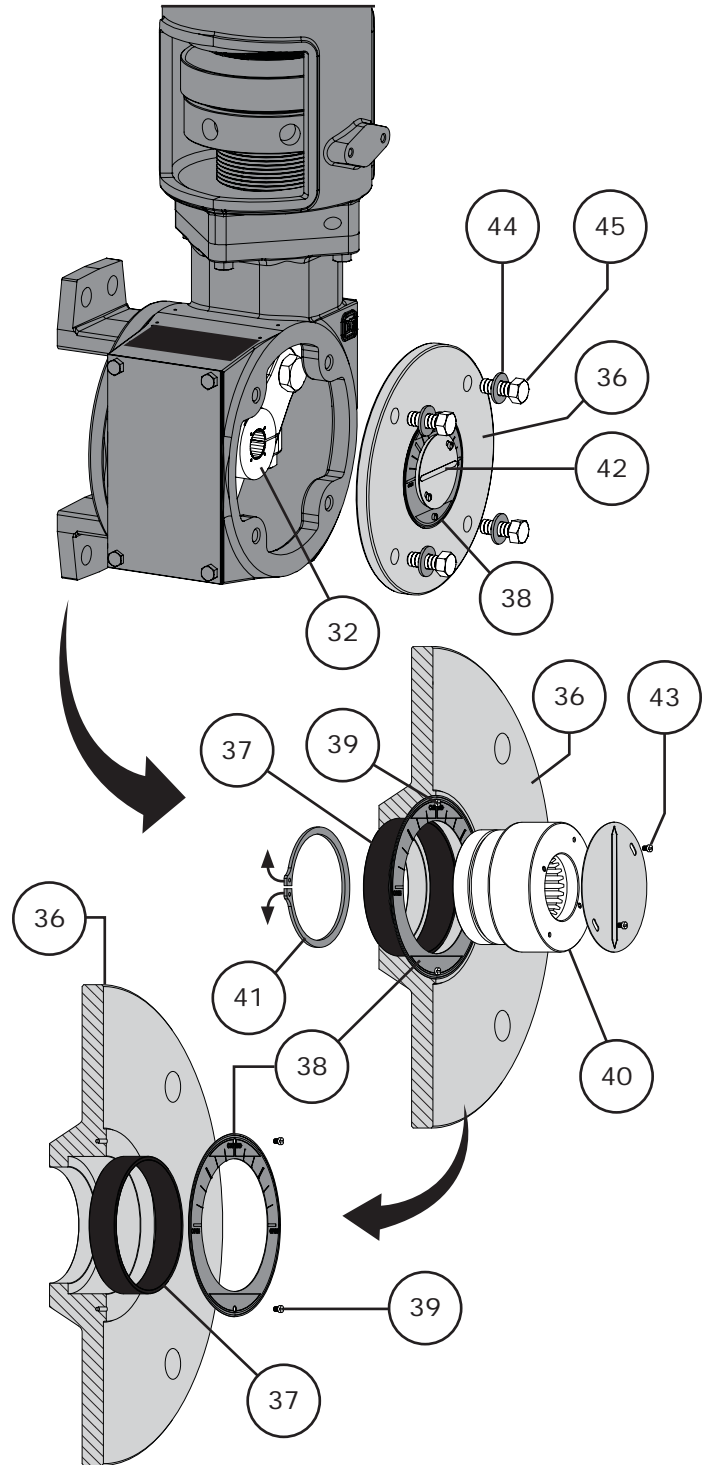


Figure 13 *Cover Plate Disassembly*

Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual



ACTUATOR DISASSEMBLY (Continued)

COVER PLATE DISASSEMBLY

- 1 Using the split ring pliers, remove the retaining ring (Key 41).
- 2 Remove the hub (Key 40) from the cover plate (Key 36).
- 3 If necessary, remove the machine screws (Key 43) and travel indicator (Key 42) from the hub (Key 40).
- 4 Inspect the bushing (Key 37). If the bushing needs to be replaced, remove the machine screws (Key 39) and remove the travel scale (Key 38). Once the travel scale has been removed, remove the bushing from the cover plate (Key 36).

LEVER REMOVAL

- 1 Make note of the position of the lever (Key 32) and valve shaft (Key V), mark the position of each with a soft tip felt marker if necessary.
- 2 If needed, support the lever (Key 32) and remove the cap screw (Key 34), hex nut (Key 38). Refer to Figure 6.

If the actuator is still mounted to the valve, loosen the lever clamp cap screw (Key 33). Refer to Figure 6. DO NOT use excessive force to drive the lever off of the valve shaft, excessive force could damage internal valve parts.

DIAPHRAGM CASING DISASSEMBLY

- 1 Refer to Figure 14, then remove the rod end bearing (Key 31), lower hex nut (Key 30), turnbuckle (Key 29), and left-hand threaded hex nut (Key 28) from the diaphragm rod (Key 20). **Note:** It may be necessary to apply operating pressure to the actuator (or adjust the handwheel if one is installed) to be able to access the turnbuckle and left-hand threaded hex nut. Use caution and avoid pinch points while the diaphragm rod is moving, be sure that the diaphragm rod or rod end bearing do not make contact with the valve shaft (Key V).
- 2 Relieve all operating pressure and/or rotate the handwheel counterclockwise to remove spring tension if a handwheel is installed. Using the metal adjusting rod (refer to Special Tools Required) remove spring tension by turning the spring adjuster (Key 14) down to the bottom of the adjustment screw (Key 9), refer to Figure 14.

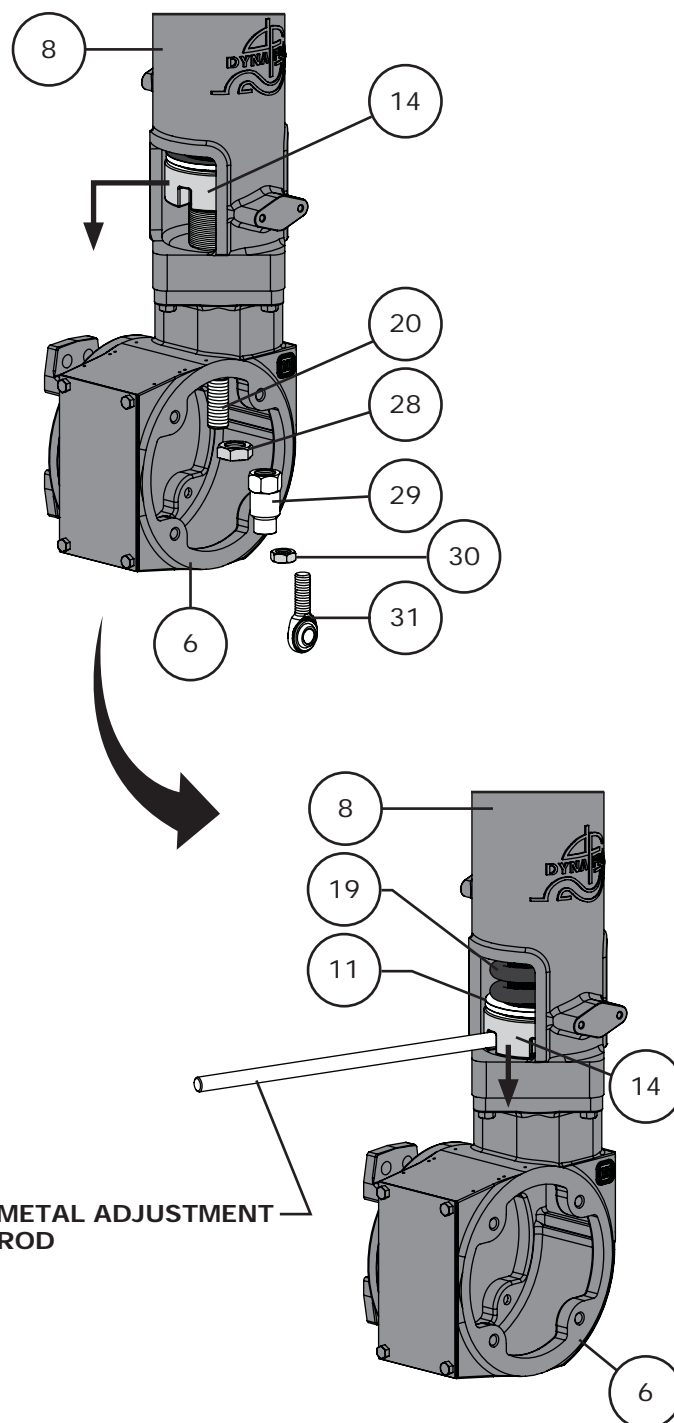


Figure 14 Turnbuckle Assembly Removal



Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

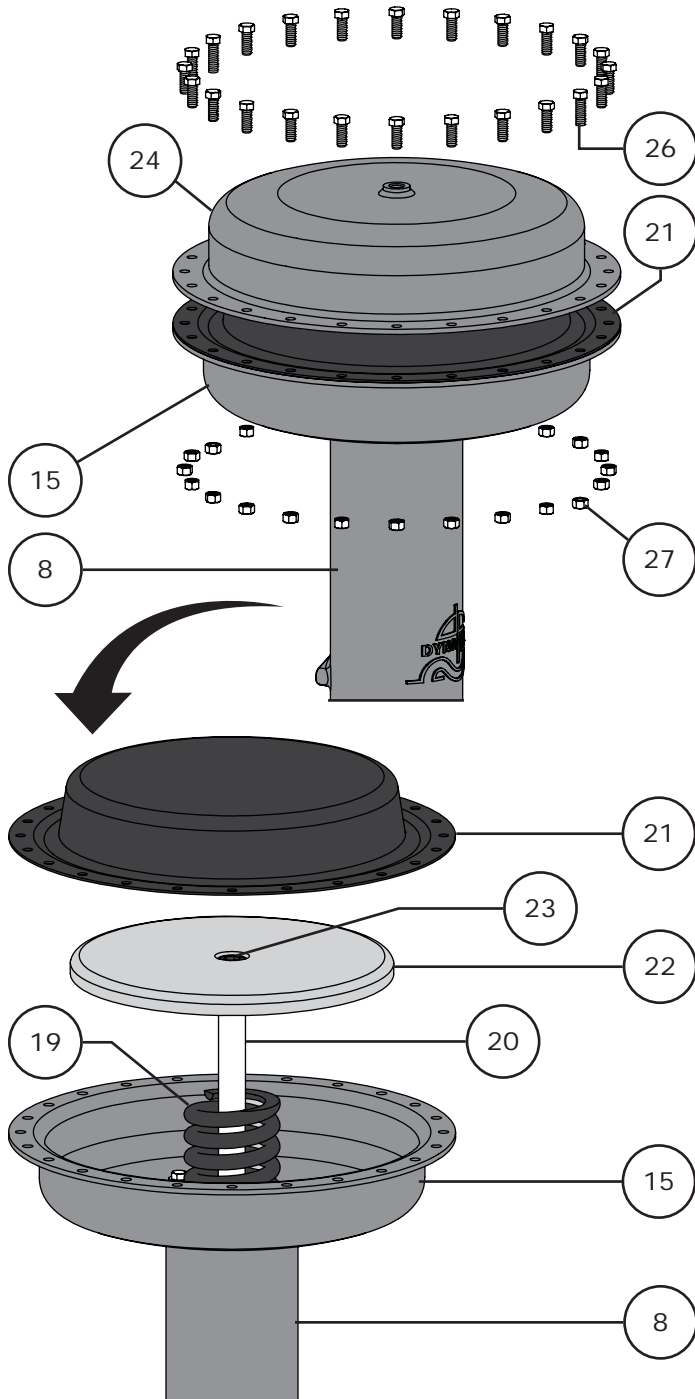


Figure 15 Diaphragm Casing Disassembly

ACTUATOR DISASSEMBLY (Continued)

DIAPHRAGM CASING DISASSEMBLY (Continued)

- 3 Remove the casing cap screws (Key 26) and hex nuts (Key 27).
- 4 Remove the upper diaphragm casing (Key 24).
- 5 Remove the diaphragm (Key 20).
- 6 Remove the diaphragm plate assembly (Keys 22, 23, and 20) from the actuator.
- 7 Remove the cap screw (Key 23), and separate the diaphragm plate (Key 22) from the diaphragm rod (Key 20). Use caution not to damage the diaphragm rod when disassembling, place the diaphragm rod into a vise with jaw softeners.
- 8 Thread the spring adjuster (Key 14) off of the adjustment screw (Key 9).
- 9 Once removed from the adjustment screw (Key 9), remove the spring seat (Key 11), thrust bearing (Key 13), and bearing races (Key 12) from the spring adjuster (Key 14).
- 10 Inspect all parts for damage or wear, replace or repair parts as necessary.

SPRING BARREL DISASSEMBLY

Note: The adjustment screw (Key 9) once installed into the spring barrel (Key 8) is not meant to be removed. If the threads of the adjusting screw or the spring barrel have been damaged, it will be necessary to order a new spring barrel/adjustment screw assembly.

- 1 Remove the lower casing cap screws (Key 16) and travel stop spacers (Key 17 & 18) if installed.
- 2 Remove the lower diaphragm casing (Key 15).
- 3 Remove the cap screws (Key 10) from the actuator housing (Key 6).
- 4 Remove the spring barrel (Key 8).

Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

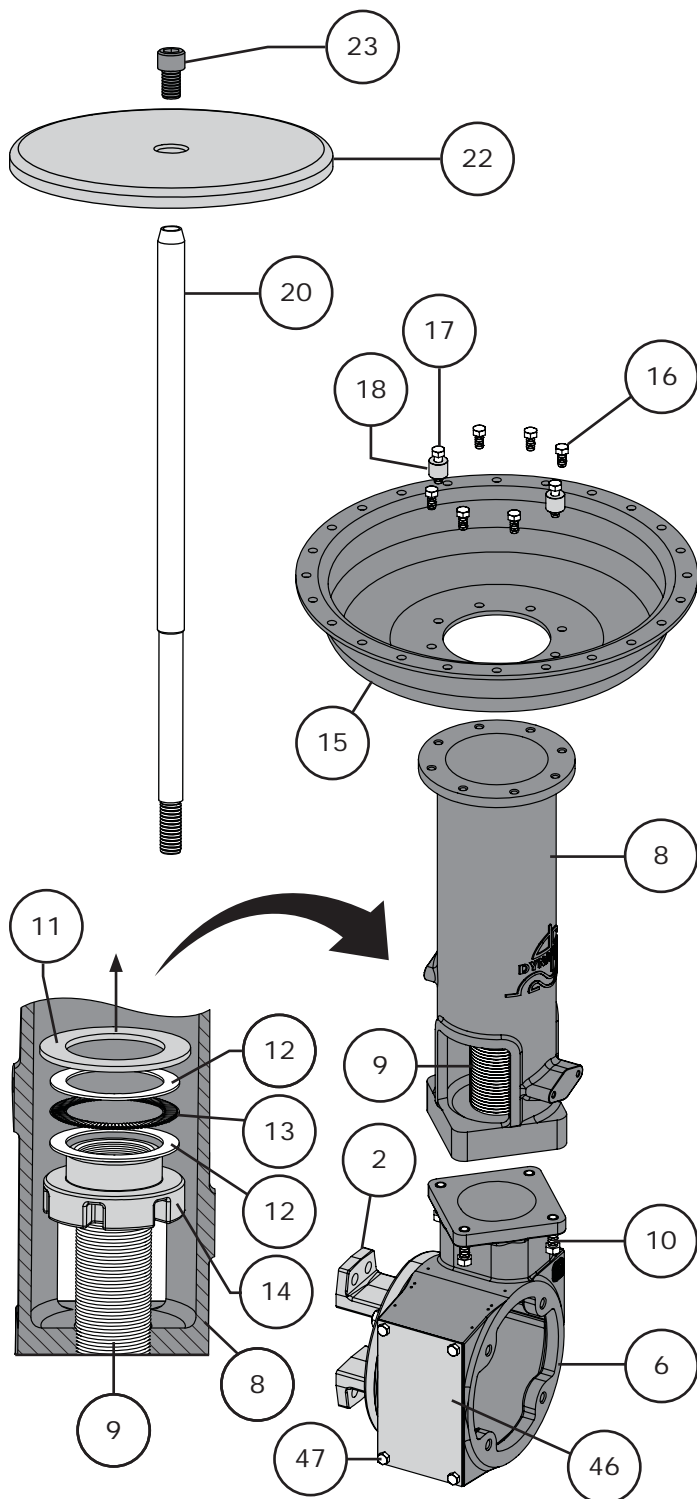


Figure 16 Spring Barrel Disassembly

ACTUATOR DISASSEMBLY (Continued)

YOKE REMOVAL

- 1 Support the actuator housing (Key 6) before removing the yoke (Key 2). To remove the yoke, remove the cap screws (Key 7). Refer to Figure 17.
- 2 If the yoke (Key 2) is still attached to the valve, separate the yoke from the valve by removing the mounting bolts (Key 3), hex nuts (Key 5) and washers (Key 4). Refer to Figure 5.
- 3 Inspect the bushing (Key 1) inside the mounting yoke (Key 2). If the bushing is worn or damaged it will need to be replaced. Replace the bushing (Key 1) by carefully pressing it out of the yoke (Key 2). Refer to Figure 17.

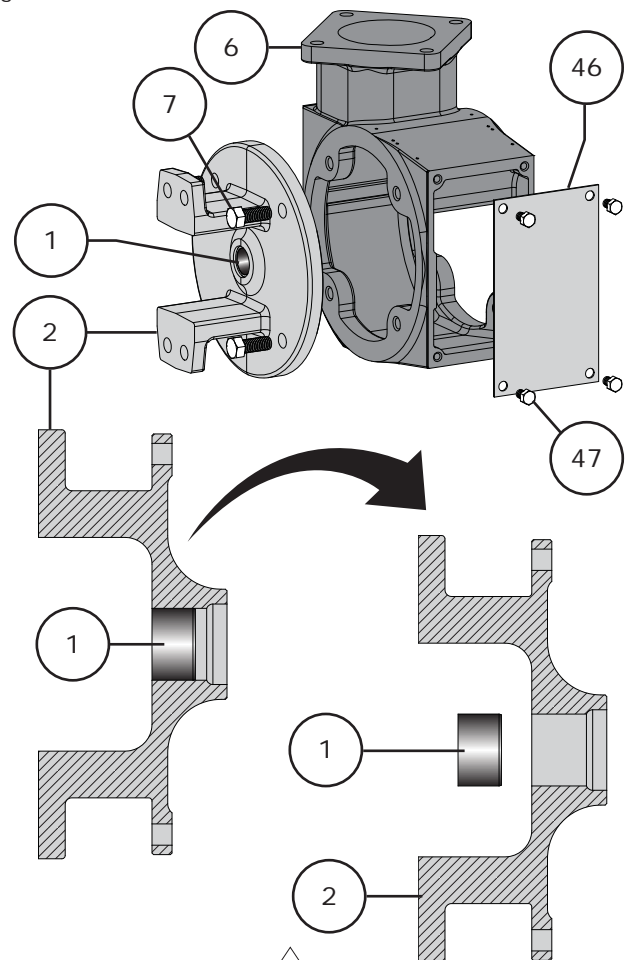


Figure 17 Yoke Removal and Disassembly



Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

ACTUATOR DISASSEMBLY (Continued)

PLATE REMOVAL

- 1 If required, remove the positioner plate cap screws (Key 47) and positioner plate (Key 46). Remove the access plate cap screws (Key 49) and access plate (Key 48). Refer to Figures 17 and 18.

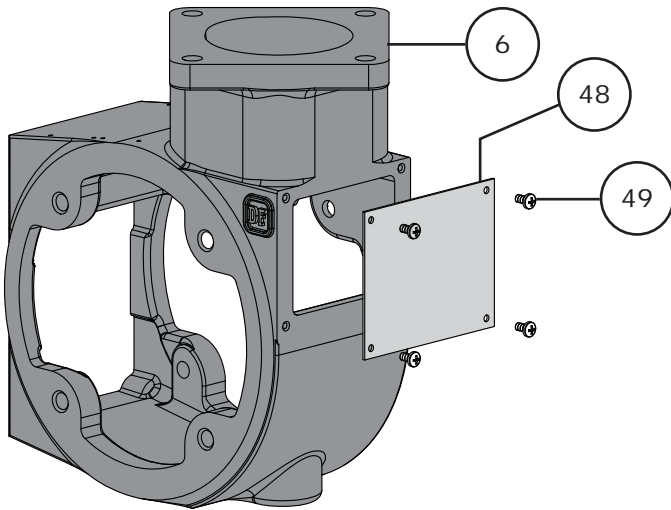


Figure 18 Access Plate Removal

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:

- Split ring pliers.
- Wrenches (See Table 5 for open-end wrenches required for turnbuckle adjustment).
- Regulated air supply (to stroke the actuator).
- Vise grips.
- Vise with soft jaws.

- Metal rod for adjusting the spring adjuster (Key 14)
 - For Size 070 Actuators - 3/8" (9.5 mm) diameter rod.
 - For Size 156 Actuators - 5/8" (15.9 mm) diameter rod.
 - For Size 220 Actuators - 3/4" (19.1 mm) diameter rod.

Lubricants Required:

- Anti-Seize Compound (Key A)
- White Petroleum Grease (Key C)
- Refined Petroleum Oil (Key D)
- Grease (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.

BUSHING/YOKE ASSEMBLY

- 1 If the bushing (Key 1) was removed from the yoke (Key 1), press in a new bushing. The end of the bushing should be flush with the outside face of the yoke (see Figure 19).
- 2 Install the mounting yoke (Key 2) over the valve shaft (Key V) and secure it to the valve with the mounting bolts (Key 3) and lockwashers (Key 4) for Model 590 valves (refer to Figure 5). Model 570 valves will also require a hex nut (Key 5). Tighten the cap screws to the torque values shown in Table 4.
- 3 Apply a small amount of anti-seize compound (Key A) to the threads of the cap screws (Key 7), then attach the actuator housing (Key 6) to the mounting yoke (Key 2) using the cap screws. Refer to Figure 12 to confirm desired actuator mounting orientation on the valve. Refer to Table 4 for cap screw (Key 7) torque specifications.

SPRING BARREL ASSEMBLY

- 1 Apply anti-seize compound (Key A) to the threads of the cap screws (Key 10). Attach the spring barrel (Key 8) to the housing (Key 6) using the cap screws, refer to Table 4 for cap screw torque values. **Note:** Align the spring barrel with the actuator housing by having the DF logo on the side of that actuator housing line up with the Dyna-Flo logo on the side of the spring barrel, refer to Figure 20.

Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

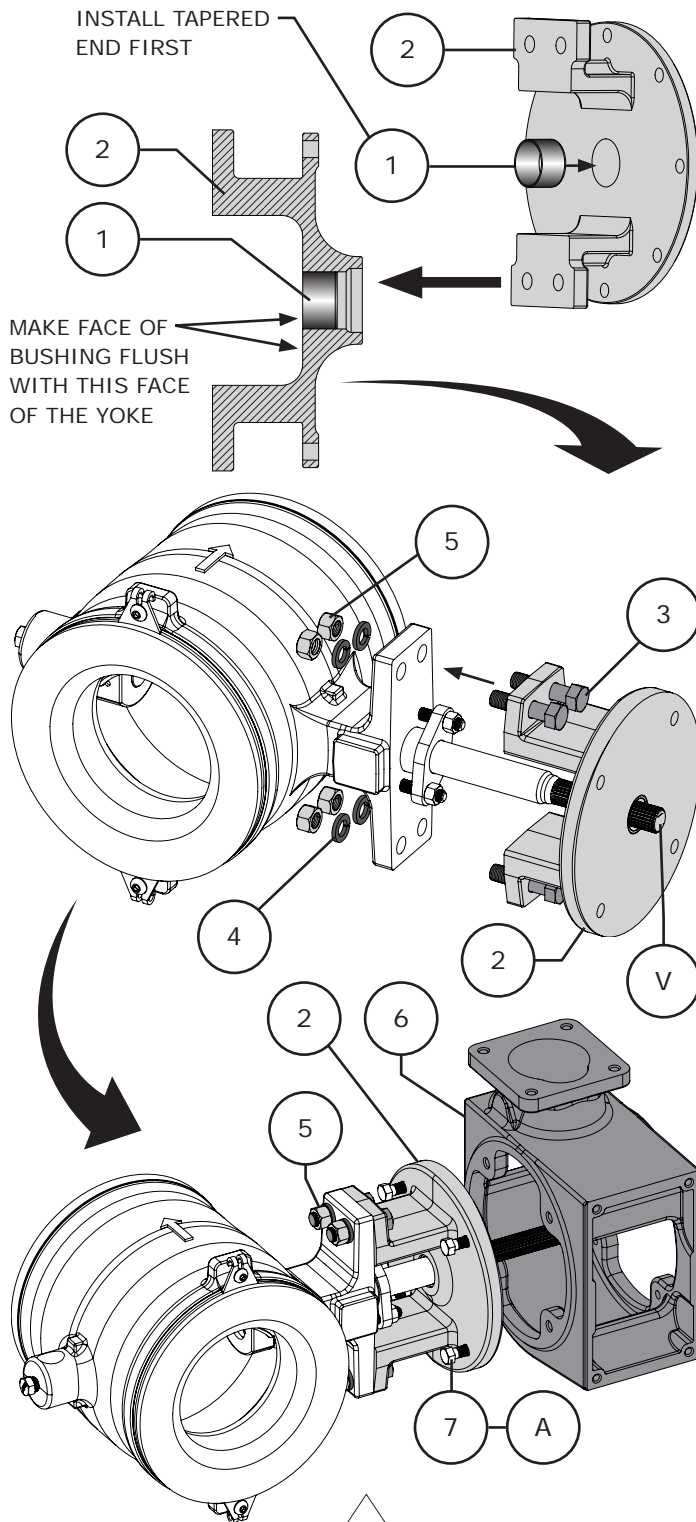


Figure 19 Yoke / Housing / Valve Assembly

ACTUATOR ASSEMBLY (Continued)

SPRING BARREL ASSEMBLY (Continued)

- 2 Apply anti-seize compound (Key A) to the threads of the adjustment screw (Key 9).
- 3 Thread the spring adjuster (Key 14) onto the adjustment screw (Key 9) until the spring adjuster comes into contact with the spring barrel (Key 8).
- 4 Lubricate the thrust bearing (Key 13) and one face of each of the bearing races (Key 12, 2 required) with green grease (Key F). Make a sandwich with the thrust bearing and bearing races by having a bearing race on top and bottom with the thrust bearing in between them. Refer to Figure 21.
- 5 Lubricate the top and bottom bearing race (Key 12) with white petroleum grease (Key C). Install the thrust bearing/bearing race assembly (Keys 12 & 13) onto the spring adjuster (Key 14).
- 6 Install the spring seat (Key 11) onto the top bearing race (Key 12).

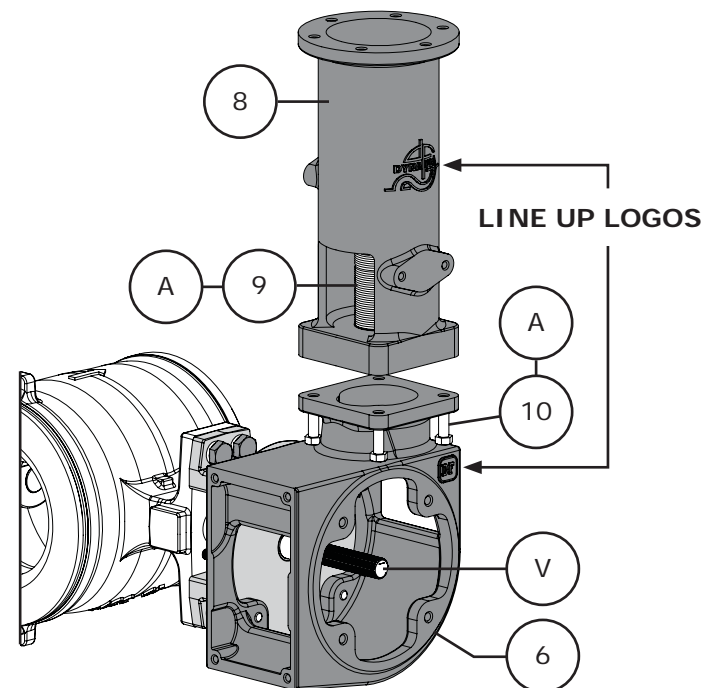
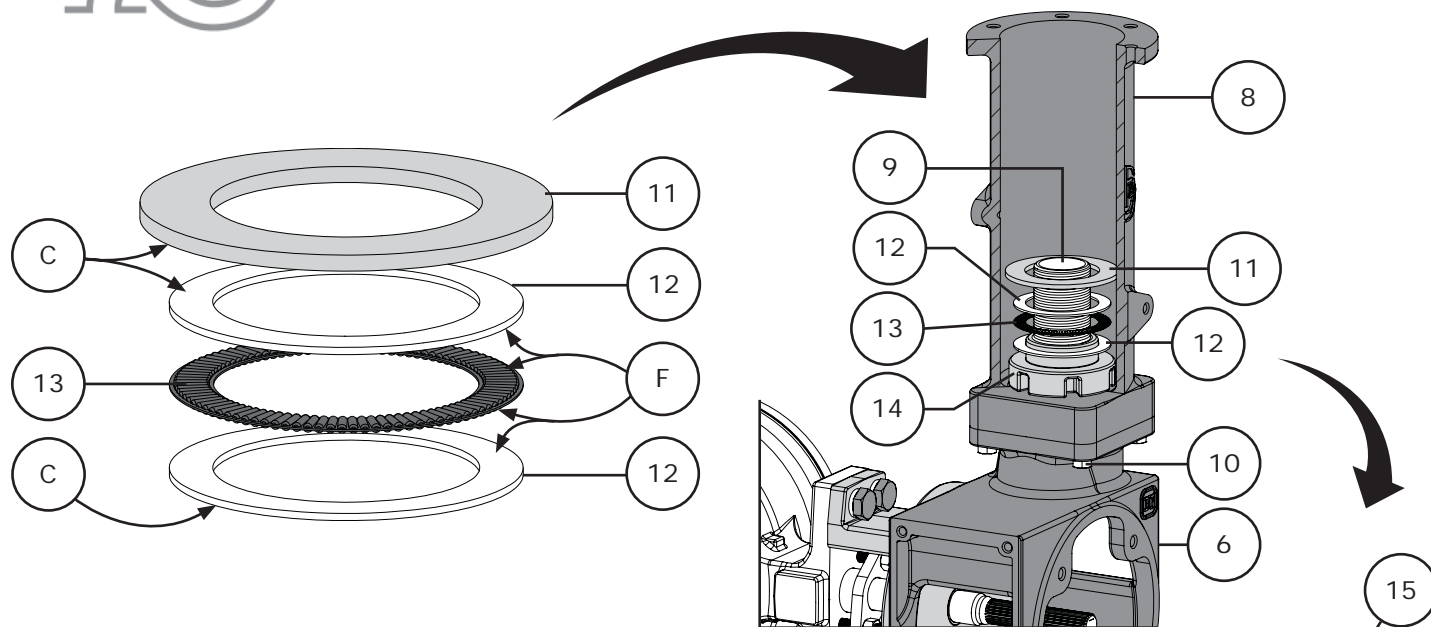


Figure 20 Spring Barrel Installation



Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual



ACTUATOR ASSEMBLY (Continued)

SPRING BARREL ASSEMBLY (Continued)

- 7 Apply anti-seize compound (Key A) to the threads of the cap screws (Keys 16 & 17).
- 8 Install the lower diaphragm casing (Key 15) using the shorter cap screws (Key 16) as shown in Figure 21. Install the travel spacers (Key 18) as shown in Figure 21, secure them in place using the longer cap screws (Key 17) to create the travel stops. Torque all cap screws to the torque specification listed in Table 4.
- 9 Set the spring (Key 19) into the spring barrel (Key 8) so that it rests on top of the spring seat (Key 11).

DIAPHRAGM PLATE ASSEMBLY

- 1 Secure the diaphragm rod (Key 20) in a clamping device, preferably a vise with soft jaws.
- 2 Apply anti-seize compound (Key A) to the threads of the cap screw (Key 23).
- 3 Secure the diaphragm plate (Key 22) to the diaphragm rod (Key 20) using the cap screw (Key 23), torque the cap screw to the torque specification recommended in Table 4.
- 4 Install the diaphragm plate assembly into the spring barrel (Key 8) so that the diaphragm plate (Key 22) seats on the spring (Key 19).

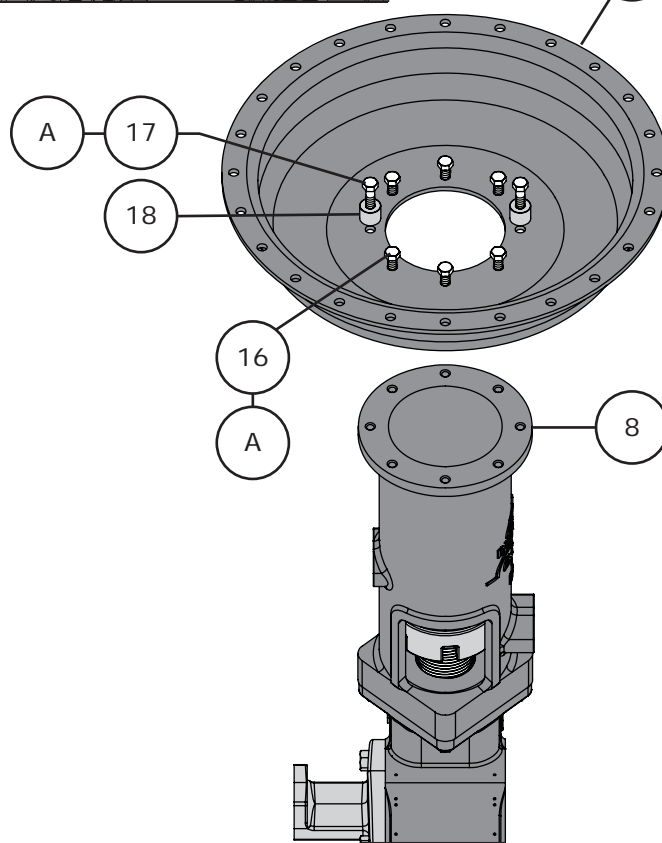


Figure 21 Spring Barrel Assembly

Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

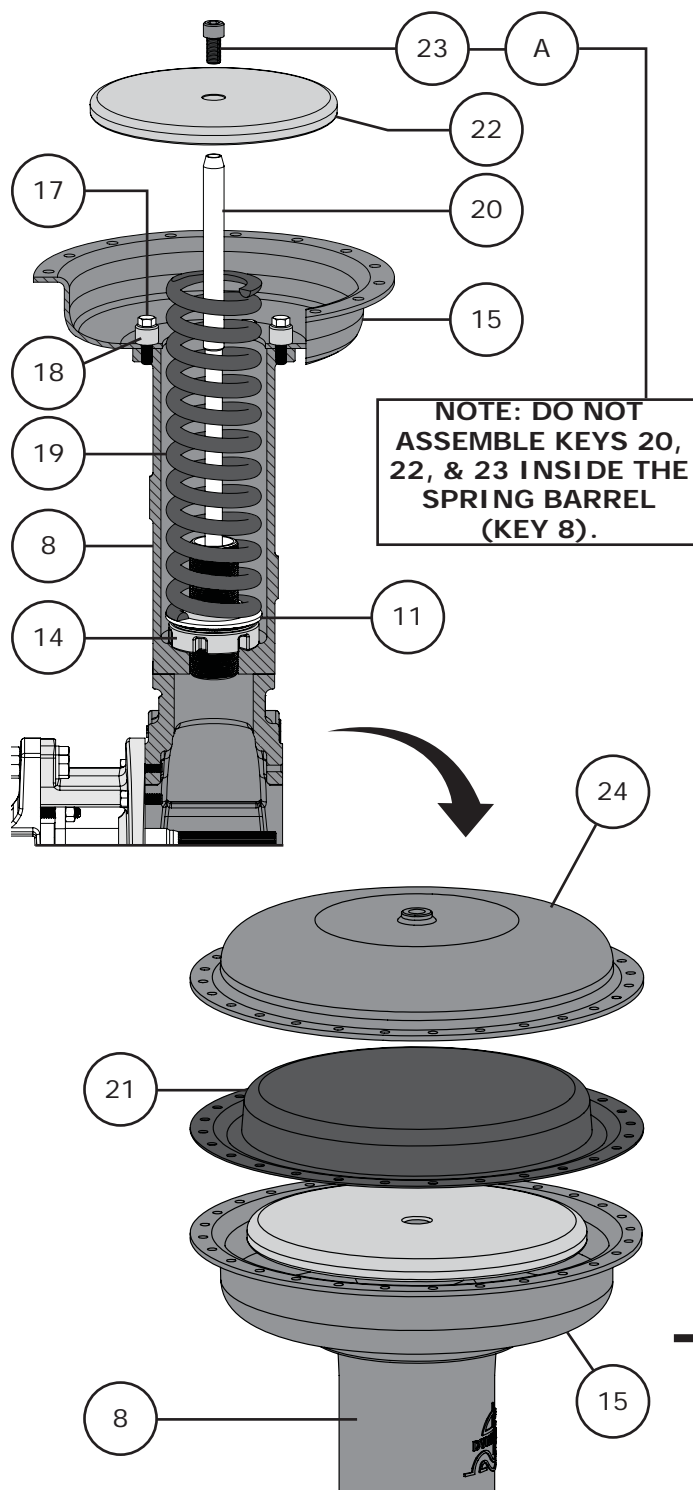
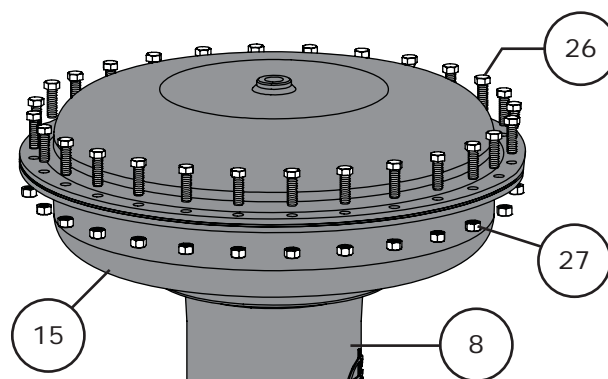


Figure 22 Diaphragm Casing Assembly

ACTUATOR ASSEMBLY (Continued)

DIAPHRAGM CASING ASSEMBLY

- 1 Place the diaphragm (Key 21) over the diaphragm plate (Key 20), align the holes in the diaphragm with the holes in the lower diaphragm casing (Key 15).
- 2 Set the upper diaphragm casing (Key 24) on top of the lower diaphragm casing (Key 15), align the holes. **Note:** If a Top-Mounted Handwheel or Adjustable Travel Stop 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 19).
- 4 Install the cap screws (Key 26) and thread the hex nuts (Key 30) onto the cap screws finger tight. **Note:** It may be necessary to grip the diaphragm (Key 21) with a pair of vise grips and pull the holes into alignment to be able to install the cap screws, loosen hex nuts if necessary.
- 5 Tighten the hex nuts (Key 27) in a crisscross pattern to the torque specification listed in Table 4.
- 6 Complete the Spring Adjustment – Initial Set section of this manual (Page 10) before proceeding with the actuator assembly.





Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

ACTUATOR ASSEMBLY (Continued)

LEVER INSTALLATION (Refer to Figures 6 & 12)

- 1 Apply anti-seize compound (Key A) to the threads of the diaphragm rod (Key 20).
- 2 Thread the left-hand threaded hex nut (Key 28) all the way onto the diaphragm rod (Key 20).
- 3 Thread the turnbuckle (Key 29) onto the diaphragm rod (Key 20) until the turnbuckle makes contact with the hex nut (Key 28). Refer to Figure 4.
- 4 Apply anti-seize compound (Key A) to the threads of the rod end bearing (Key 31). Thread the other hex nut (Key 30) completely onto the rod end bearing.
- 5 Thread the rod end bearing (Key 31) into the turnbuckle (Key 29) until the hex nut (Key 30) makes contact with the turnbuckle. Refer to Figure 4.
- 6 Lubricate the teeth of the valve shaft spline (Key V) with refined petroleum oil (Key D). Refer to Figure 6.
- 7 Loosen the lever clamp cap screw (Key 33) if not already loosened. Install the lever onto the valve shaft (Key V).
Refer to Figures 6, 12, and the appropriate valve instruction manual for proper lever orientation or if marks were made during disassembly refer to those marks.
- 8 Slide the lever (Key 32) so that the rod end bearing (Key 31) will be in alignment between the cap screw holes of the lever. Tighten the cap screw (Key 34) once in position.

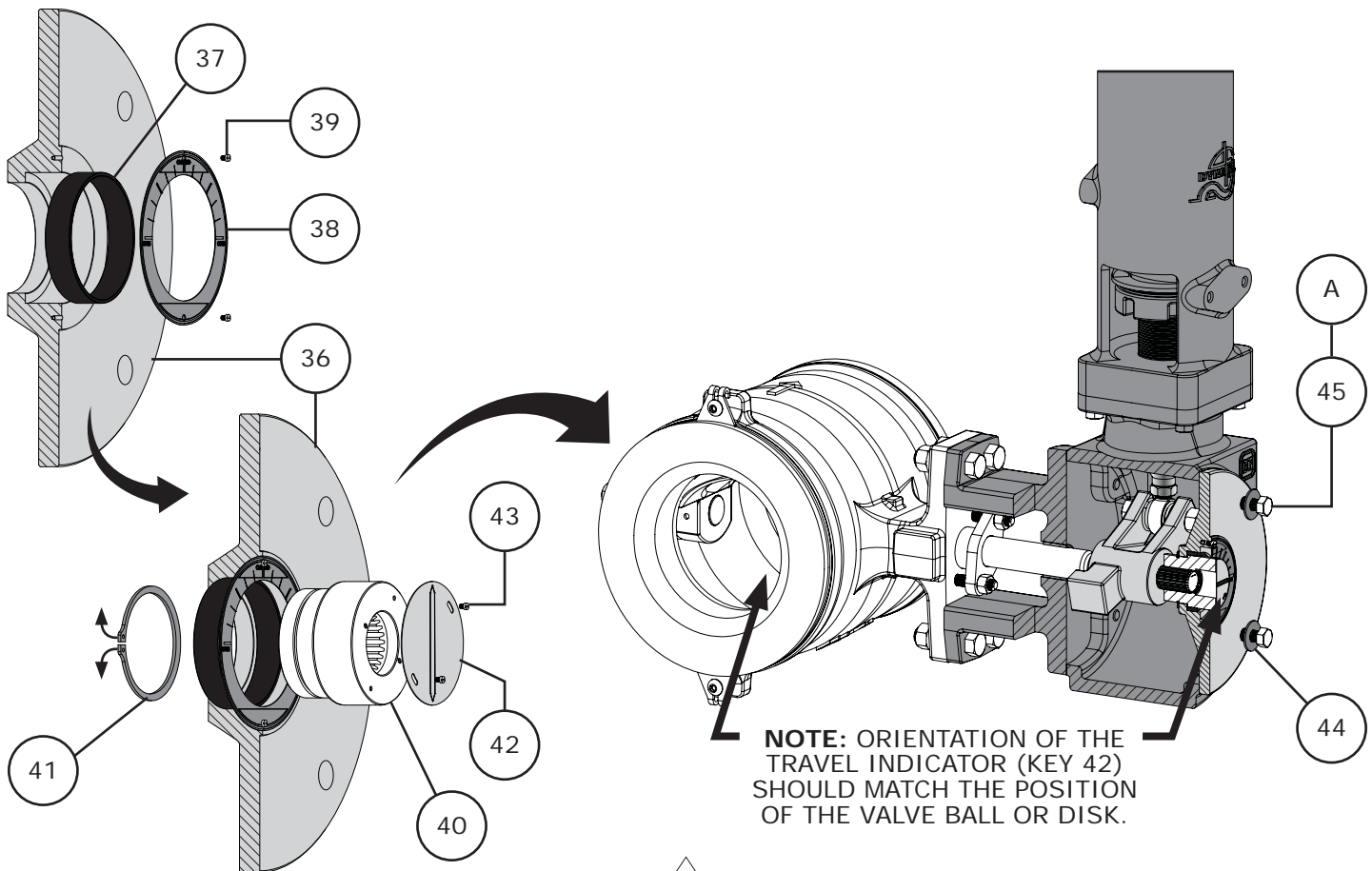


Figure 24 Cover Plate Assembly and Installation

Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual



ACTUATOR ASSEMBLY (Continued)

COVER PLATE ASSEMBLY

- 1 If the bushing (Key 37) was removed, press a new bushing into the cover plate (Key 36).
- 2 Install the hub (Key 40) into the cover plate (Key 36). Using the split ring pliers, install the retainer ring (Key 41) onto the groove on the hub, this will secure the hub in the cover plate.
- 3 Install the travel scale (Key 38) using the machine screws (Key 39).
- 4 Install the travel indicator (Key 42) using the machine screws (Key 43). Rotate the hub (Key 40) so that once installed the arrows of the travel indicator are in alignment with the open or closed markers of the travel scale (Key 38) (the valve/actuator action will determine which position to place the travel indicator in).

COVER PLATE INSTALLATION

Note: If the actuator is equipped with a positioner, refer to the separate instruction manual for those products, or contact Dyna-Flo Control Valves for more information.

- 1 Adjust the valve into the full open or fully closed position.
- 2 Slide the cover plate assembly (Keys 36, 37, 38, 39, 40, 41, 42, and 43) onto the valve stem (Key V) so that the valve stem slides through the teeth of the hub (Key 40).

Note: Try to position the cover plate (Key 36) so that the holes in the cover plate align with those of the actuator housing (Key 6), it will also be necessary to position the cover plate appropriately so that the travel scale (Key 38) is in the desired orientation for valve position.

- 3 Apply anti-seize compound (Key A) to the threads of the cap screws (Key 45). Install the washers (Key 44) onto the cap screws and thread them through the cover plate (Key 36) and into the actuator housing (Key 6).
- 4 Secure the cover plate assembly in place by tightening the cap screws (Key 45) to the torque specification shown in Table 3.
- 5 Refer to the Actuator Adjustment section (Page 8) for instructions on re-adjusting the turnbuckle assembly.

PLATE INSTALLATION

- 1 If the access plate (Key 48) and positioner plate (Key 46) have not been installed, do not install them until the actuator adjustments have been performed.
- 2 Apply anti-seize compound (Key A) to the threads of the cap screws (Key 49) and use them to install the access plate (Key 48).
- 3 Apply anti-seize compound (Key A) to the threads of the cap screws (Key 47) and use them to install the positioner plate (Key 46).

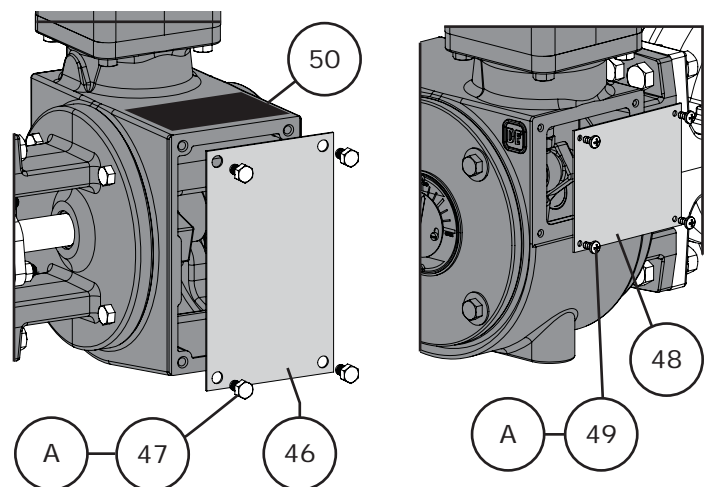


Figure 25 Small Plate Installations



Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

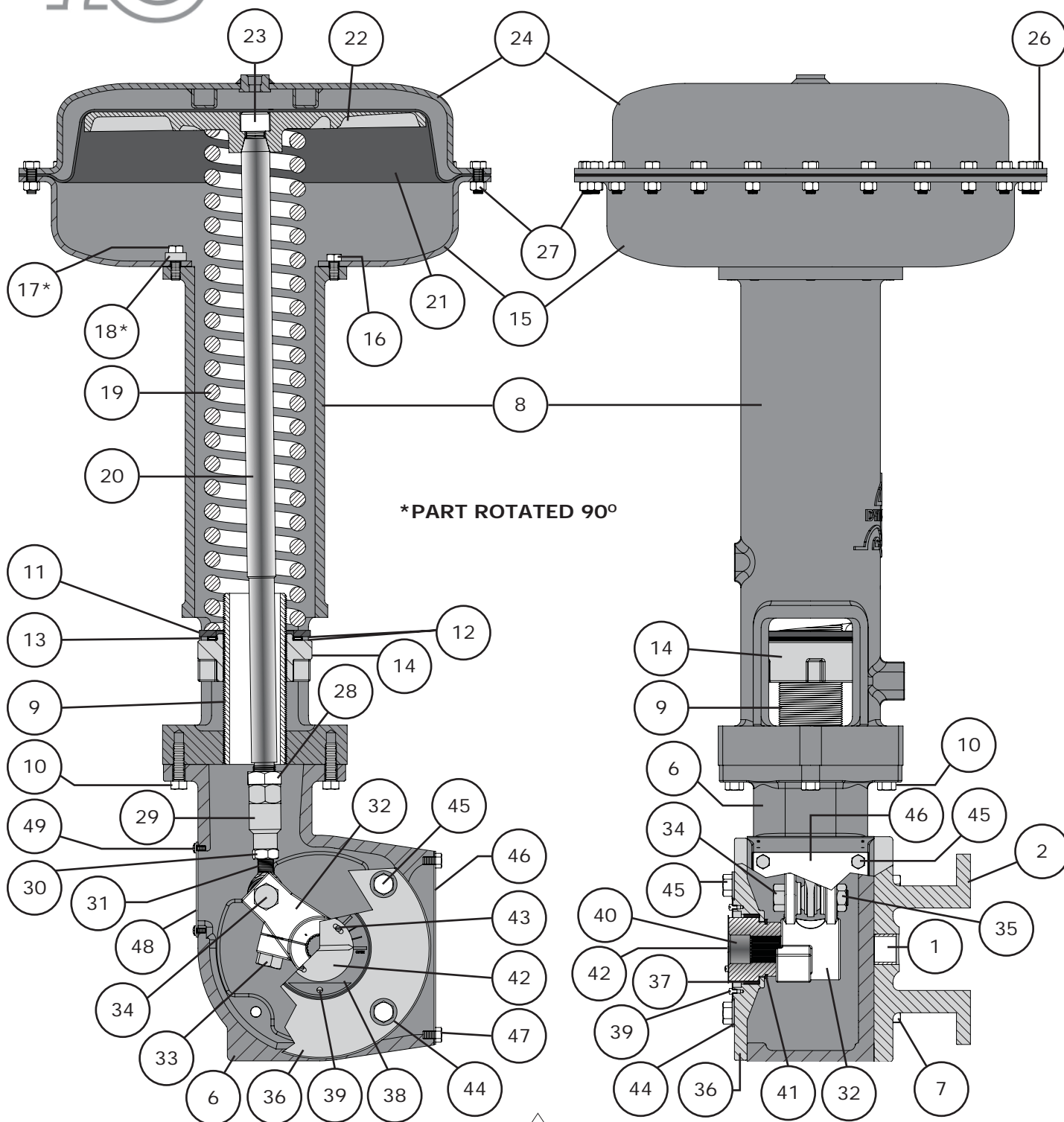


Figure 26 DFR Cross Section

Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual



PRINCIPLES OF OPERATION AND ADJUSTMENT – HANDWHEELS AND TRAVEL STOPS

TOP-MOUNTED HANDWHEELS

DFR Top-Mounted Handwheel assemblies are attached to a modified upper diaphragm casing (Key 24) 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 19) and move diaphragm rod (Key 20) down:

Turning the handwheel (Key 102) clockwise into the upper diaphragm casing (Key 24) forces the pusher plate (Key 112) into the diaphragm (Key 21) and diaphragm plate (Key 22) to compress the spring.

To decompress the spring (Key 19) and allow diaphragm rod (Key 20) to move up:

Turning the handwheel (Key 102) counterclockwise away from the upper diaphragm casing (Key 24) allows the actuator spring to decompress which moves the diaphragm plate (Key 22) and diaphragm rod (Key 20) 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.

ADJUSTABLE UP TRAVEL STOPS (Refer to Figures 29 & 30)

Adjustable up travel stops are used to limit the actuator stroke in the upward direction.

To adjust up travel stop position:

- 1 Relieve actuator loading pressure.
- 2 Remove the closing cap (Key 118). **Note:** The closing cap is a pressure containing part, use caution when removing.
- 3 Loosen the lock nut (Key 104).
- 4 Rotate the stem (Key 103) clockwise to move the diaphragm rod (Key 20) down, counterclockwise to move the diaphragm rod upward.

- 5 After the travel stop has been adjusted to the desired position, tighten the lock nut (Key 104) into the body (Key 105).

- 6 Re-install the closing cap

Note: Full opening or closing of the valve can be adjusted by positioning the up travel stop to the desired position.

ADJUSTABLE DOWN TRAVEL STOPS (Refer to Figure 31)

Adjustable down travel stops are used to limit the actuator stroke in the downward direction.

To adjust down travel stop position:

- 1 Relieve actuator loading pressure.
- 2 Remove the closing cap (Key 118). **Note:** The closing cap is a pressure containing part, use caution when removing.
- 3 Loosen the jam nut (Key 119).
- 4 Move the hex nut (Key 120) down the stem (Key 103) to limit travel, or up the stem to allow for more travel.
- 5 Lock the jam nut (Key 119) into hex nut (Key 120) once the desired travel stop position has been reached.
- 6 Re-install the closing cap (Key 118).

MAINTENANCE - TOP-MOUNTED HANDWHEELS AND TRAVEL STOPS

Maintenance should be performed if actuator loading pressure appears to be leaking from either the handwheel or travel stop. It is possible that either the o-rings (Keys 107 & 108) or closing cap (Key 118) need to be replaced.

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

- Tighten the closing cap (Key 118). If tightening the closing cap does not stop the leak, apply thread sealant to the threads of the closing cap.
- Lubricate the threads of the stem (Key 103) with white petroleum grease, stroke the device a couple times after application. Size 220 Handwheels and Travel Stops have a grease fitting (Key 106) available for lubricating the stem.



Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

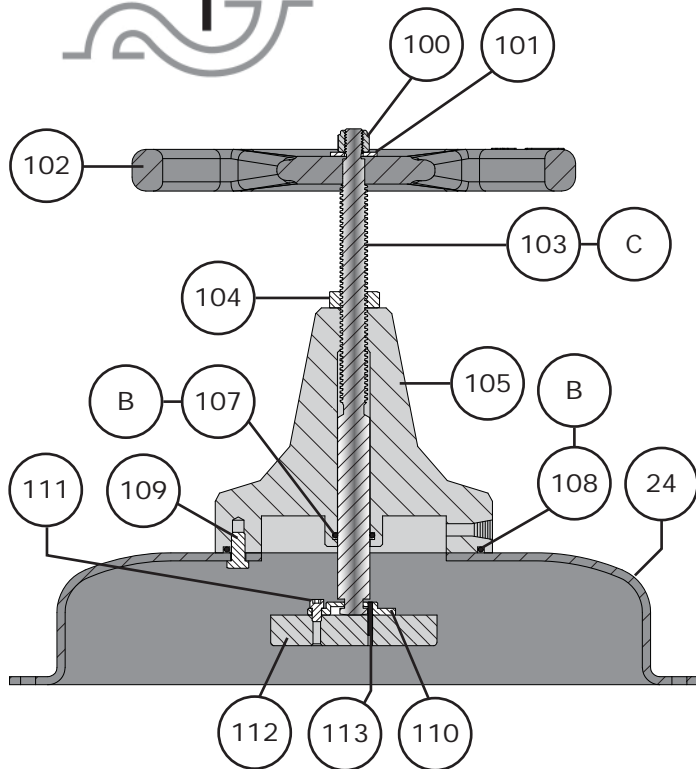


Figure 27 DFR 070-156 Top-Mounted Handwheel

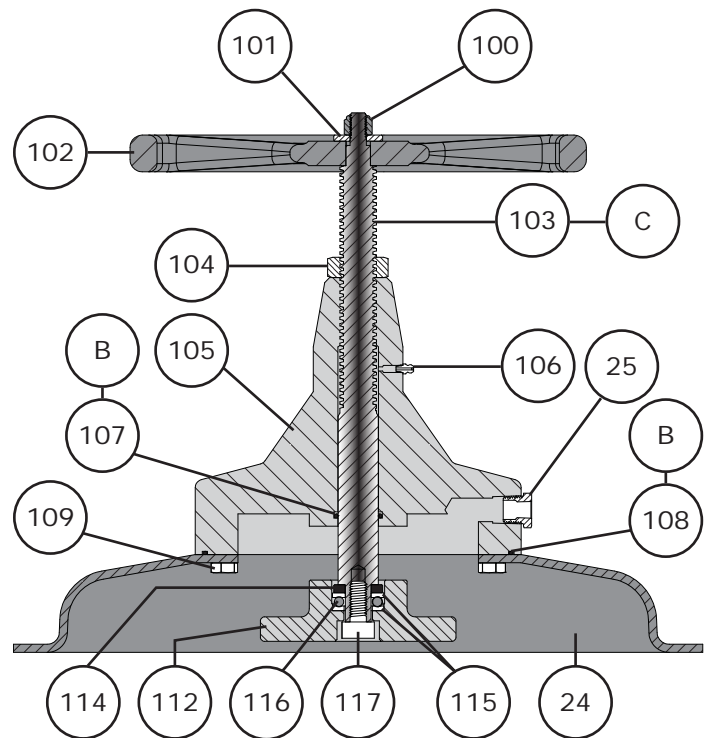


Figure 28 DFR 220 Top-Mounted Handwheel

MAINTENANCE - TOP-MOUNTED HANDWHEELS AND TRAVEL STOPS 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).

Special Tools Required:

- Metal rod for adjusting the spring adjuster (Key 14):
 - For Size 070 Actuators - 3/8" (9.5 mm) diameter rod.
 - For Size 156 Actuators - 5/8" (15.9 mm) diameter rod.
 - For Size 220 Actuators - 3/4" (19.1 mm) diameter rod.

Lubricants Required:

- Silicone-Based O-Ring Compound (Key B)
- White Petroleum Grease (Key C)

TOP-MOUNTED HANDWHEEL O-RING REPLACEMENT

- 1 Rotate the handwheel counterclockwise and remove any spring tension applied by the handwheel.
- 2 Relieve any actuator spring (Key 19) compression by turning the spring adjuster (Key 14) clockwise until it touches the bottom of the spring barrel (Key 8). Refer to Step 2 of the Diaphragm Casing Disassembly Section.

Operation, Parts, and Instruction Manual

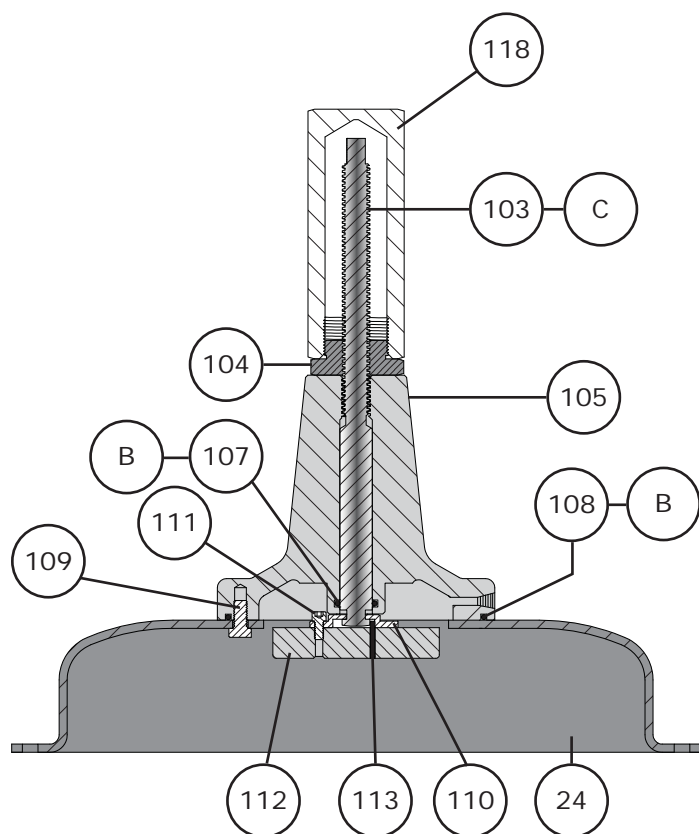


Figure 29 *DFR 070-156 Adjustable Up Travel Stop*

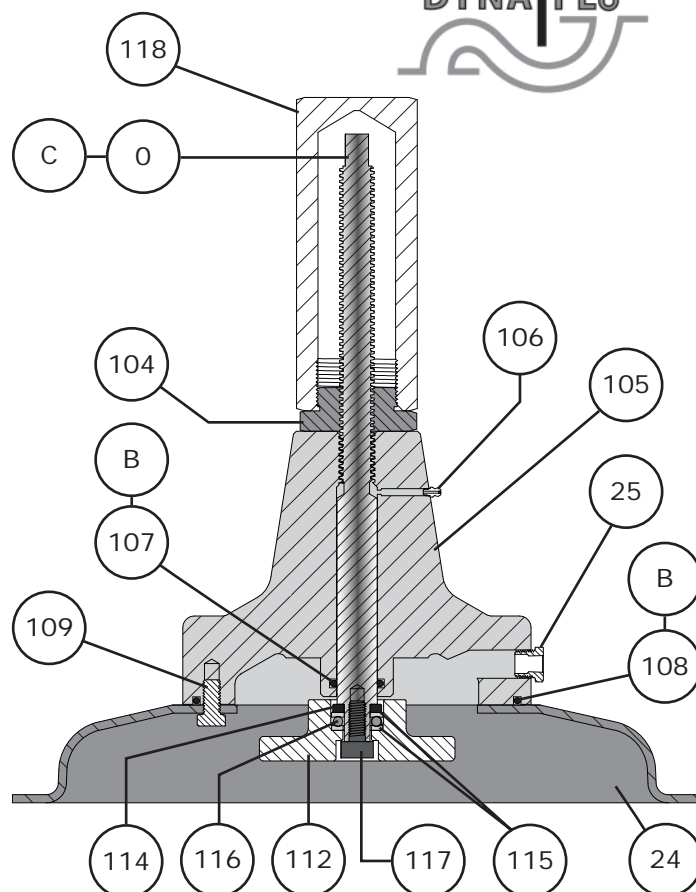


Figure 30 *DFR 220 Adjustable Up Travel Stop*

MAINTENANCE - TOP-MOUNTED HANDWHEELS AND TRAVEL STOPS O-RING REPLACEMENT (Continued)

TOP-MOUNTED HANDWHEEL O-RING REPLACEMENT

(Continued)

- 3 Refer to the Actuator Disassembly – Diaphragm Casing Disassembly Steps 3 – 4 and remove the upper diaphragm casing (Key 24).
- 4 Separate the handwheel assembly from the upper diaphragm casing (Key 24) by remove the cap screws (Key 109).
- 5 Loosen the lock nut (Key 104).
- 6 Remove the hex nut (Key 100), 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 silicone-based o-ring compound (Key B).
- 9** Re-assemble the handwheel and diaphragm casing. Refer to the Actuator Assembly section (Page 23).
- 10** Perform spring adjustment.

ADJUSTABLE UP TRAVEL STOP O-RING REPLACEMENT

- 1 Remove the closing cap (Key 118).
- 2 Loosen the lock nut (Key 104) and rotate the stem (Key 103) counterclockwise and remove any spring tension applied by the up stop.
- 3 Relieve any actuator spring (Key 19) compression by turning the spring adjuster (Key 14) clockwise until it touches the bottom of the spring barrel (Key 8). Refer to Step 2 of the Diaphragm Casing Disassembly Section.



Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

MAINTENANCE - TOP-MOUNTED HANDWHEELS AND TRAVEL STOPS O-RING REPLACEMENT (Continued)

ADJUSTABLE UP TRAVEL STOP O-RING REPLACEMENT (Continued)

- 4 Refer to the Actuator Disassembly – Diaphragm Casing Disassembly Steps 3 – 4 and remove the upper diaphragm casing (Key 24).
- 5 Separate the travel stop assembly from the upper diaphragm casing (Key 24) by removing the cap screws (Key 109).
- 6 Loosen the lock nut (Key 104).
- 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 silicone-based o-ring compound (Key B).
- 9 Re-assemble the travel stop and diaphragm casing. Refer to the Actuator Assembly section (Page 23).
- 10 Perform spring adjustment.

ADJUSTABLE DOWN TRAVEL STOP O-RING REPLACEMENT

- 1 Remove the closing cap (Key 118) and o-ring (Key 107).
- 2 Remove the jam nut (Key 119) and hex nut (Key 120).
- 3 Relieve any actuator spring (Key 19) compression by turning the spring adjuster (Key 14) clockwise until it touches the bottom of the spring barrel (Key 8). Refer to Step 2 of the Diaphragm Casing Disassembly Section.
- 4 Refer to the Actuator Disassembly – Diaphragm Casing Disassembly Steps 3 – 4 and remove the upper diaphragm casing (Key 24).
- 5 Separate the travel stop assembly from the upper diaphragm casing (Key 24) by remove the cap screws (Key 109).

- 6 Loosen the jam nut (Key 121). To completely disassemble the actuator from this point, unscrew the stem (Key 103) from the diaphragm rod (Key 20) and remove the upper diaphragm plate (Key 124). Refer to Actuator Disassembly – Diaphragm Casing Disassembly Step 5 to complete actuator disassembly.
- 8 Remove and replace the o-ring (Key 108). Lubricate the new o-rings with silicone-based o-ring compound (Key B).
- 9 Re-assemble the travel stop and diaphragm casing. Refer to the Actuator Assembly section (Page 23).
- 10 Perform spring adjustment.

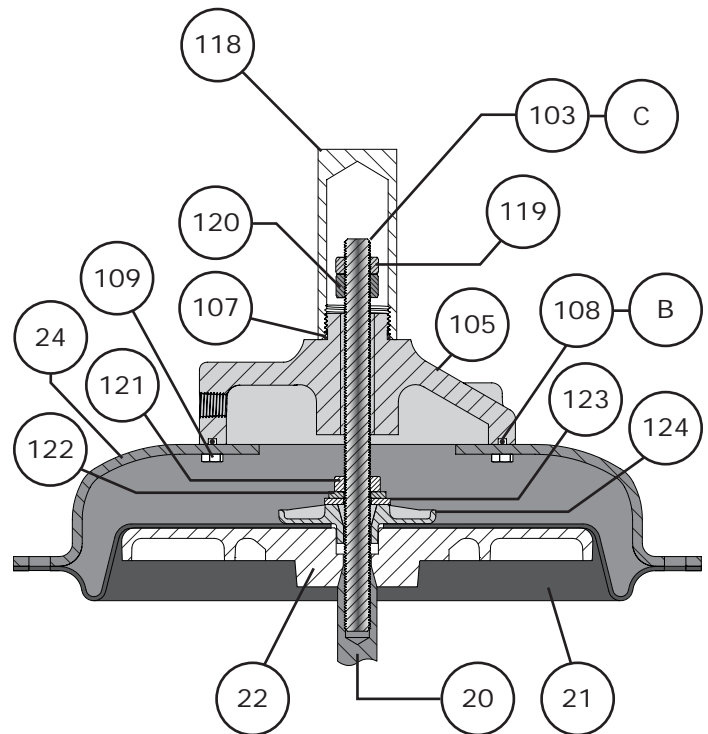


Figure 31 DFR Adjustable Down Travel Stop

Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual



Table 3

Torque Specifications for Valve Mounting Bolts (Key 3)

Valve Shaft Diameter	Mounting Bolts	
	lbf-ft	N•m
1/2 Inch to 1 Inch	65	80
1-1/4 Inch & 1-1/2 Inch	100	135
1-3/4 Inch & 2 Inch	135	183
2-1/2 Inch	290	390

Table 4

DFR Torque Specifications lbf-ft (N•m)

Key	Actuator Size					
	070		156		220	
	Size	Torque	Size	Torque	Size	Torque
7	3/8"-16	25 (34)	1/2"-13	60 (81)	1/2"-13	60 (81)
10	5/16"-18	17 (23)	7/16"-14	50 (68)	5/8"-18"	50 (68)
16/17	3/8"-16	30 (41)	3/8"-16	30 (41)	1/2"-13	75 (102)
23	1/2"-20	25 (34)	3/4"-16	75 (102)	3/4"-16	75 (102)
27	3/8"-24	20 (27)	3/8"-24	20 (27)	3/8"-24	20 (27)
28	3/4"-16-LH	75 (102)	7/8"-14-LH	120 (163)	7/8"-14-LH	120 (163)
30	1/2"-20	25 (34)	5/8"-18	45 (61)	3/4"-16	75 (102)
33	1/2"-13	60 (81)	5/8"-11	120 (163)	3/4"-10	200 (271)
34	1/2"-13	60 (81)	5/8"-11	120 (163)	3/4"-10	200 (271)
44	3/8"-16	25 (34)	1/2"-13	60 (81)	1/2"-13	60 (81)
100	1/2"-20	25 (34)	5/8"-18	25 (34)	---	25 (34)
109	3/8"-16	30 (41)	3/8"-16	30 (41)	1/2"-13	60 (81)
123	1/2"-20	20 (27)	3/4"-16	49 (66)	3/4"-16	51 (69)

Table 5

Open-End Wrench Size Requirements for Turnbuckle Assembly Adjustment

Actuator Size	Lower hex nut (Key 30)	Turnbuckle (Key 29)	Upper hex nut (Key 28)
070	3/4 inch	1-1/8 inch	1-1/8 inch
156	15/16 inch	1-5/16 inch	1-5/16 inch
220	1-1/8 inch	1-5/16 inch	1-5/16 inch



Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

Parts

Key	Description	Part Number
1	Bushing , Mounting Yoke, Bronze	Refer to Table 6
2	Mounting Yoke & Bushing Assembly , Cast Iron & Bronze	Refer to Table 6
3	Mounting Bolt , Actuator / Valve, Zinc Plated Steel Mounting bolts are included with the valve assembly.	
4	Lockwasher , Actuator / Valve, Zinc Plated Steel lockwashers are included with the valve assembly.	
5	Hex Nut , Mounting Bolt, Zinc Plated Steel Hex nuts are included with a 570 valve assembly.	
6	Housing , Cast Iron	
	Size 220	48A5246X01D
	Size 156	48A5246X01D
	Size 070	48A5245X01D
7	Cap Screw , Mounting Yoke, Zinc Plated Steel	
	Size 220 (4 Required)	H5CZ12.112
	Size 156 (4 Required)	H5CZ12.112
	Size 070 (4 Required)	H5CZ38.114
8	Spring Barrel , Cast Iron	
	Size 220	46A9171X01D
	Size 156	48A2484X01D
	Size 070	48A2485X01D
9	Adjustment Screw , Zinc Plated Steel	
	Size 220	26A9172X01D
	Size 156	18A2476X01D
	Size 070	18A2480X01D
10	Cap Screw , Spring Barrel, Zinc Plated Steel	
	Size 220 (4 Required)	H5CZ716.112
	Size 156 (4 Required)	H5CZ716.112
	Size 070 (4 Required)	H5CZ516.100
11	Spring Seat , Zinc Plated Steel	
	Size 220	16A9174X01D
	Size 156	18A2477X01D
	Size 070	18A2483X01D
12	Bearing Race	
	Size 220 (2 Required)	16A9182X01D
	Size 156 (2 Required)	1N88889901D
	Size 070 (2 Required)	10A4635X01D
13	Thrust Bearing	
	Size 220	16A9175X01D
	Size 156	1N88879901D
	Size 070	10A4636X01D

Key	Description	Part Number
14	Spring Adjuster , Zinc Plated Steel	
	Size 220	16A9176X01D
	Size 156	18A2479X01D
	Size 070	18A2482X01D
15	Lower Diaphragm Casing , Steel	
	Size 220	2N12712506D
	Size 156	2E84742506D
	Size 070	2E80632506D
16	Cap Screws , Lower Diaphragm Casing, Zinc Plated Steel	
	Size 220 (10 Required)	H5CZ12.100
	Size 156 (6 Required)	H5CZ38.034
	Size 070 (4 Required)	H5CZ38.034
17	Cap Screws , Travel Stop, Zinc Plated Steel	
	Size 220 (2 Required)	1P40662409D
	Size 156 (2 Required)	H5CZ38.112
	Size 070 (2 Required)	H5CZ38.100
18	Travel Spacer , Travel Stop, Stainless Steel	
	Size 220	N/A
	Size 156 (2 Required)	SPC380-875-763D
	Size 070 (2 Required)	SPC380-875-196D
19	Spring	
	Size 220	See Table 7
	Size 156	See Table 7
	Size 070	See Table 7
20	Diaphragm Rod , Zinc Plated Steel	
	Size 220	26A9173X01D
	Size 156	25A6969X01D
	Size 070	25A6968X01D
21	Diaphragm , Nitrile	
	Size 220	2N12690220D
	Size 156	2E85970220D
	Size 070	2E67000220D
22	Diaphragm Plate , Zinc Plated Steel	
	Size 220	2N12701904D
	Size 156	43B9677X01D
	Size 070	33B9688X01D
23	Cap Screw , Diaphragm Plate, Zinc Plated Steel	
	Size 220	1E77543298D
	Size 156	1E77543298D
	Size 070	1E76043299D

Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual



Parts (Continued)

Key	Description	Part Number
24	Upper Diaphragm Casing, Steel	
	Size 220	2N12662899D
	Size 156	30A0055X01D
	Size 070	2L44182899D
25	Reducer Bushing	
	Size 220	1C37902623D
	Size 156	N/A
	Size 070	N/A
26	Cap Screw, Diaphragm Casing	
	Size 220 (26 Required)	H5FZ38.114
	Size 156 (22 Required)	H5FZ38.100
	Size 070 (16 Required)	H5FZ38.100
27	Hex Nut, Diaphragm Casing	
	Size 220 (28 Required)	NHFZ38
	Size 156 (24 Required)	NHFZ38
	Size 070 (16 Required)	NHFZ38
28	Upper Hex Nut, Turnbuckle	
	Size 220	1R43892412D
	Size 156	1R43892412D
	Size 070	12A9629X01D
29	Turnbuckle	
	Size 220	22A9630X01D
	Size 156	22A9624X01D
	Size 070	22A9625X01D
30	Lower Hex Nut, Turnbuckle	
	Size 220	NHJFZ34
	Size 156	NHJFZ58
	Size 070	NHJFZ12
31	Rod End Bearing	
	Size 220	1R58769901D
	Size 156	1R44089901D
	Size 070	1E56169901D
32	Lever	
	Size 220	See Table 6
	Size 156	See Table 6
	Size 070	See Table 6
33	Cap Screw, Lever Clamp	
	Size 220	H5CZ34.134
	Size 156	H5CZ58.114
	Size 070	H5CZ12.114

Key	Description	Part Number
34	Cap Screw, Lever/Rod End Bearing	
	Size 220	H5CZ34.234
	Size 156	H5CZ58.234
	Size 070	H5CZ12.212
35	Hex Nut, Lever/Rod End Bearing	
	Size 220	NHJCZ34
	Size 156	NHJCZ58
	Size 070	DFR0690002D
36	Cover Plate / Bushing Assembly	
	Size 220	32A9532X01D
	Size 156	32A9532X01D
	Size 070	32A9533X01D
37	Bushing, Cover Plate	
	Size 220	12A9374X01D
	Size 156	12A9374X01D
	Size 070	DFR070X001D
38	Travel Scale	
	Size 220	28A8492X01D
	Size 156	28A8492X01D
	Size 070	28A8533X01D
39	Machine Screw, Travel Scale	
	Size 220 (2 Required)	1V74353522D
	Size 156 (2 Required)	1V74353522D
	Size 070 (2 Required)	1V74353522D
40	Hub	
	Size 220	See Table 6
	Size 156	See Table 6
	Size 070	See Table 6
41	Retaining Ring, Hub, Carbon Steel	
	Size 220	12A9455X01D
	Size 156	12A9455X01D
	Size 070	12A9409X01D
42	Travel Indicator, Stainless Steel	
	Size 220	28A8495X01D
	Size 156	28A8495X01D
	Size 070	28A8534X01D
43	Machine Screw, Travel Indicator, Stainless Steel	
	2 Required	1V74353522D
44	Washer, Cover Plate, Zinc Plated Steel	
	Size 220 (4 Required)	FWZ12
	Size 156 (4 Required)	FWZ12
	Size 070 (4 Required)	FWZ38



Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

Parts (Continued)

Key	Description	Part Number
45	Cap Screw , Cover Plate, Zinc Plated Steel	
	Size 220 (4 Required)	H5CZ12.114
	Size 156 (4 Required)	H5CZ12.114
	Size 070 (4 Required)	H5CZ38.100
46	Positioner Plate , Steel	
	Size 220	22A9359X01D
	Size 156	22A9359X01D
	Size 070	22A9359X01D
47	Cap Screw , Positioner Plate	
	4 Required	1C27522405D
48	Access Plate , Steel	12A9638X01D
49	Cap Screw , Access Plate	1A33212898D
	4 Required	
50	Nameplate	NAMEXSRACTD

PARTS - DFR Handwheel Parts List

KEY	PART DESCRIPTION	SIZE 070	SIZE 156	SIZE 220
100	NYLOCK HEX NUT	DFO30109X1D	DFO30109X1D	DFO30109X1D
101	WASHER	DFO60110X1D	DFO60110X1D	DFO30111X1D
102	HANDWHEEL	DFO40106X1D	DFO30106X1D	DFO50106X1D
103	STEM	DFR70102X1D	DFR50102X1D	DFR20102X1D
104	LOCK NUT	DFO60107X1D	DFO60107X1D	DFO30107X1D
105	BODY	DFR70101X1D	DFR50101X1D	DFR20101X1D
106	GREASE FITTING	-	-	DFO3011X01D
107	O-RING, STEM	1D23750699D	1B8855X004D	1E73690699D
108	O-RING, BODY/CASING	1D26730699D	1D54710699D	1D26910699D
109	CAP SCREW, BODY/CASING	1A36842405D - Qty: 6	1A36842405D - Qty: 8	H5CZ12.100 - Qty: 8
110	PUSHER PLATE RETAINER	DFO60111X1D	DFO60111X1D	-
111	CAP SCREW, PUSHER PLATE RETAINER	DFO60114X1D - Qty: 3	DFO60114X1D - Qty: 3	-
112	PUSHER PLATE	DFO60103X1D	DFR50103X1D	DFO30103X1D
113	SPRING PIN	DFO60115X1D	DFR20115X1D	-
114	THRUST WASHER	-	-	DFO30104X1D
115	BEARING RACE - PART OF THRUST BEARING	-	-	-
116	THRUST BEARING	-	-	DFO30105X1D
117	CAP SCREW - LEFT-HAND THREAD	-	-	DFO30108X1D
24	UPPER DIAPHRAGM CASING	2E80632506D	2E84742506D	2N13102506D

Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual



PARTS - DFR Up Travel Stop Parts List

KEY	PART DESCRIPTION	SIZE 070	SIZE 156	SIZE 220
103	STEM	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
105	BODY	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
104	LOCK NUT	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
106	GREASE FITTING	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
107	O-RING, STEM	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
108	O-RING, BODY/CASING	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
109	CAP SCREW, BODY/CASING	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
110	PUSHER PLATE RETAINER	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
111	CAP SCREW, PUSHER PLATE RETAINER	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
112	PUSHER PLATE	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
113	SPRING PIN, PUSHER PLATE	Consult Dyna-Flo	Consult Dyna-Flo	-
114	THRUST WASHER	-	-	Consult Dyna-Flo
115	BEARING RACE - PART OF THRUST BEARING	-	-	Consult Dyna-Flo
116	THRUST BEARING	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
117	CAP SCREW - LEFT-HAND THREADED	-	-	Consult Dyna-Flo
118	CLOSING CAP	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
24	UPPER DIAPHRAGM CASING	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo

PARTS - DFR DOWN Travel Stop Parts List

KEY	PART DESCRIPTION	SIZE 070	SIZE 156	SIZE 220
103	STEM	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
105	BODY	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
107	O-RING, CLOSING CAP/BODY	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
108	O-RING, BODY/CASING	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
109	CAP SCREW, BODY/CASING	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
118	CLOSING CAP	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
119	JAM NUT	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
120	HEX NUT	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
121	JAM NUT	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
122	WASHER, SMALL	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
123	WASHER, LARGE	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
124	UPPER DIAPHRAGM PLATE	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo
24	UPPER DIAPHRAGM CASING	Consult Dyna-Flo	Consult Dyna-Flo	Consult Dyna-Flo



Model DFR 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual

Table 6

Parts Table DFR220

SHAFT SIZE Inch	YOKE/BUSHING ASSEMBLY (Key 2)	BUSHING (Key 1)	LEVER (Key 32)	HUB (Key 40)	HUB MATERIAL
1	12A9799X0HD	DFRBShX100D	32A9574X01D	22A9420X02D	Aluminum
1-1/4	12A9799X0JD	DFRBShX125D	32A9575X01D	22A9500X02D	Aluminum
1-1/2	12A9799X0KD	DFRBShX150D	32A9576X01D	22A9501X02D	Aluminum
1-3/4	12A9799X0LD	DFRBP411X1D	32A9679X01D	24A6358X01D	S41600
2	12A9799X0MD	DFRBP412X1D	32A9679X01D	24A6358X01D	S41600

DFR156

SHAFT SIZE Inch	YOKE/BUSHING ASSEMBLY (Key 2)	BUSHING (Key 1)	LEVER (Key 32)	HUB (Key 40)	HUB MATERIAL
3/4	12A9799X0DD	DFRBShX750D	32A9589X01D	22A9499X01D	S41600
7/8	12A9799X0FD	DFRBShX875D	32A9590X01D	22A9420X02D	Aluminum
1	12A9799X0HD	DFRBShX100D	32A9590X01D	22A9420X02D	Aluminum
1-1/4	12A9799X0JD	DFRBShX125D	32A9591X01D	22A9500X02D	Aluminum
1-1/2	12A9799X0KD	DFRBShX150D	32A9592X01D	22A9501X02D	Aluminum

DFR070 Parts Table

SHAFT SIZE Inch	YOKE/BUSHING ASSEMBLY (Key 2)	BUSHING (Key 1)	LEVER (Key 32)	HUB (Key 40)	HUB MATERIAL
5/8	12A9799X0BD	DFRBShX625D	32A9568X01D	22A9419X02D	Aluminum
3/4	12A9799X0CD	DFRBShX750D	32A9569X01D	22A9497X02D	Aluminum
7/8	12A9799X0ED	DFRBShX875D	32A9570X01D	22A9486X02D	Aluminum
1	12A9799X0GD	DFRBShX100D	32A9570X01D	22A9486X02D	Aluminum

Parts Ordering

Whenever corresponding with Dyna-Flo about a DFR actuator, refer to the nameplate (Key 53) 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 070/156/220 Rotary Actuator

Operation, Parts, and Instruction Manual



Table 7

DFR Spring (Key 19) Information

Actuator Size	Casing Pressure		Initial Spring Compression				Part Number
	Psig	kPag	Push-Down-To-Open		Push-Down-To-Close		
			Psig	kPag	Psig	kPag	
070	0 - 18	0 - 124	3.0	21	3.0	21	1L21742704D
			4.3	30	3.0	21	1P63712708D
	0 - 33	0 - 228	4.3	30	4.3	30	1P63712708D
			6.0	41	3.0	21	1L21732704D
	3 - 27	21 - 186	4.3	30	3.4	23	1P63712708D
			6.0	41	3.1	21	1L21732704D
156	0 - 18	0 - 124	3.7	26	3.0	21	1K16272708D
	0 - 33	0 - 228	7.0	48	3.0	21	1K16282708D
	3 - 27	21 - 186	7.0	48	3.1	21	1K16282708D
			-	-	3.1	21	1K16272708D
220	0 - 33	0 - 228	10.1	70	3.0	21	1R67602708D
	3 - 27	21 - 186	-	-	3.1	21	1R67602708D



Model DFR 070/156/220 Rotary Actuator

MODEL NUMBERING SYSTEM

SAMPLE PART NUMBER: DFR-070-C-06S1-D-RA1

ACTUATOR							070	
070	SIZE 070	156	SIZE 156	220	SIZE 220		C	
FAIL POSITION								
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)						06	
SHAFT CONNECTION SIZE								
04	1/2 INCH	05	5/8 INCH	06	3/4 INCH	07		7/8 INCH
08	1 INCH	10	1-1/4 INCH	12	1-1/2 INCH	14		1-3/4 INCH
16	2 INCH						S	
SHAFT CONNECTION TYPE								
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)							D	
E	1L21732704D			D	1P63712708D			
G	1R67602708D			F	1K16282708D			
I	1L21742704D			K	1K16272708D			
HANDWHEELS / TRAVEL STOPS							-	
-	NONE (STANDARD)			D	ADJUSTABLE DOWN STOP (DFR 070-220)			
U	ADJUSTABLE UP STOP (DFR 070-220)			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 -

Our Commitment to Quality

Dyna-Flo is committed to continuous improvement. While all efforts have been made to ensure the accuracy of the content in this document, modifications or improvements to the information, specifications, and designs may occur at any time without notice. This document was published for informational purposes only, and does not express or imply suitability, a warranty, or guarantee regarding the products or services described herein or their use or applicability.

Neither Dyna-Flo Control Valve Services Ltd., nor any of their affiliated entities assumes responsibility for the selection, use and maintenance of any product. Responsibility for selection, use and maintenance of any product remains with the purchaser and end-user.