

Model DFC Linear Actuator

Operation, Parts, and Instruction Manual



Figure 1 360 Control Valve & DFC Actuator



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NOTICE

These instructions are meant to be used with the Dyna-Flo DFC / DFO Technical Bulletin as they refer to Figures and Tables therein. If you do not have the Technical 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 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 DFC Valve 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 done by experienced personnel. Throughout the manual, safety and caution notes appear and must be strictly followed to prevent serious injury or equipment malfunction.

SCOPE

This manual will provide detailed information on the complete disassembly and reassembly of the Model DFC pneumatic actuator. Refer to separate instruction manuals for the installation of positioners and all other accessories used with these actuators. 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 to successfully using the Dyna-Flo Model DFC for many years.

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 valves have dangerous pinch points. Never put your hands inside the valve unless you are certain that the plug and stem will not move.

MAXIMUM CASING PRESSURE LIMITS

DFC casings and diaphragms are pressure operated and this pressure is used to compress the actuator spring which strokes the actuator stem. Refer to the definitions in the NOTES of Table 1 for explanations of the Maximum Pressure Limits for DFC actuators, also refer to the nameplate (Key 29) for the maximum values specific to your actuator.

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Table 1

SPECIFICATION		ACTUATOR SIZE								
		1046	1069	2069	2105	2156	3105	3156	3220 ⁽¹⁾	
Nominal Effective Area	inch ²	46	69	69	105	156	105	156	220	
	cm ²	297	445	445	667	1006	677	1006	1419	
Yoke Boss Diameter	inch	2-1/8	2-1/8	2-13/16	2-13/16	2-13/16	3-9/16	3-9/16	3-9/16	
	mm	54	54	71	71	71	90	90	90	
Acceptable Valve Stem Diameter	inch	3/8	3/8	1/2	1/2	1/2	3/4	3/4	3/4	
	mm	9.5	9.5	12.7	12.7	12.7	19.1	19.1	19.1	
Maximum Allowable Output Thrust	lb	2,300	2,300	2,700	5,650	7,550	5,650	6,800	8,800	
	N	10,230	10,230	12,010	25,131	33,582	25,131	30,246	39,142	
Maximum Travel⁽²⁾	Standard	inch	3/4	1-1/8	1-1/2	2	2	2	2	3 ⁽³⁾
		mm	19	29	38	51	51	51	51	76
	Top-Loaded	inch	---	3/4	---	3/4	---	---	1-1/8	---
		mm	---	19	---	19	---	---	29	---
Maximum Casing Pressure for Actuator Sizing^(4,5)	Psig	55	70	70	65	55	65	55	50	
	kPag	380	483	483	448	379	448	379	345	
Maximum Excess Diaphragm Pressure⁽⁴⁾	Psig	55	20	20	10	10	10	10	10	
	kPag	380	138	138	69	69	69	69	69	
Maximum Diaphragm Casing Pressure^(4,5)	Psig	110	90	90	75	65	75	65	60	
	kPag	760	621	621	517	448	517	448	414	
Approximate Weight	lbs	34	48	50	90	121	94	122	254	
	Kg	15	22	23	41	55	43	55	115	
Material Temperature Capabilities	Nitrile Elastomers	-40 to 180°F (-40 to 82°C)								
	Silicone Elastomers	-65 to 300°F (-54 to 149°C)								

NOTES:

- (1) These values also apply to the DFC Size 3220-4 actuator.
- (2) Actuator travel may be less than the value listed after connected to the valve.
- (3) Maximum actuator travel for the 3220-4 is 4 inches (102 mm).
- (4) Additional pressure may be added to the actuator when the actuator is at full travel. Damage to the actuator will occur if the Maximum Excess Diaphragm Pressure is exceeded. When the actuator has reached its full travel, and the diaphragm plate (Key 19) is physically stopped from moving, the energy from additional pressure is transferred to the diaphragm (Key 18) and casing (Key 22). The amount of excess pressure that can be added at full travel is limited, exceeding this limiting factor will result in damage to the actuator, leakage, and/or casing fatigue or deformation.
- (5) This Maximum Casing Pressure is not to be used for normal operating pressure. Its purpose is to allow for typical regulator supply settings and/or relief valve tolerances. The maximum casing pressure is the pressure that can be applied to the actuator when the actuator is at less than full travel. Damage to the actuator may occur if this pressure is exceeded before the full travel is reached.



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UNPACKING VALVE FROM SHIPPING CONTAINER

Special Tools Required:

- Properly Rated Lifting Straps (2 – 4 Straps). Refer to 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 29). Refer to Figure 2 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.

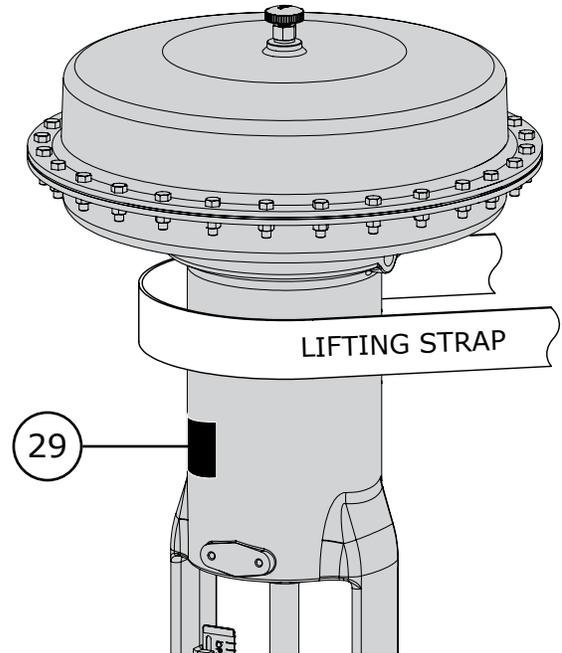


Figure 2 Actuator Lifting Suggestions

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.
- Use safe work practices and lock out procedures before placing valve in-line.
- Standard actuators accept 1/4" (6 mm) NPT connections.
- **Warning:** Do not use operating pressure that exceeds the Maximum Casing Pressure. Also, be sure the operating pressure does not create a force on the actuator stem (Key 13) that is greater than the Maximum Allowable Output Thrust. Refer to Table 1.
- **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.

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 inline.

If the actuator was shipped separately, it will be necessary to mount the actuator to the valve prior to installation, refer to the Actuator Mounting section (Page 7). Before the actuator can be mounted, ensure that the actuator travel has been checked and that the actuator has been properly bench set. Refer to the Bench Setting section (Page 5) for information on verifying actuator travel and bench setting instructions.

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. For information regarding instrument mounting pad dimensions for DFC actuators, refer to Pages 30 & 31.

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AIR PIPING

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 NPT connection from 1/2" (12.7 mm) to 1/4" (6 mm), the bushing fitting is removable (Refer to Figure 25).

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.

BENCH SETTING ACTUATOR

NOTE: To prevent damage to the valve stem (Key V), it is recommended that bench setting be performed with the actuator removed from the valve. If the actuator cannot be removed from the valve, disconnect the actuator stem (Key 13) from the valve stem and place the valve into its closed position.

- 1 The following procedures must be completed before installing the connecting block (Key 27). If the connecting block is still attached to the actuator stem (Key 13), remove it by removing the connecting block cap screws (Key 28). Refer to Figures 11 & 12.
- 2 To properly verify the bench set, 3 pieces of information are required:
 - A Upper Bench Set Loading Pressure.
 - B Lower Bench Set Loading Pressure (example: for a 10-30 Psig bench set, 10 is the lower and 30 Psig the upper).
 - C Travel.

This information is available on the actuator nameplate (Key 29). If the information is missing or incomplete, contact your Dyna-Flo Sales Office.

- 3 Before applying pressure to the diaphragm casing, make sure that the spring (Key 1) is properly seated onto the spring seat (Key 14). This step is not required for a new, factory assembled actuator.
- 4 Connect an operating medium supply line with a gauge (that can accurately measure both 0 Psi and the upper bench set pressure limit) to the actuator. Refer to Figure 3.

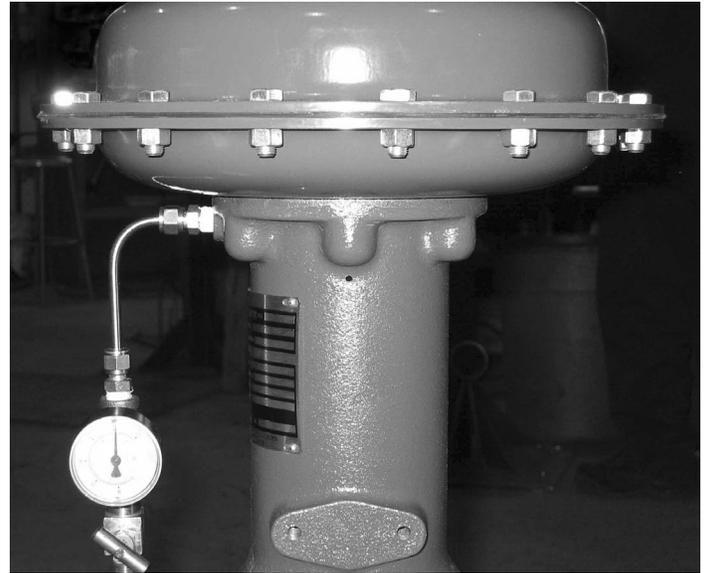


Figure 3 Supply Line and Gauge

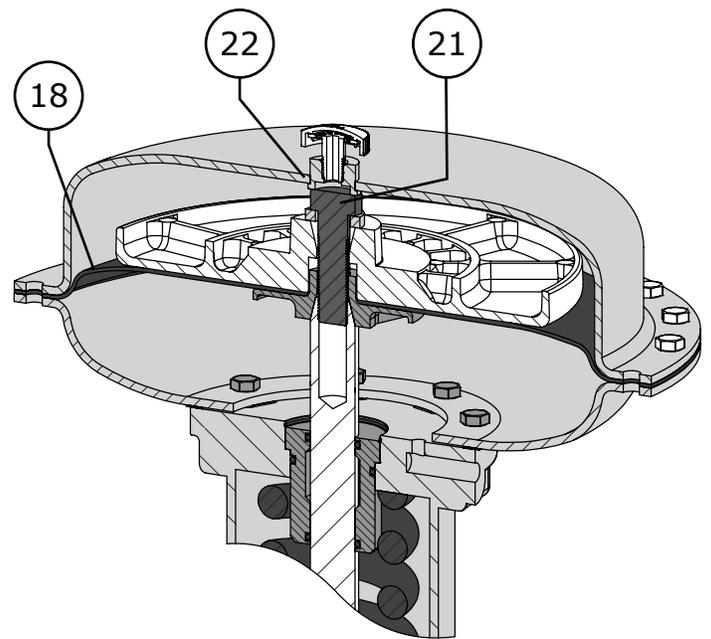


Figure 4 Correct Upper Bench Set Loading Pressure Position



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BENCH SETTING ACTUATOR (Continued)

- 5 Apply the maximum casing pressure to the actuator to verify seal integrity. Use a soapy solution to check for any air leaks from the lower casing gasket (Key 9) and the diaphragm (Key 18). This step will have been performed at the factory and will not be required for new actuators.
- 6 Apply the upper bench set loading pressure plus 5 Psi (34 kPa). Make note of where the actuator stem (Key 13) travel stops. The actuator stem travel should stop when the cap screw head (Key 21) makes contact with the upper diaphragm casing (Key 22) or installed Up Travel Stop (refer to Figures 4, 29 & 30). **NOTE:** The cap screw head should make contact with upper diaphragm casing when the upper bench set loading pressure is reached (example: For a 10-30 Psig bench set, travel should stop at 30 Psig).

Applying 5 Psi (34 kPa) above or below the upper bench set loading pressure should help to verify the accuracy of the desired travel.

If stem travel stops before upper bench set limit:
Adjust the spring adjuster (Key 15) to the right (counter-clockwise) to increase the bench set pressure required. It may be necessary to lower the loading pressure to make adjustments to the spring adjuster. Refer to Figure 5.

If stem travel stops after the upper bench set limit:
Adjust the spring adjuster (Key 15) to the left (clockwise) to decrease the bench set pressure required. It may be necessary to lower the loading pressure to make adjustments to the spring adjuster. Refer to Figure 5.

- 7 Decrease the loading pressure to the lower bench set limit, the actuator stem (Key 13) should lower towards the direction of the valve (if a valve were installed). Mark the position of the bottom of the actuator stem using the method shown in Figure 6 or equivalent.
- 8 Increase the loading pressure to the upper bench set limit and mark the position of the bottom of the actuator stem (Key 13).
- 9 The measurement between the marked upper and lower bench set limit should equal the travel indicated on the nameplate (Key 29) to within 1/16" (1.6 mm). If the measurements match then the bench set is complete, proceed to the Actuator Mounting section.

If the measurements do not match then an incorrect or damaged parts may be the problem. Contact Dyna-Flo Control Valve Services for more information.

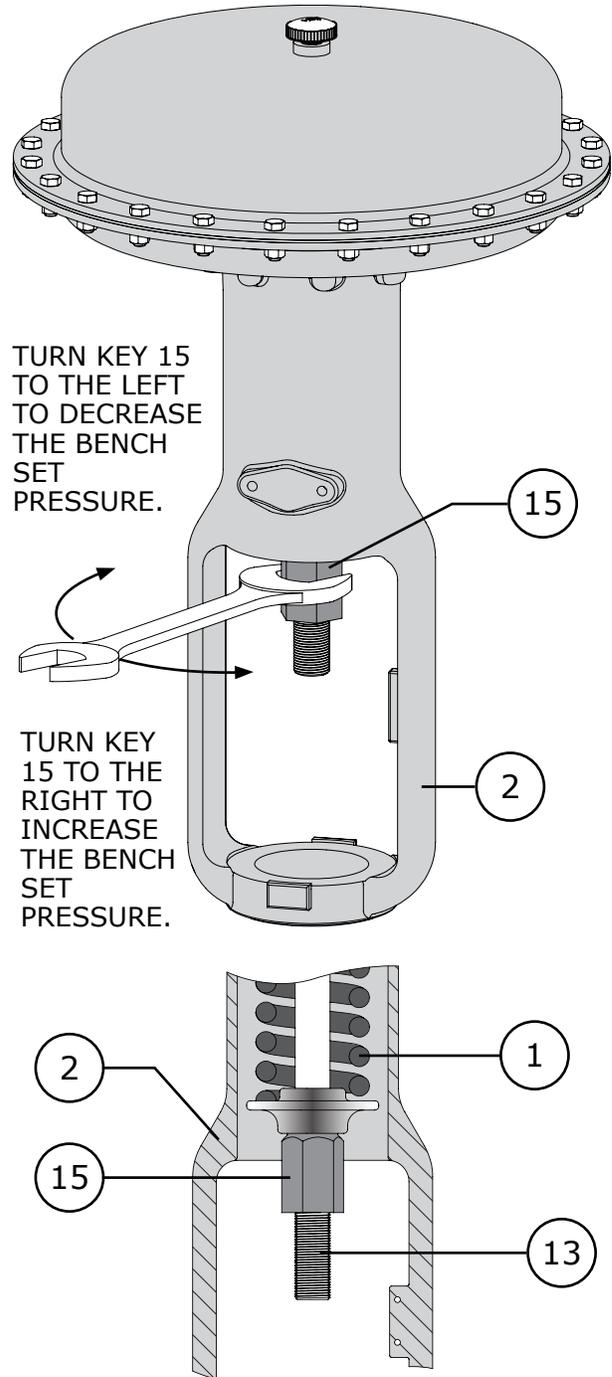


Figure 5 Spring Adjustment

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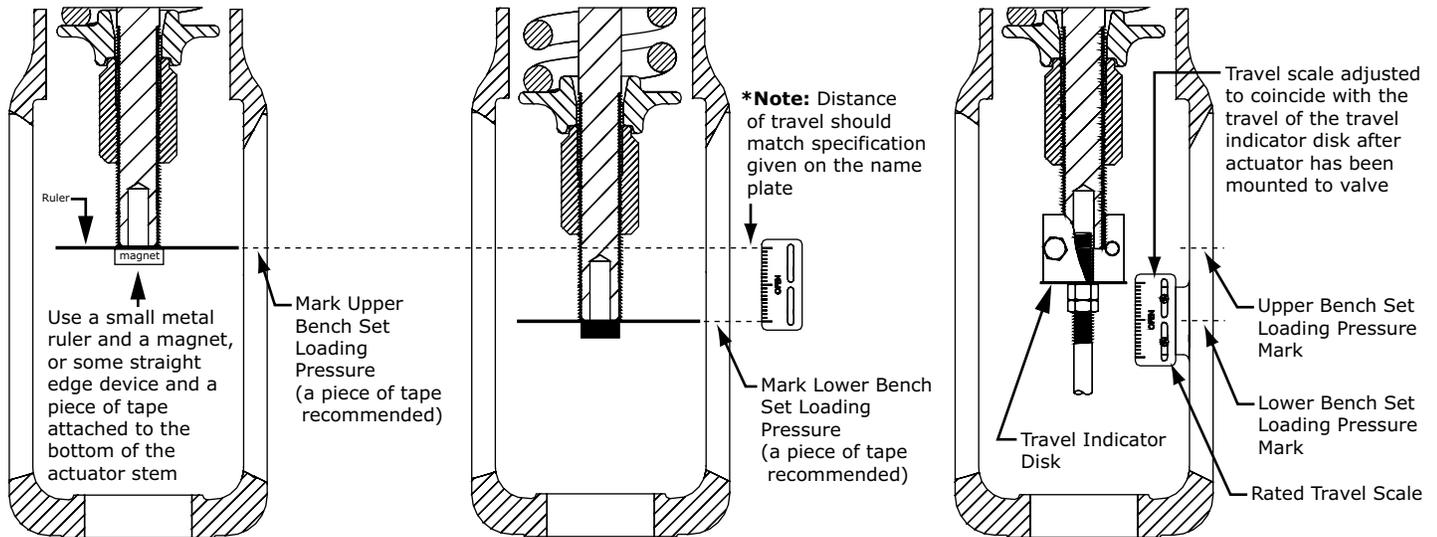


Figure 6 Bench Set Travel Adjustment Diagram

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 before placing valve in-line.
- Standard actuators accept 1/4" (6 mm) NPT connections.
- **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.
- Sudden movement of actuator can cause damage or injury. It helps to have the actuator de-energized but it may be necessary to apply operating pressure temporarily to move the actuator stem (Key 13) away from the valve stem during mounting. Also, place the valve into its closed position to allow for more clearance between stems.

If it is not possible to apply operating pressure to the actuator during mounting, use caution when lowering the actuator onto the valve body to avoid damage to stems and threads.

- 1 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. **NOTE:** Refer to Figures 32 and 33 on Page 30 for information about instrument mounting pad dimensions. Be aware that the lower mounting pad of the actuator yoke (Key 2) is the standard instrument mounting location and should be orientated to be in-line with the flow path of the valve on the side of the valve with the flow arrow (Refer to Figure 7).



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ACTUATOR MOUNTING (Continued)

- 3 Completely thread the jam nut (Key 36) and hex nut (Key 35) onto the valve stem (Key V). Apply Permatex® Nickel Anti-Seize (Key A) to the threads of the valve bonnet.
- 4 Set the yoke locknut (Key 37) inside the yoke (Key 2) of the actuator, or have the yoke locknut ready to be placed between the actuator stem (Key 13) and valve stem (Key V) while lowering the actuator into place on the valve. Have the travel disc (Key 34) ready to be placed on the valve stem as well.
- 5 Carefully lift and lower the actuator into place on the valve body as shown in Figure 7. Refer to Unpacking Valve From Shipping Container (Page 4) for information on proper lifting techniques. As the yoke passes over the valve stem, insert the yoke locknut (Key 37) and travel disc (Key 34) between the actuator stem (Key 13) and valve stem (Key V) as shown in Figure 8. The travel disc should be placed on top of the hex nut (Key 35) concave side facing towards the valve body.
- 6 Completely lower the actuator into place on the valve and orientate the actuator with the window of the yoke (Key 2) parallel with the front of the valve body so the lower mounting pad facing the front of the valve as shown in Figure 7.
- 7 Secure the actuator to the valve by tightening the yoke locknut (Key 37) on the valve bonnet.

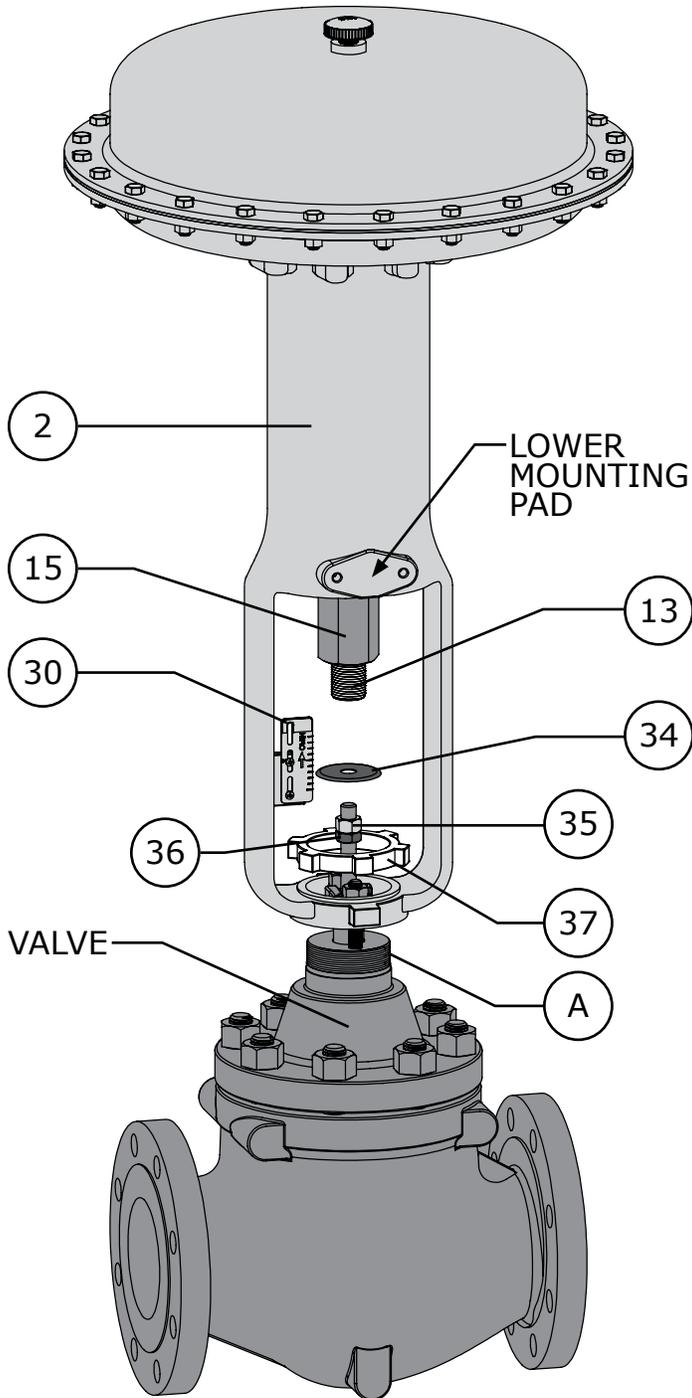


Figure 7 Actuator Mounting

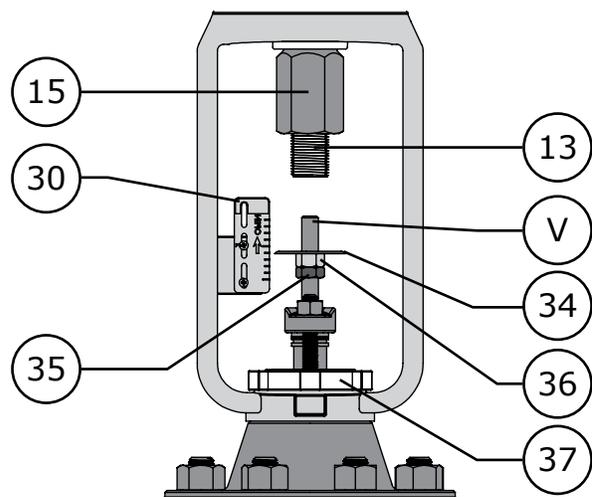


Figure 8 Actuator Mounting Detail

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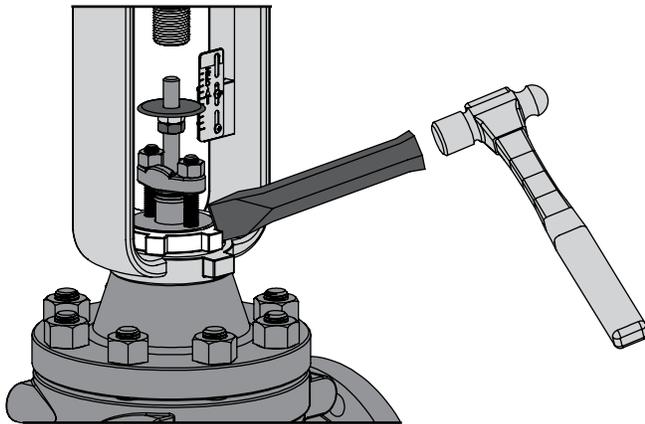


Figure 9 Yoke Locknut Tightening Detail

ACTUATOR MOUNTING (Continued)

CONNECTING BLOCK INSTALLATION

WARNING: It is important that the valve stem not be rotated while the valve plug is seated during stem connector installation. Valve plug and stem rotation can cause damage to the seating surface and stem threads.

NOTE: The threads of the actuator stem (Key 13) and valve stem (Key V) should engage the threads of the connecting block (Key 27) by a distance equal to that of the diameter of the stem or greater. Refer to Figure 10.

- 1 Make sure that the valve has been placed into its closed position by pushing the valve stem (Key V) into the valve body.
- 2 Apply the upper bench set operating pressure to the actuator. Refer to the actuator nameplate (Key 29).
- 3 Loosely install the travel scale (Key 30) using the speed nuts (Key 33) and machine screws (Key 32). Adjust the jam nut (Key 36), hex nut (Key 35), and travel disc (Key 34) so that the travel disc is set to the lowest mark (closed position) of the travel scale.
- 4 Adjust the valve plug/stem so that the valve is in its full open position.

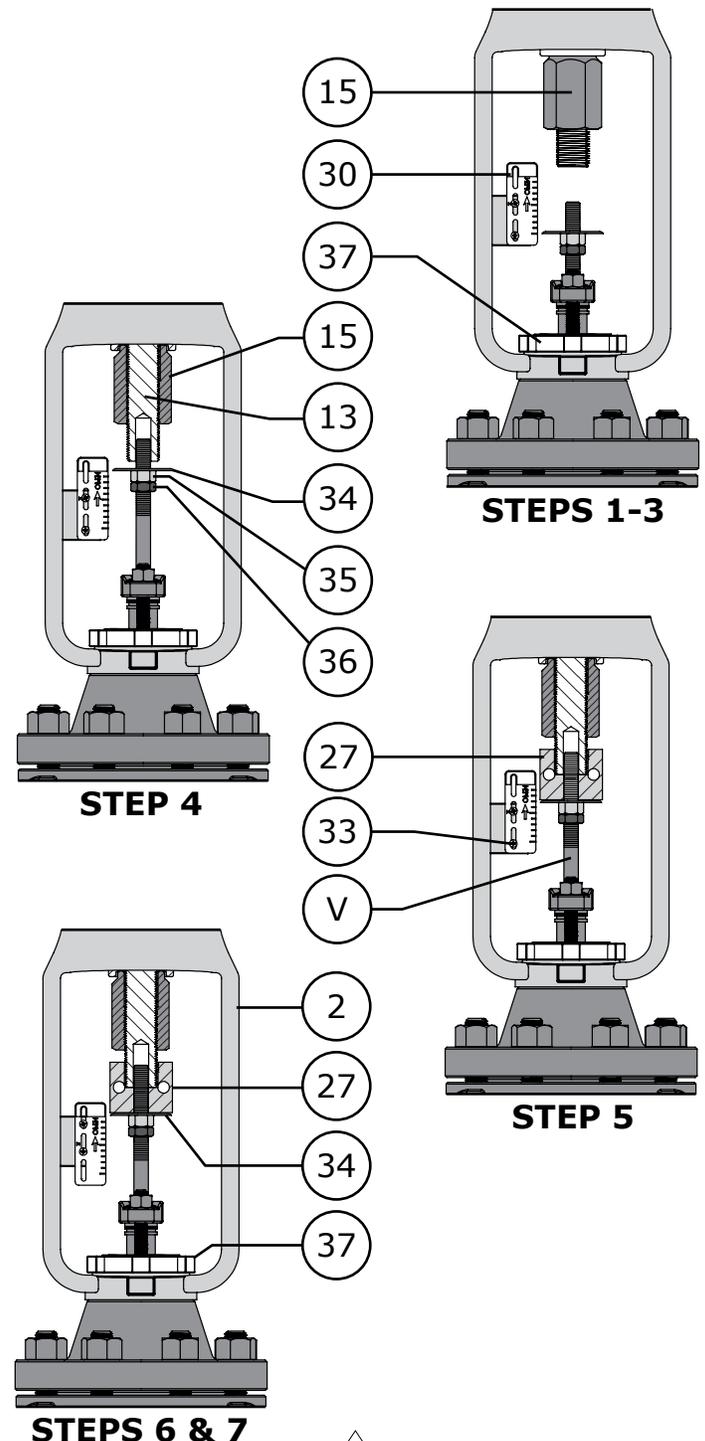


Figure 10 Connecting Block Installation



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ACTUATOR MOUNTING (Continued)

CONNECTING BLOCK INSTALLATION (Continued)

- 5 Align the connecting block (Key 27) with the window of the yoke (Key 2) and install the connecting block using cap screws (Key 28), refer to Figure 11. Be careful to achieve proper thread engagement between the stems and the connecting block, avoid cross-threading any threads. A slight change to operating pressure may be necessary to help with alignment.
- 6 Adjust the jam nut (Key 36), hex nut (Key 35), and travel disc (Key 34) so that the travel disc is touching the bottom of the connecting block (Key 27). Lock the travel disc in place using the hex nut and jam nut, do not overtighten the nuts.
- 7 Re-position the travel scale (Key 30) so that the travel disc (Key 34) is aligned with the top mark (open position) of the travel scale.
- 8 Stroke the actuator and valve to verify that the travel and travel scale are accurate. If the travel is not correct it may be necessary to repeat the stem connector installation or bench set procedures.

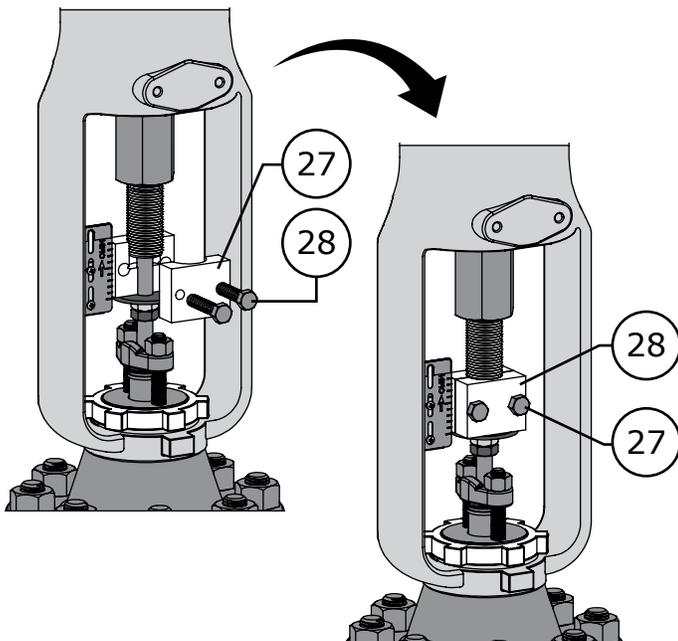


Figure 11 Standard DFC Connecting Block Assembly

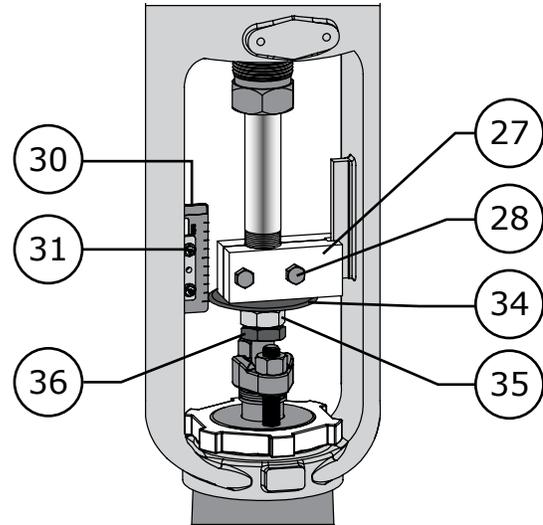


Figure 12 Size 3220 & 3220-4 DFC Connecting Block Detail

ACTUATOR DISASSEMBLY

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. De-energize the actuator before disassembly.
- Use safe work practices and lock out procedures.
- Standard actuators accept 1/4" (6 mm) NPT connections.
- **WARNING:** Do not use operating pressure that exceeds the Maximum Casing Pressure. Also, be sure the operating pressure does not create a force on the actuator stem (Key 13) that is greater than the Maximum Allowable Output Thrust. Refer to Table 1.
- **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.
- 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. Refer to the appropriate valve instruction manual.

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ACTUATOR DISASSEMBLY (Continued)

- 1 If the valve has been removed from line, disconnect any tubing, piping, or instrumentation from the actuator.
- 2 Remove all spring tension by turning the spring adjuster (Key 15) counter-clockwise (to the left). Refer to Figure 5. For handwheels or travel stops, refer to Pages 20 & 52.
- 3 For complete actuator disassembly it will be necessary to separate the actuator from the valve:
 - A Loosen the jam nut (Key 36) and hex nut (Key 35). Lower the jam nut, hex nut, and travel disc (Key 34) away from the connecting block (Key 27).
 - B Remove the connecting block cap screws (Key 28) and separate and remove the connecting block (Key 27).
 - C Secure the actuator for hoisting using the procedures mentioned in the Unpacking section (Page 4). Using a heavy blunted chisel or metal rod and a hammer, loosen the yoke locknut as shown in Figure 9.
 - D Carefully lift the actuator from the valve, remove the yoke locknut (Key 37) from between the valve and actuator as the actuator is lifted.
 - E Secure the actuator in a clamping device that will support the weight of the actuator.
- 4 To perform maintenance on the diaphragm (Key 18) while leaving the actuator mounted to the valve, remove the connecting block (Keys 27 & 28) so that the actuator stem (Key 13) cannot rotate the valve stem which could damage the plug/seat ring. Proceed to UPPER DIAPHRAGM CASING DISASSEMBLY on Page 12.

SPRING REMOVAL

- 1 Unscrew the spring adjuster (Key 15) from the actuator stem (Key 13) so as not to let the spring seat (Key 14) and spring (Key 1) drop out from the yoke (Key 2). Refer to Figure 13.

NOTE: For most actuator sizes the spring (Key 1) can not be removed from the yoke (Key 2) until after the actuator stem (Key 13) has been removed. For these actuators it will be necessary to leave the spring adjuster (Key 15) and spring seat (Key 14) on the actuator stem to support the spring until the actuator stem can be removed. It is recommended to place a block between the bottom of the actuator stem and the yoke.
- 2 Clean and inspect all parts for damage, especially threads. Replace all damaged parts as necessary.

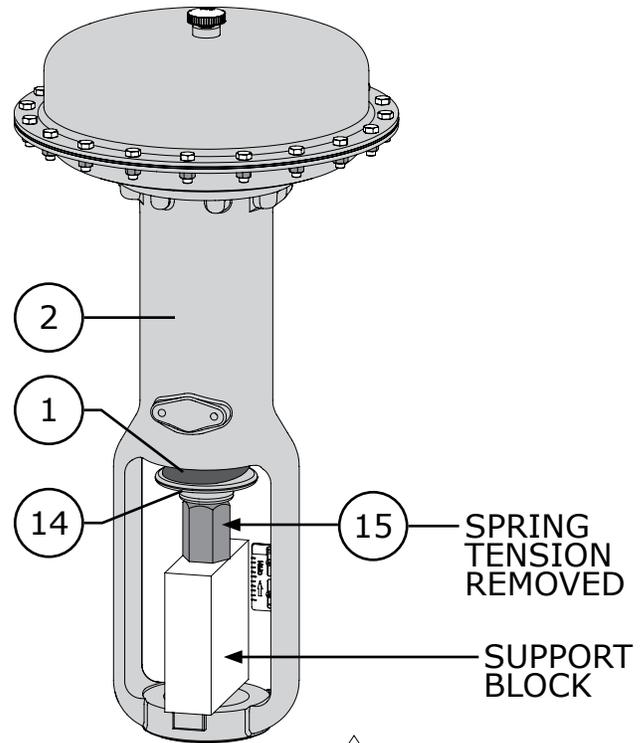


Figure 13 Spring Removal Step 1

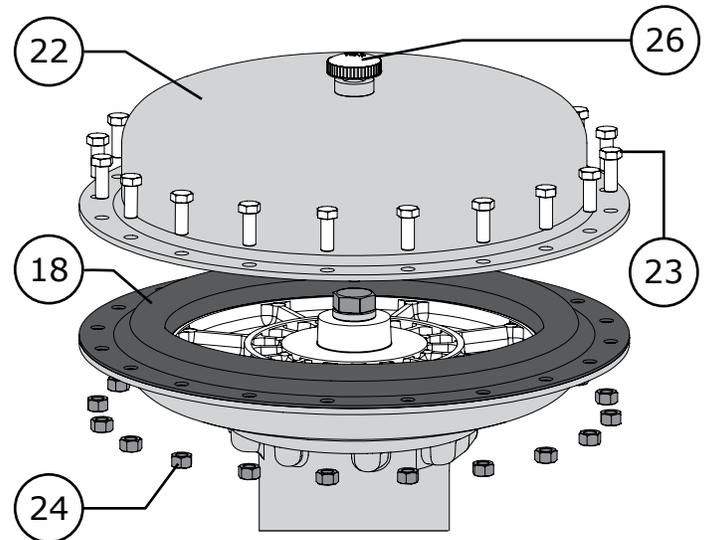


Figure 14 Upper Diaphragm Casing Disassembly Steps 1 & 2



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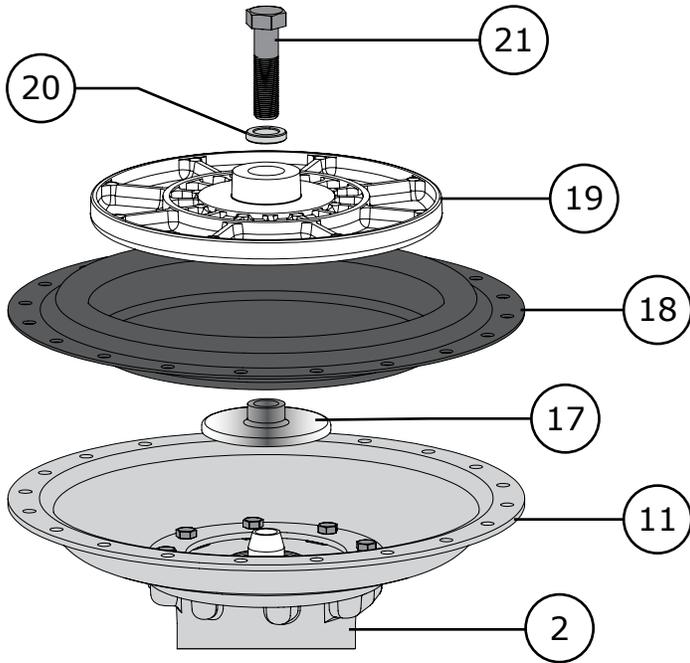


Figure 15 Upper Diaphragm Casing Disassembly Steps 3 & 4

ACTUATOR DISASSEMBLY (Continued)

UPPER DIAPHRAGM CASING DISASSEMBLY

- 1 Remove the casing cap screws (Key 23) and nuts (Key 24), Refer to Figures 14 and 25.
- 2 Remove the upper diaphragm casing (Key 22).
- 3 Carefully remove the cap screw (Key 21) and travel stop spacer (Key 20) from the top of the actuator stem (Key 13). **NOTE:** It maybe be necessary to thread two nuts onto the actuator stem, lock them in place, and use a wrench on these nuts to keep the actuator stem from rotating while removing the cap screw. Support the actuator stem from the bottom as described in Step 1 of Spring Removal before loosening the cap screw.
- 4 Remove the upper diaphragm plate (Key 19).
- 5 Remove the diaphragm (Key 18).
- 6 Remove the lower diaphragm plate (Key 17).

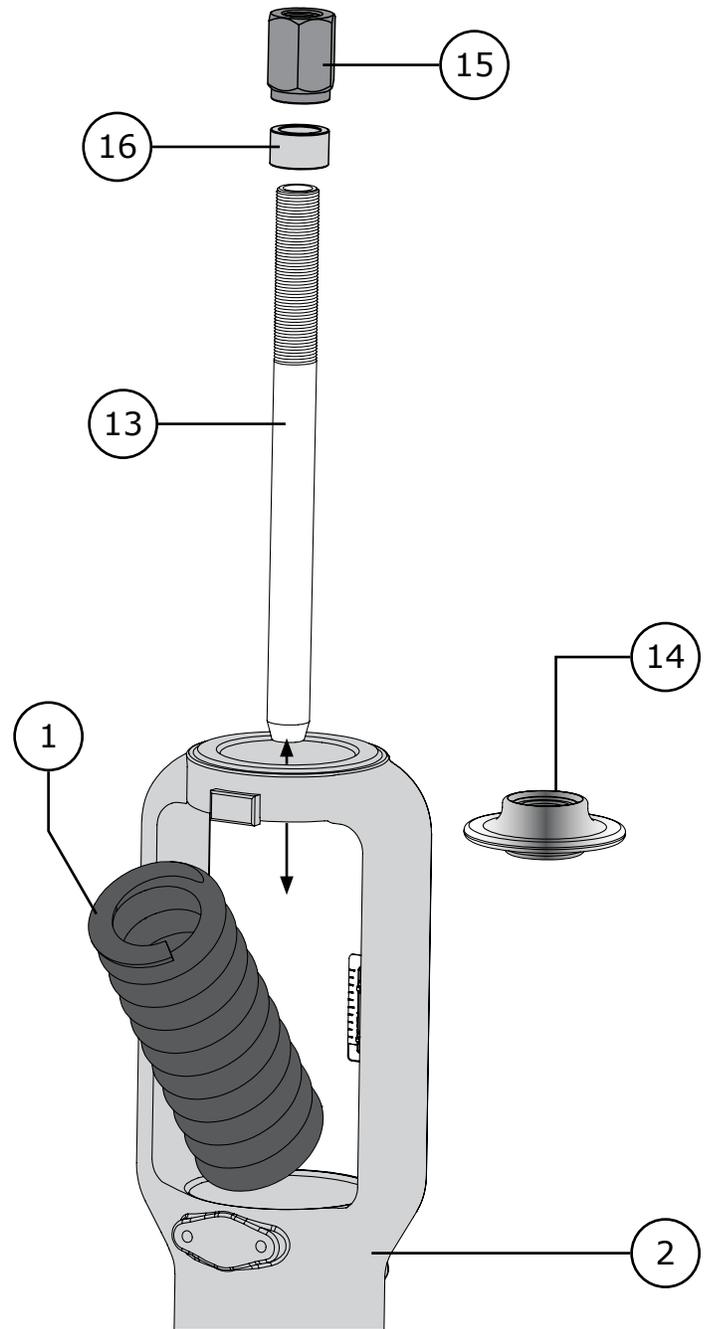


Figure 16 Upper Diaphragm Casing Disassembly Steps 7-10

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ACTUATOR DISASSEMBLY (Continued)

UPPER DIAPHRAGM CASING DISASSEMBLY

(Continued)

- 7 Carefully flip the actuator upside down and remove the support block. Pull the actuator stem (Key 13) up out of the bushing (Key 5) and out the bottom of the yoke (Key 2). Refer to Figures 16.
- 8 Remove the spring adjuster (Key 15) from the actuator stem (Key 13). Also, remove the spacer (Key 16) if included, refer to Figures 16 & 27.
- 9 Remove the spring seat (Key 14) and spring (Key 1) from inside the yoke (Key 2). **NOTE:** For size 3220-4 actuators the spring casing adapter (Key 3) must be removed from the yoke (Key 2) to remove the spring. Refer to Figure 18.
- 10 Inspect all parts for damage, replace or repair parts as necessary.

LOWER DIAPHRAGM CASING DISASSEMBLY

- 1 Remove the cap screws (Key 12) and remove the lower diaphragm casing (Key 11) from the yoke (Key 2).
- 2 Remove the gasket (Key 9). **NOTE:** Size 3220 and 3220-4 actuators make their seal using an o-ring (Key 10) instead of a gasket. Remove the o-ring (Figure 18).
- 3 Carefully remove the snap ring (Key 8) and remove the bushing (Key 5) from the yoke (Key 2). Refer to Figure 19.
- 4 Using a pick set, carefully remove the o-rings (Keys 6 & 7) from the bushing (Key 5). Refer to Figure 20.
- 5 Inspect all parts for damage, especially sealing surfaces, gasket surfaces and o-ring grooves. Replace or repair parts as necessary, all o-rings and gaskets should be replaced.

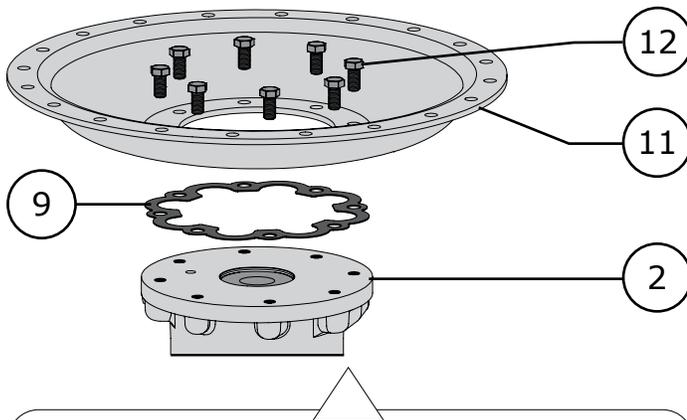


Figure 17 Lower Diaphragm Casing Disassembly Steps 1 & 2

SIZE 3220-4 SPRING CASE ADAPTER REMOVAL

Size 3220-4 actuators have extended travel and as such are constructed with a spring case adapter (Key 3) installed between the lower diaphragm casing (Key 11) and the yoke (Key 2).

- 1 After the lower diaphragm casing (Key 11) has been removed, remove the socket head cap screws (Key 4) and separate the spring case adapter (Key 3) from the yoke (Key 2).
- 2 Remove the spring (Key 1) from the yoke (Key 2).

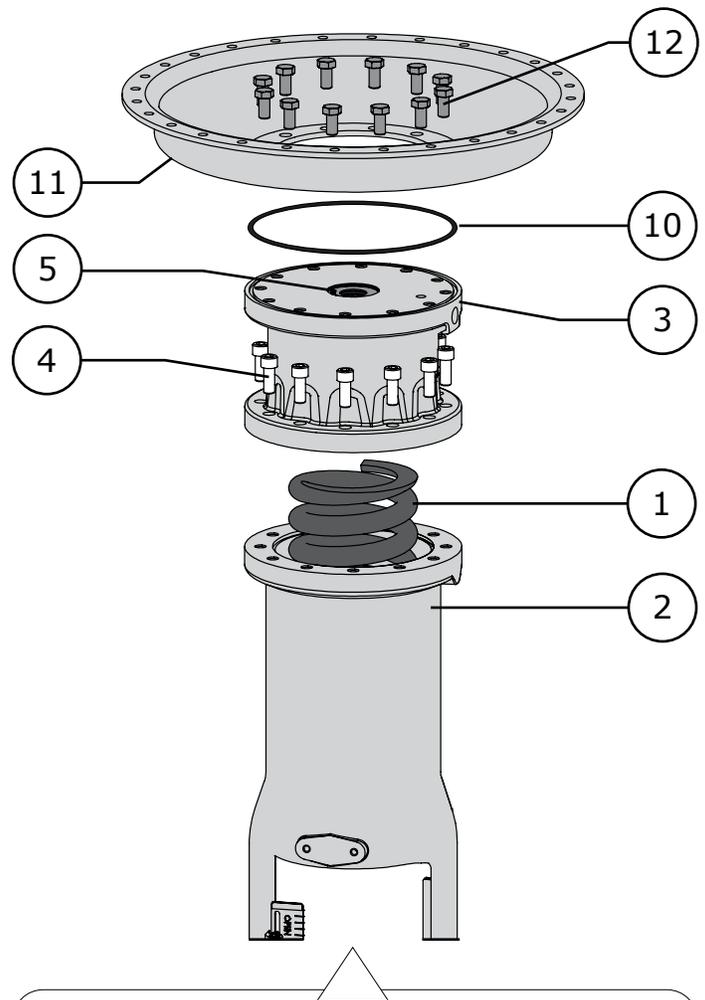


Figure 18 3220-4 Disassembly Detail



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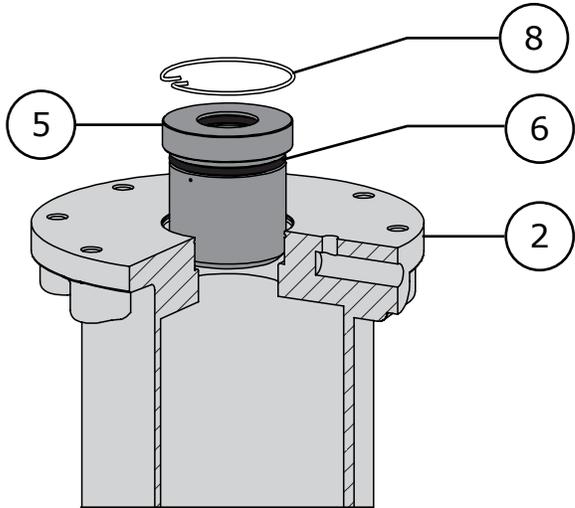


Figure 19 Actuator Bushing Removal

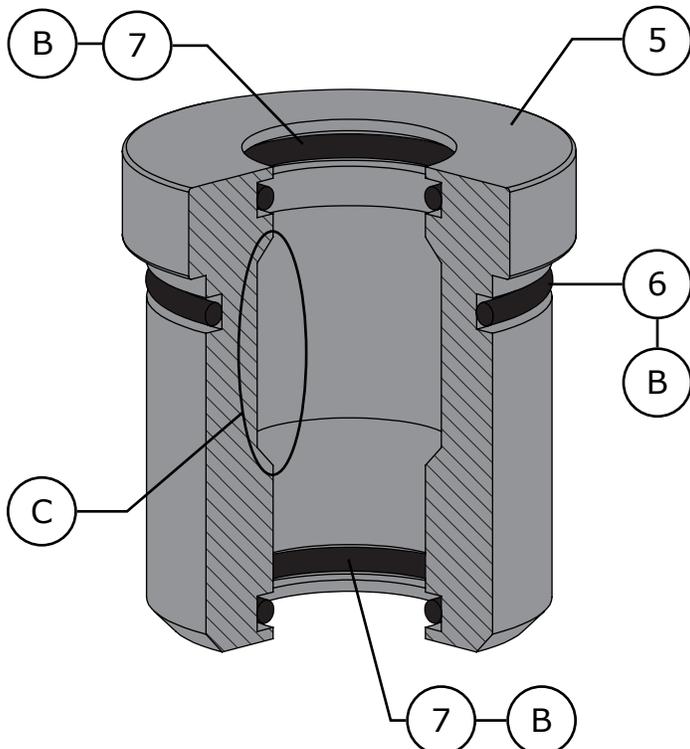


Figure 20 Bushing / O-Ring Detail

ACTUATOR ASSEMBLY

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.
- Standard actuators accept ¼" (6 mm) NPT connections.
- **WARNING:** Do not use operating pressure that exceeds the Maximum Casing Pressure. Also, be sure the operating pressure does not create a force on the actuator stem (Key 13) that is greater than the Maximum Allowable Output Thrust. Refer to Table 1.
- **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.
- Clean and inspect all parts.
- Replace or repair damaged parts. Replace all soft parts (Seals, o-rings, gaskets).

Lubricants Required:

- Permatex® Nickel Anti-Seize or equivalent (Key A)
- Dow Corning Molykote® 111 or equivalent (Key B)
- Lubriplate® No. 105 Grease or equivalent (Key C)

SIZE 3220-4 SPRING CASE ADAPTER ASSEMBLY

Size 3220-4 actuators have extended travel and as such are constructed with a spring case adapter (Key 3) installed between the lower diaphragm casing (Key 11) and the yoke (Key 2). The spring (Key 1) must be installed before the spring case adapter.

- 1 Carefully lower the spring (Key 1) into the yoke (Key 2) through the top opening. Refer to Figure 21.
- 2 Place the spring case adapter (Key 3) on top of the yoke (Key 2) and orientate it as shown in Figure 18.
- 3 Apply Permatex® Nickel Anti-Seize to the threads of the socket head cap screws (Key 4).
- 4 Thread the socket head cap screws (Key 4) through the spring case adapter (Key 3) and into the yoke (Key 2). Completely tighten the socket head cap screws.

BUSHING ASSEMBLY

- 1 Fill the pocket inside the bushing (Key 5) with Lubriplate® No. 105 (Key C), refer to Figure 20.

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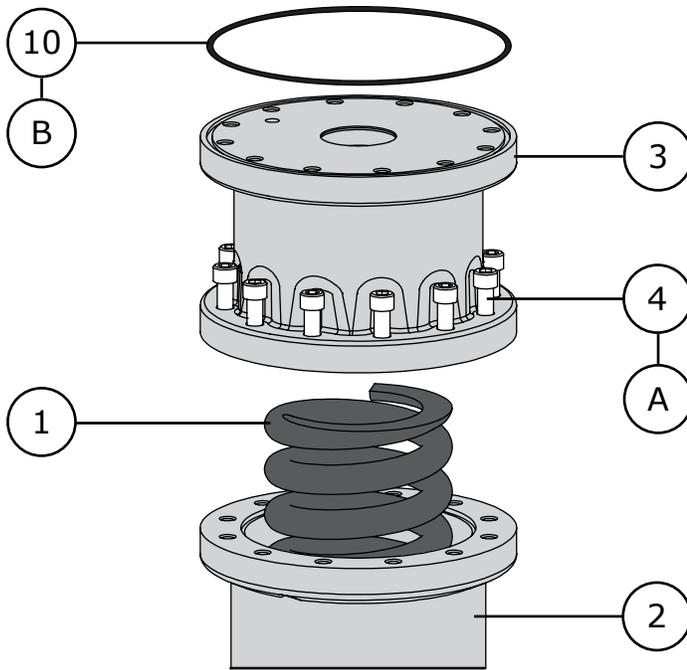


Figure 21 3220-4 Spring Case Adapter

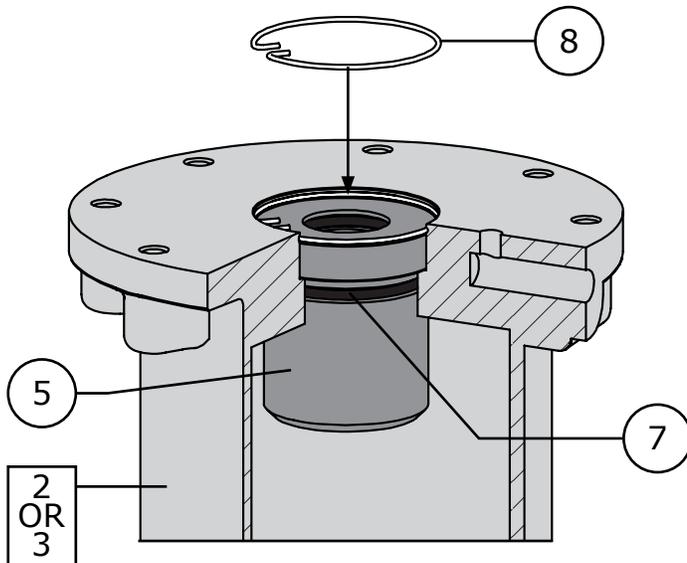


Figure 22 Bushing Assembly Installation

ACTUATOR ASSEMBLY (Continued)

BUSHING ASSEMBLY (Continued)

- 2 Apply Dow Corning Molykote® 111 to the o-rings (Keys 6 & 7) and install them into the bushing (Key 5). Refer to Figure 20.
- 3 Install the bushing assembly into the yoke (Key 2) as shown in Figure 22. **NOTE:** For size 3220-4 actuators, install the bushing assembly into the top of the spring case adapter (Key 3).
- 4 Secure the bushing assembly in place by installing the snap ring (Key 8) into the groove in the top of the yoke (Key 2) or spring case adapter (Key 3). Refer to Figure 22.

LOWER DIAPHRAGM PLATE ASSEMBLY

- 1 Apply Permatex® Nickel Anti-Seize (Key A) to both surfaces of the gasket (Key 9). Place the gasket on the top face of the yoke (Key 2). **NOTE:** Size 3220 and 3220-4 actuators use an o-ring (Key 10) instead of a gasket. Apply Dow Corning Molykote® 111 to the o-ring and install it into the o-ring groove in the top of the yoke (Key 2) or spring case adapter (Key 3) for the size 3220-4. Refer to Figures 23 & 21.
- 2 Place the lower diaphragm casing (Key 11) over top of the gasket (Key 9) or o-ring (Key 10).
- 3 Apply nickel based anti-seize to the threads of the cap screws (Key 12) and thread them through the lower diaphragm casing (Key 11) and into the yoke (Key 2). Refer to Table 4 for torque specifications when tightening the cap screws and tighten the cap screw evenly in a criss-cross pattern.

SPRING INSTALLATION - For sizes 1046, 1069, 2069, 2105, 2156, 3105, 3156

- 1 Flip the actuator assembly upside down.
- 2 Install the spring (Key 1) into the yoke (Key 2) as shown in Figure 24.
- 3 Clean and slide the actuator stem (Key 13) through the bottom of the yoke (Key 2) and through the bushing. Refer to Figure 24.
- 4 Install the spring seat (Key 14) onto the actuator stem (Key 13).



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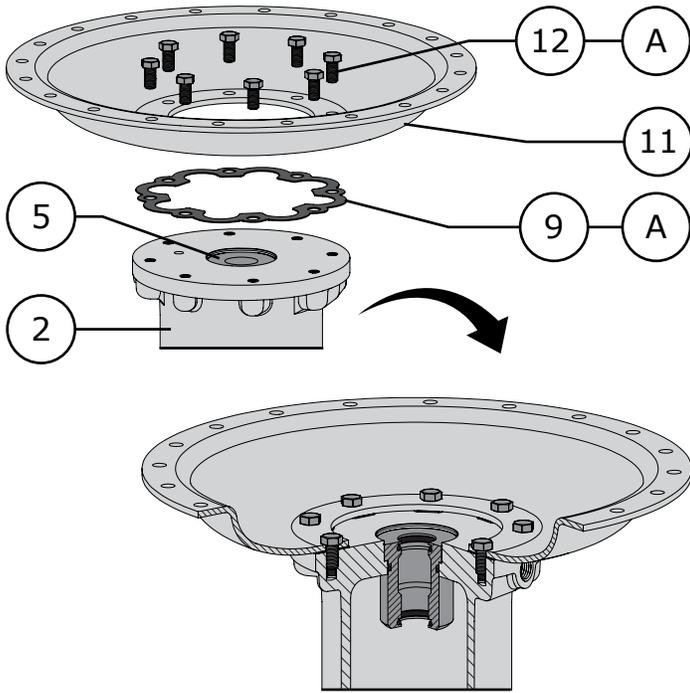


Figure 23 Lower Diaphragm Casing Assembly

ACTUATOR ASSEMBLY (Continued)

SPRING INSTALLATION (Continued)

- 5 Apply Permatex® Nickel Anti-Seize to the threads of the actuator stem (Key 13) and thread the spring adjuster (Key 15) onto the end of the actuator stem. **NOTE:** For some higher bench set actuators a spacer (Key 16) is required between the spring seat (Key 14) and the spring adjuster. Refer to Figure 27, and consult Dyna-Flo for more information.
- 6 Place a block or spacer between the bottom of the yoke (Key 2) and the bottom of the actuator stem (Key 13). The block or spacer will keep the actuator stem assembly and spring (Key 1) from falling out of the yoke during assembly. Refer to Figure 24.
- 7 Flip the actuator assembly right side up.

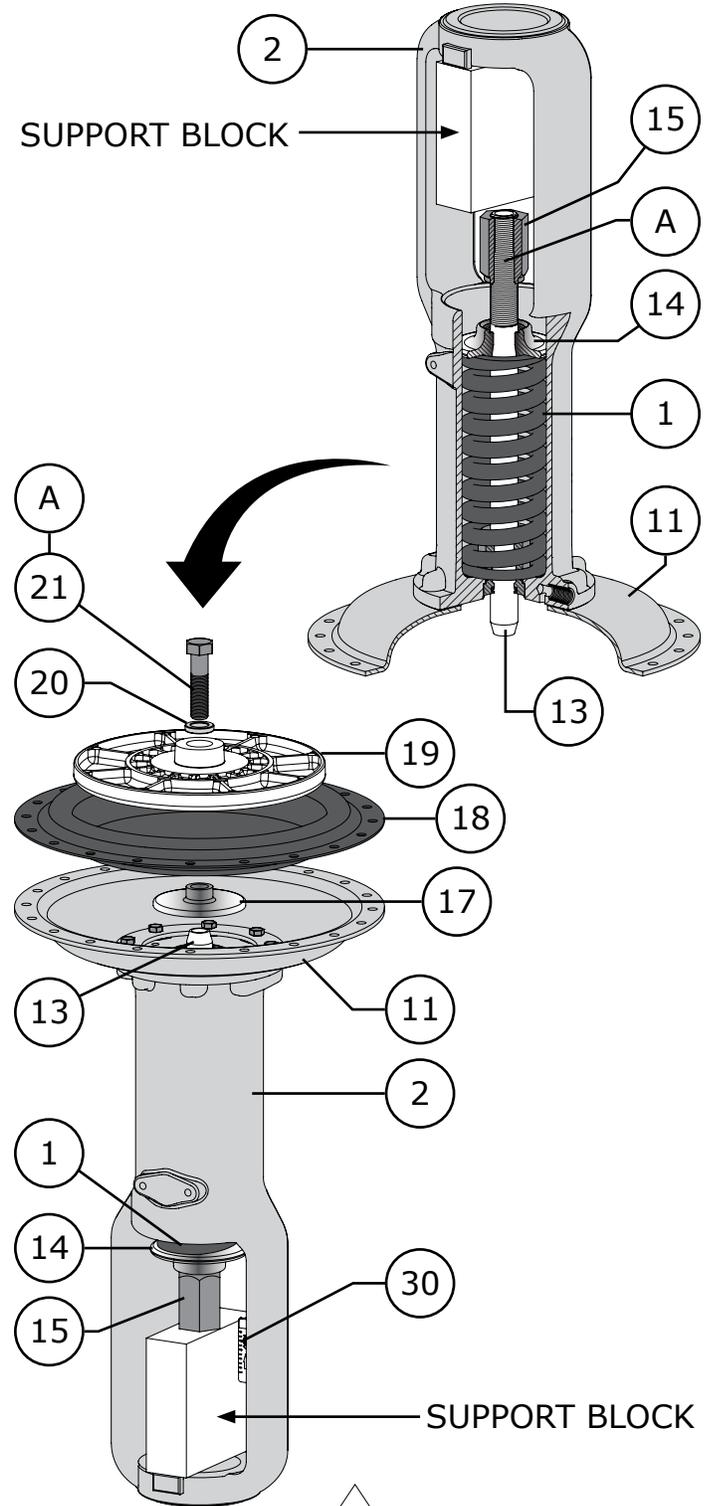


Figure 24 Spring Installation / Upper Diaphragm Casing

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ACTUATOR ASSEMBLY (Continued)

UPPER DIAPHRAGM CASING ASSEMBLY

NOTE: For information on top-mounted handwheels and travel stops refer to Page 20.

- 1 Set the lower diaphragm plate (Key 17) onto the actuator stem (Key 13). Refer to Figure 24.
- 2 Place the diaphragm (Key 18) on top of the lower diaphragm plate (Key 17) as shown in Figure 24.
- 3 Set the upper diaphragm plate (Key 19) into the diaphragm (Key 18) and onto the lower diaphragm plate (Key 17) as shown in Figure 24.
- 4 Slide the travel stop spacer (Key 20) onto the cap screw (Key 21).
- 5 Apply Anti-Seize to the threads of the cap screw (Key 21).
- 6 Thread the cap screw (Key 21) through the upper diaphragm plate (Key 19) and into the top of the actuator stem (Key 13). Tighten the cap screw to the torque specification listed in Table 4, use caution not to damage the actuator stem while tightening.
- 7 Align the holes in the diaphragm (Key 18) with those of the lower diaphragm casing (Key 11).
- 8 Place the upper diaphragm casing (Key 22) on top of the actuator assembly and align the holes with those of the lower diaphragm casing (Key 11) and diaphragm (Key 18).
- 9 Install the cap screws (Key 23) through the holes in the upper and lower diaphragm casings (Keys 11 & 22), if it becomes difficult to install the cap screws it may be necessary to use vise grips or pliers to pull the diaphragm (Key 18) into a more co-operative position.
- 10 Tighten all the hex nuts (Key 24) evenly in a crisscross pattern to half the torque specification listed in Table 4. Then tighten the hex nuts again, using the same alternating pattern, to the full torque specification.
- 11 Install the reducer bushings (Key 25 – for size 220 actuators only) and vent (Key 26) if they were removed or damaged.
- 12 Refer to the BENCH SETTING ACTUATOR section on Page 5 for instructions on adjusting the actuator after assembly is complete.

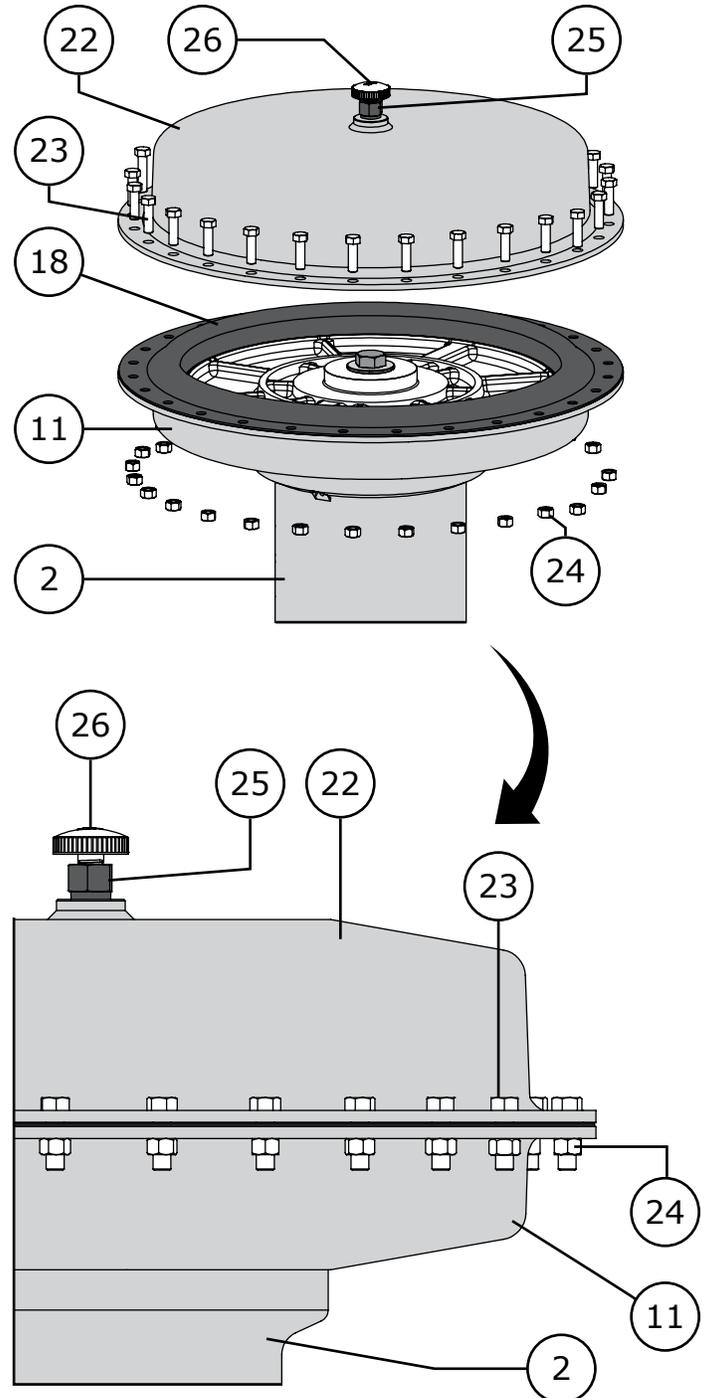


Figure 25 Upper Diaphragm Casing Assembly



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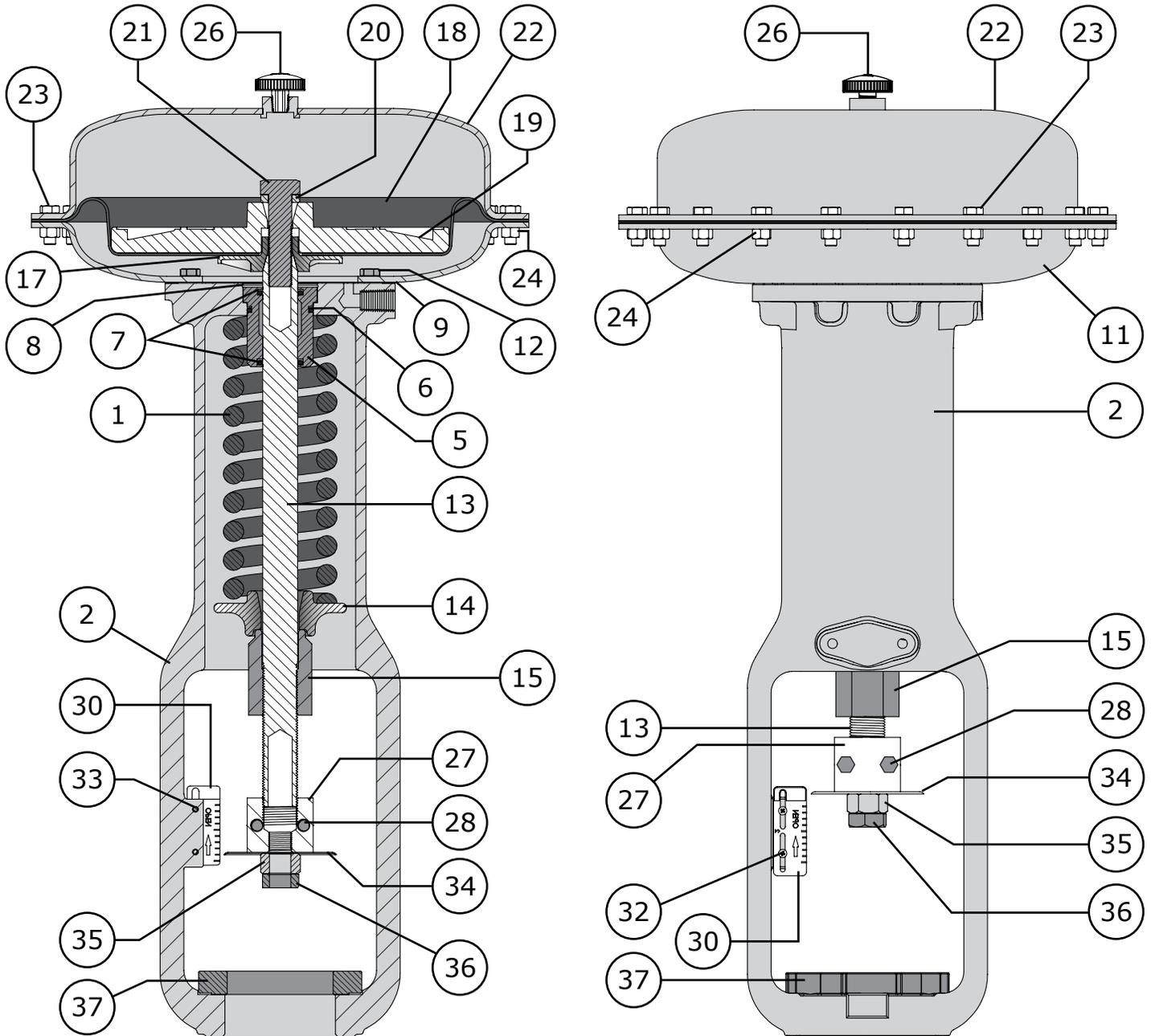


Figure 26 Cross Section - Sizes 046, 069, 105, and 156

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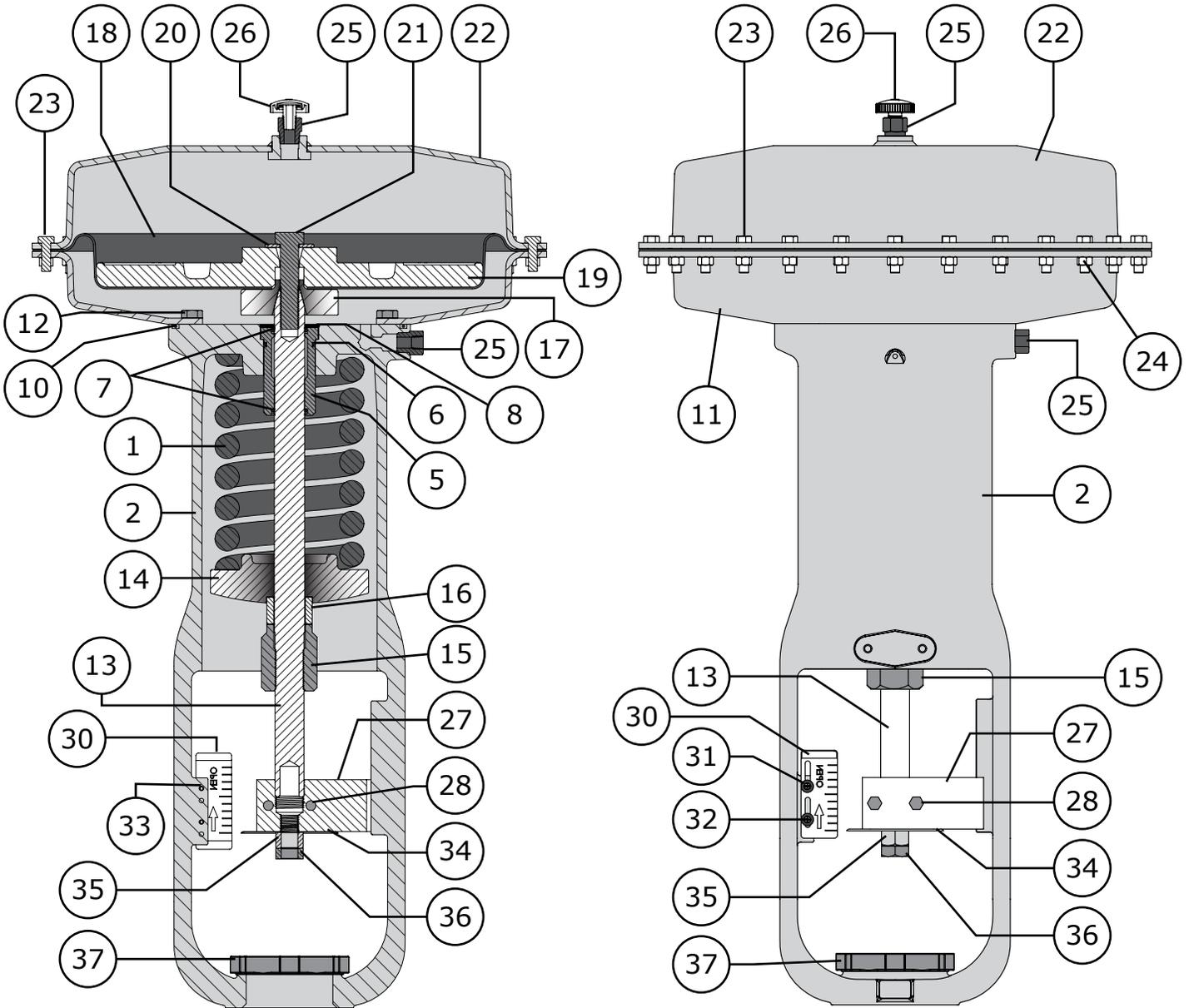


Figure 27 Cross Section - Size 220



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PRINCIPLES OF OPERATION AND ADJUSTMENT – HANDWHEELS AND TRAVEL STOPS

TOP-MOUNTED HANDWHEELS (Refer to Figure 28)

DFC Top-Mounted Handwheel assemblies are attached to a modified upper diaphragm casing (Key 100) using cap screws (Key 107). Top-Mounted Handwheels are typically used as an adjustable down travel stop which limit the full extension of the actuator stem (Key 13). If frequent manual operation of the handwheel is to be expected, it is recommended that a Side-Mounted Handwheel be used instead of the Top-Mounted Handwheel. Side-Mounted Handwheels are designed for frequent manual operation.

Using the handwheel as a travel stop:

Stem travel limits can be adjusted and set by rotating the handwheel to a desired position and then tightening the lock nut (Key 115) into the body (Key 106) of the handwheel (refer to Figure 28). By extending the adjustment screw (Key 109) and then locking it in place by tightening the lock nut, the length of travel can be shortened.

To decompress the spring (Key 1) and force the actuator stem (Key 13) down:

Rotating the handwheel (Key 110) clockwise into the upper diaphragm casing (Key 100) pushes the extension rod (Key 103) and actuator stem down decompressing the actuator spring.

To compress the spring (Key 1) and pull the actuator stem (Key 13) up:

Rotating the handwheel (Key 110) counterclockwise away from the upper diaphragm casing (Key 100) pulls the extension rod (Key 103) up and compresses the actuator spring.

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 Type 4 up travel stop position:

- 1 Relieve actuator loading pressure.
- 2 Remove the closing cap (Key 403).
- 3 Loosen the lock nut (Key 402).

- 4 Rotate the adjusting screw (Key 401) clockwise to increase the limit of upward stem travel. Rotate the adjusting screw counterclockwise to decrease the limit of upward stem travel.
- 5 Once the adjusting screw (Key 401) has been adjusted to the desired travel length, tighten the lock nut (Key 402) into the body (Key 400) of the travel stop.
- 6 Re-install the closing cap (Key 403)

To adjust Type 5 up travel stop position:

- 1 Relieve actuator loading pressure.
- 2 Loosen the lock nut (Key 501).
- 3 Rotate the travel stop (Key 500) clockwise to increase the limit of upward stem travel. Rotate the adjusting screw counterclockwise to decrease the limit of upward stem travel.
- 4 Once the travel stop (Key 500) has been adjusted to the desired travel length, tighten the lock nut (Key 501) into the upper diaphragm casing (Key 502).

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 Type 3 down travel stop position:

- 1 Apply actuator loading pressure.
- 2 Remove the closing cap (Key 307).
- 3 Loosen the jam nut (Key 306) and hex nut (Key 305).
- 4 Adjust the hex nut (Key 305) to the desired length of travel. The hex nut will make contact with the body (Key 304) of the travel stop and limit downward travel, the distance set between the top of the body and the bottom of the hex nut will be the length of travel.
- 5 Lock the hex nut (Key 305) in place using the jam nut (Key 306).
- 6 Re-install the closing cap (Key 307).

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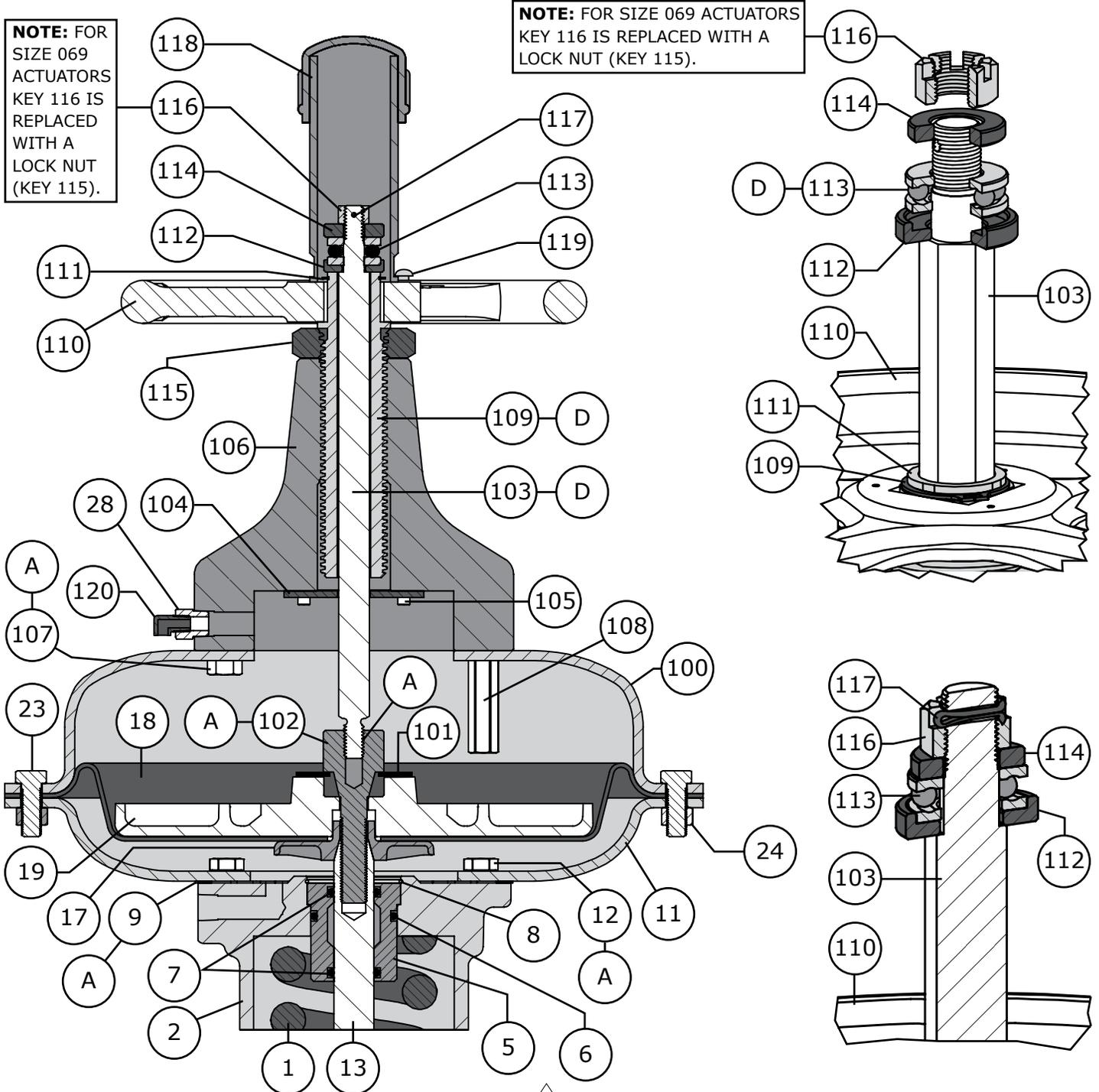
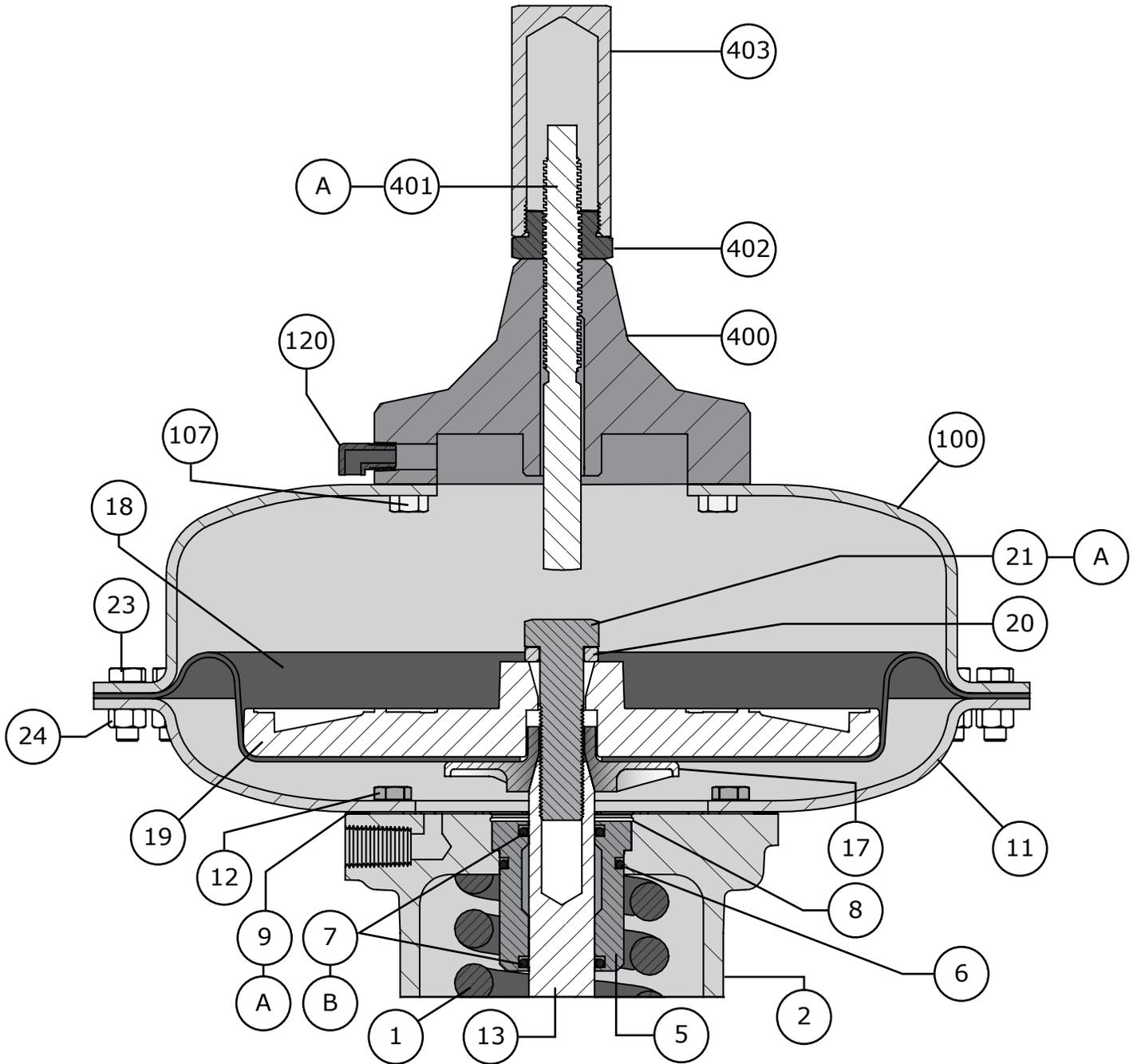


Figure 28 Top-Mounted Handwheel Cross Section



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▲
Figure 29 Type 4 Up Travel Stop Cross Section

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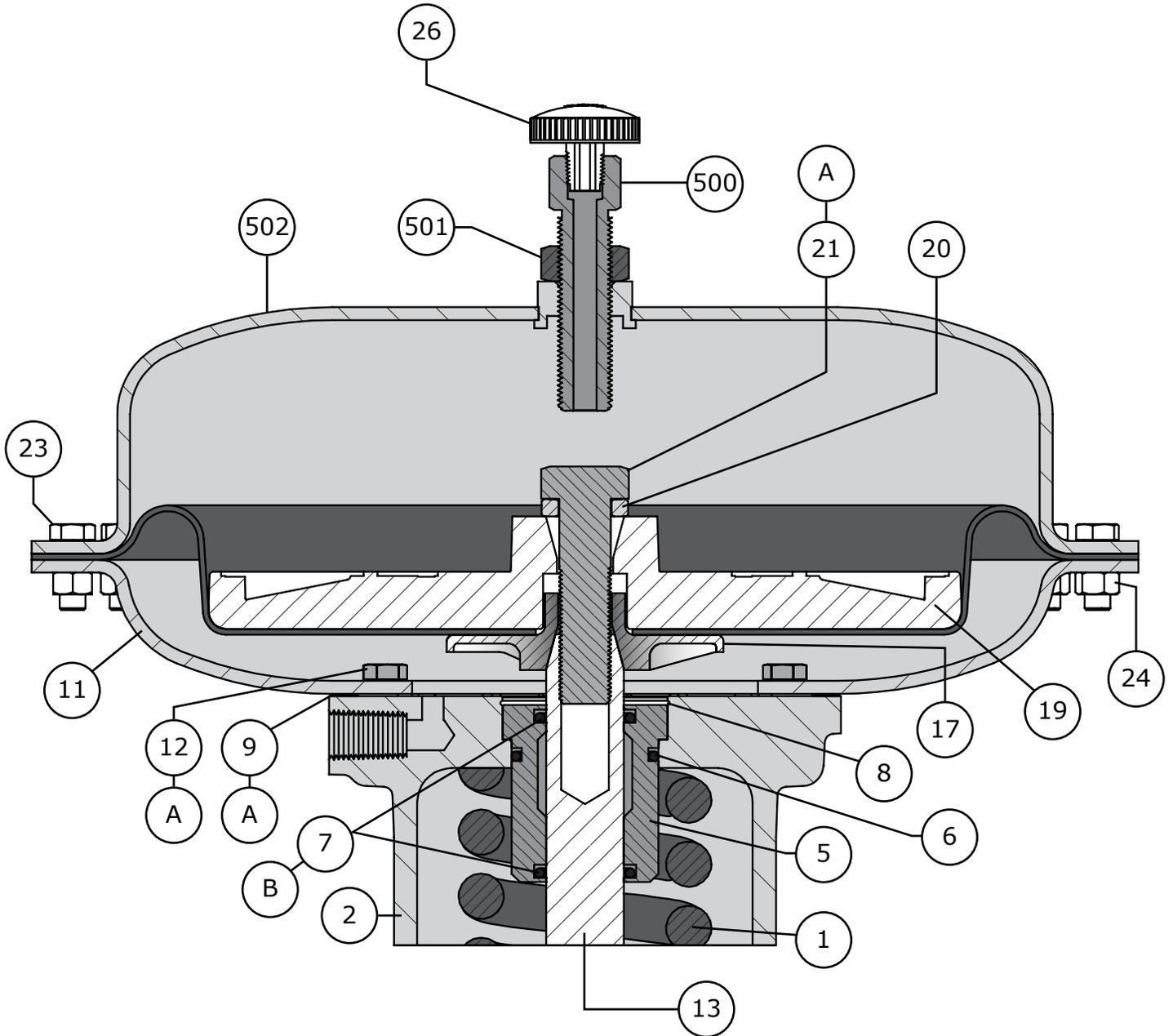


Figure 30 Type 5 Up Travel Stop Cross Section



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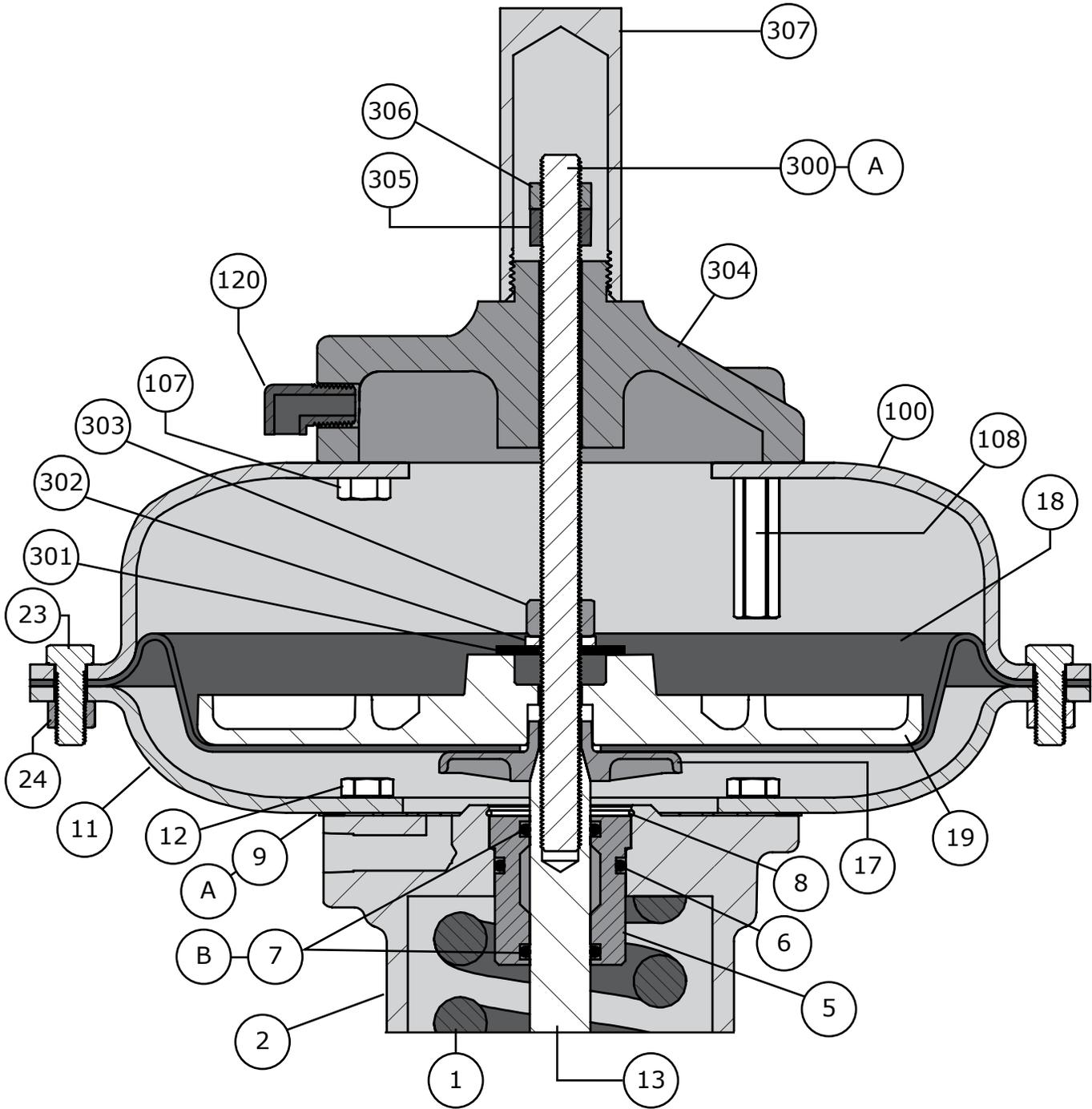


Figure 31 Type 3 Down Travel Stop Cross Section

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DISASSEMBLY - TOP-MOUNTED HANDWHEELS AND TRAVEL STOPS

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. De-energize the actuator before disassembly.
- Use safe work practices and lock out procedures.
- Standard actuators accept 1/4" (6 mm) NPT connections.
- **Warning:** Do not use operating pressure that exceeds the Maximum Casing Pressure. Also, be sure the operating pressure does not create a force on the actuator stem (Key 13) that is greater than the Maximum Allowable Output Thrust. Refer to Table 1.
- **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.
- 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. Refer to the appropriate valve instruction manual.

TOP-MOUNTED HANDWHEELS DISASSEMBLY:

Special Equipment Required:

- Split Ring Pliers.
- 1 Completely rotate the handwheel (Key 110) clockwise to decompress the spring (Key 1).
 - 2 Remove all spring tension by turning the spring adjuster (Key 15) counter-clockwise (to the left). Refer to Figure 5.
 - 3 Remove the 3 machine screws (Key 119) and remove the top cap (Key 118).
 - 4 Remove the cotter pin (Key 117). A cotter pin is only used for Size 105, 156, and 220 actuators.
 - 5 Remove the castle nut (Key 116), or lock nut (Key 115) for Size 069 actuators.

- 6 Remove the thrust washer (Key 114), thrust bearing (Key 113), and bearing seat (Key 112). **NOTE:** The top bearing race of the thrust bearing is press fit and may be difficult to remove, use caution.

- 7 Rotate the handwheel (Key 110) counter-clockwise to remove the adjusting screw (Key 109), handwheel, and retaining ring (Key 111) from the handwheel assembly.

NOTE: If handwheel maintenance is all that is required (lubrication of the bearing and adjusting screw) further disassembly is not required. To completely disassemble the handwheel follow the steps below.

- 8 Remove the retaining ring (Key 111) and separate the handwheel (Key 110) from the adjusting screw (Key 109).
- 9 Remove the lock nut (Key 115) from the adjusting screw (Key 109).
- 10 Remove the cap screws (Key 23) and hex nuts (Key 24).
- 11 Remove the upper diaphragm casing (Key 100) / hand wheel assembly (Keys 104, 105, 106, 107, and 108), be careful not to damage the extension rod (Key 103) during removal.
- 12 Separate the body (Key 106) from the upper diaphragm casing (Key 100) by removing the cap screws (Key 107) and upper travel stops (Key 108). **NOTE:** Record the position of the cap screws and travel stops for re-assembly purposes.
- 13 Remove the socket head cap screws (Key 105) and anti-rotation guide plate (Key 104).
- 14 Remove the extension rod (Key 103), extension rod connector (Key 102), and flat washer (Key 101) if necessary. **NOTE:** A flat washer is only included for Size 220 actuators with 2 and 3 inch travel.
- 15 Inspect all parts for damage and wear. Replace or repair parts as necessary. To continue actuator disassembly from this point, proceed to ACTUATOR DISASSEMBLY, Upper Diaphragm Casing Disassembly, Step 4, Page 12.

TYPE 4 UP TRAVEL STOP DISASSEMBLY:

- 1 Relieve actuator loading pressure.
- 2 Remove closing cap (Key 403).



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DISASSEMBLY - TOP-MOUNTED HANDWHEELS AND TRAVEL STOPS (Continued)

TYPE 4 UP TRAVEL STOP DISASSEMBLY (Continued):

- 3 Remove adjusting screw (Key 401) and lock nut (Key 402). Remove the lock nut from the adjusting screw.

NOTE: If travel stop maintenance is all that is required (lubrication of the adjusting screw) further disassembly is not required. To completely disassemble the travel stop follow the steps below.

- 4 Remove all spring tension by turning the spring adjuster (Key 15) counter-clockwise (to the left). Refer to Figure 5.
- 5 Remove the cap screws (Key 23) and hex nuts (Key 24).
- 6 Remove the upper diaphragm casing (Key 100) / travel stop assembly (Keys 107 and 400).
- 7 Separate the body (Key 400) from the upper diaphragm casing (Key 100) by removing the cap screws (Key 107).
- 8 Inspect all parts for damage and wear. Replace or repair parts as necessary. To continue actuator disassembly from this point, proceed to ACTUATOR DISASSEMBLY, Upper Diaphragm Casing Disassembly, Step 4, Page 12.

TYPE 5 UP TRAVEL STOP DISASSEMBLY:

- 1 Relieve actuator loading pressure.
- 2 Loosen the lock nut (Key 501).
- 3 Remove the travel stop (Key 500) from the upper diaphragm casing (Key 502).
- 4 Remove the lock nut (Key 501) from the travel stop (Key 500).
- 5 Inspect all parts for damage and wear. Replace or repair parts as necessary.

NOTE: Type 5 Up Travel Stops use a modified upper diaphragm casing (Key 502). To continue actuator disassembly from this point, proceed to ACTUATOR DISASSEMBLY on Page 10.

TYPE 3 DOWN TRAVEL STOP DISASSEMBLY:

Special Equipment Required:

- Split Ring Pliers.

- 1 Apply actuator loading pressure.
- 2 Remove the closing cap (Key 307).
- 3 Loosen then remove both the jam nut (Key 306) and the hex nut (Key 305).
- 4 Relieve actuator loading pressure and remove all spring tension by turning the spring adjuster (Key 15) counter-clockwise (to the left). Refer to Figure 5.
- 5 Remove the cap screws (Key 23) and hex nuts (Key 24).
- 6 Remove the upper diaphragm casing (Key 100) / travel stop assembly (Keys 107, 108, and 304), be careful not to damage the stem (Key 300) during removal.
- 7 Separate the body (Key 304) from the upper diaphragm casing (Key 100) by removing the cap screws (Key 107) and travel stops (Key 108). **NOTE:** Record the position of the cap screws and travel stops for re-assembly purposes.
- 8 Remove the stem (Key 300), hex nut (Key 303), lock washer (Key 302) and flat washer (Key 301) if necessary.
- 9 Inspect all parts for damage and wear. Replace or repair parts as necessary. To continue actuator disassembly from this point, proceed to ACTUATOR DISASSEMBLY, Upper Diaphragm Casing Disassembly, Step 4, Page 12.

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ASSEMBLY - TOP-MOUNTED HANDWHEELS AND TRAVEL STOPS

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.
- Standard actuators accept 1/4" (6 mm) NPT connections.
- **Warning:** Do not use operating pressure that exceeds the Maximum Casing Pressure. Also, be sure the operating pressure does not create a force on the actuator stem (Key 13) that is greater than the Maximum Allowable Output Thrust. Refer to Table 1.
- **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.
- Clean and inspect all parts.
- Replace or repair damaged parts. Replace all soft parts (Seals, o-rings, gaskets).

Lubricants Required:

- Permatex® Nickel Anti-Seize or equivalent (Key A)
- Dow Corning Molykote® 111 or equivalent (Key B)
- Lubriplate® No. 105 Grease or equivalent (Key C)
- Mobil Unirex™ Lotemp Grease or Equivalent (Key D)

TOP-MOUNTED HANDWHEELS ASSEMBLY:

Special Equipment Required:

- Split Ring Pliers.
- Vise Grips.

NOTE: Begin the following handwheel assembly instructions after completing ACTUATOR ASSEMBLY instructions to UPPER DIAPHRAGM CASING ASSEMBLY, Step 3, Page 17.

- 1 Place the flat washer (Key 101) on top of the upper diaphragm plate (Key 19) as shown in Figure 28. **NOTE:** A flat washer is only included for Size 220 actuators with 2 and 3 inch travel.
- 2 Apply Permatex® Nickel Anti-Seize (Key A) to the threads of the extension rod connector (Key 102) and thread it into the actuator stem (Key 13). Be sure to align the holes of the lower diaphragm casing (Key 11) with those of the

diaphragm (Key 18) during extension rod connector installation. Tighten the extension rod connector.

- 3 Apply Permatex® Nickel Anti-Seize (Key A) to the threads of the extension rod (Key 103) and thread it into the extension rod connector (Key 102). Be sure not to completely tighten the extension rod, leave loose 1-2 threads, this will help with casing/diaphragm alignment later in assembly. Apply Mobil Unirex™ Lotemp Grease (Key D) to the shaft of the extension rod.
- 4 Install the anti-rotation guide plate (Key 104) onto the body (Key 106) using the socket head cap screws (Key 105).
- 5 Connect the body (Key 106) to the upper diaphragm casing (Key 100) using the cap screws (Key 107) and upper travel stops (Key 108) if used. Refer to Table 4 for recommended torque values. **NOTE:** Position the upper travel stops according to positions that were recorded/ marked during disassembly. If travel stop positions were not recorded or marked during disassembly, distribute the travel stops evenly around the diaphragm casing. Apply Permatex® Nickel Anti-Seize (Key A) to the threads.
- 6 Carefully lift and lower the upper diaphragm casing / body assembly (Keys 100, 104, 105, 106, 107, & 108) onto the actuator assembly as shown in Figure 28. Use caution not to damage the extension rod (Key 103) when sliding it through the anti-rotation plate (Key 104). It is important that the holes of the upper diaphragm casing are in alignment with those of the diaphragm (Key 18) and lower diaphragm casing (Key 11).
- 7 Install the cap screws (Key 23) through the holes in the upper and lower diaphragm casings (Keys 100 & 11), if it becomes difficult to install the cap screws it may be necessary to use vise grips or pliers to pull the diaphragm (Key 18) into a more cooperative position.
- 8 Tighten all the hex nuts (Key 24) evenly in a crisscross pattern to half the torque specification listed in Table 4. Then tighten the hex nuts again, using the same alternating pattern, to the full torque specification.
- 9 Install the adjustment screw (Key 109) into the hand wheel (Key 110) and secure it in place using the retaining ring (Key 111). Refer to Figure 28.



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ASSEMBLY - TOP-MOUNTED HANDWHEELS AND TRAVEL STOPS (Continued)

TOP-MOUNTED HANDWHEELS ASSEMBLY (Continued):

- 11** Apply a generous amount of Mobil Unirex™ Lotemp Grease (Key D) to the threads of the adjusting screw (Key 109) and thread the lock nut (Key 115) completely onto the adjustment screw.
- 13** Carefully slide the handwheel / adjusting screw assembly (Keys 109, 110, & 111) over the extension rod (Key 103) and thread the adjusting screw completely into the body (Key 106) by turning the handwheel (Key 110) clockwise.
- 14** Install the bearing seat (Key 112) onto the extension rod (Key 103) as shown in Figure 28.
- 15** Apply Mobil Unirex™ Lotemp Grease (Key D) to the inner layers of the thrust bearing (Key 113). Install the thrust bearing onto the extension rod (Key 103) so that it rests inside the bearing seat as shown in Figure 28. **NOTE:** The top and bottom bearing races are different sizes, the bottom bearing race should fit easily onto the extension rod. The top bearing race will need to be press fit onto the extension rod.
- 16** Set the thrust washer (Key 114) on top of the thrust bearing (Key 113).
- 17** Thread the lock nut (Key 115, for Size 069 actuators) or castle nut (Key 116, for Size 105, 156, & 220 actuators) onto the extension rod (Key 103). The lock nut or castle nut must be tightened until the top bearing race is press fit in place and the bearing firmly compressed between both the top and bottom bearing race.
NOTE: Rotate the castle nut into a position where the hole in the extension rod is clearly visible and the cotter pin (Key 117) can easily be inserted through both. Once the cotter pin is install, bend out both pegs of the open end to secure it in place. Refer to Figure 28.
- 18** Install the top cap (Key 118) over the extension rod (Key 103) and secure it by installing the 3 machine screws (Key 119) into the handwheel (Key 110). Install the elbow vent (Key 120).
- 19** Refer to the BENCH SETTING ACTUATOR section on Page 5 for instructions on adjusting the actuator after assembly is complete. Refer to the PRINCIPLES OF OPERATION AND ADJUSTMENT section on Page 20 for instructions on adjusting the handwheel.

TYPE 4 UP STOP ASSEMBLY:

- 1** Apply Permatex® Nickel Anti-Seize (Key A) to the threads of the cap screws (Key 107) and use them to connect the body (Key 400) to the upper diaphragm casing (Key 100), refer to Table 4 for recommended torque values.
- 2** Place the upper diaphragm casing / body assembly (Keys 100 & 400) onto the actuator assembly so that the casing rests on top of the diaphragm (Key 18). Align the holes up the upper and lower diaphragm casing.
- 3** Install the cap screws (Key 23) through the holes in the upper and lower diaphragm casings (Keys 100 & 11), if it becomes difficult to install the cap screws it may be necessary to use vise grips or pliers to pull the diaphragm (Key 18) into a more cooperative position.
- 4** Tighten all the hex nuts (Key 24) evenly in a crisscross pattern to half the torque specification listed in Table 4. Then tighten the hex nuts again, using the same alternating pattern, to the full torque specification.
- 5** Apply Permatex® Nickel Anti-Seize (Key A) to the threads of the adjusting screw (Key 401) and thread the adjusting screw into the body (Key 400) as shown in Figure 29.
- 6** Thread the lock nut (Key 402) onto the adjusting screw (Key 401) as shown in Figure 29. Refer to ADJUSTABLE UP TRAVEL STOPS on Page 20 for information on adjusting the travel position.
- 7** Tighten the lock nut (Key 402) into the body (Key 400) and thread the closing cap (Key 403) onto the lock nut.
- 8** Install the elbow vent (Key 120).
- 9** Refer to the BENCH SETTING ACTUATOR section on Page 5 for instructions on adjusting the actuator after assembly is complete. Refer to the PRINCIPLES OF OPERATION AND ADJUSTMENT section on Page 20 for instructions on adjusting the travel stop.

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TYPE 5 UP STOP ASSEMBLY:

NOTE: Type 5 Up Travel Stops use a modified upper diaphragm casing (Key 502). If you are installing a Type 5 travel stop into a standard actuator assembly, the upper diaphragm casing (Key 22) will have to be replaced with the modified casing (Key 502). Follow the appropriate disassembly and assembly steps - ACTUATOR DISASSEMBLY on Page 10 & ACTUATOR ASSEMBLY - UPPER DIAPHRAGM CASING ASSEMBLY on Page 16.

- 1 Apply Permatex® Nickel Anti-Seize (Key A) to the threads of the travel stop (Key 500) and thread the lock nut (Key 501) on to the travel stop.
- 2 Thread the travel stop / lock nut assembly (Keys 500 & 501) into the top diaphragm casing (Key 502).
- 3 Install the vent (Key 26) into the top of the travel stop (Key 500).
- 4 Refer to the PRINCIPLES OF OPERATION AND ADJUSTMENT section on Page 20 for instructions on adjusting the travel stop.

TYPE 3 DOWN STOP ASSEMBLY:

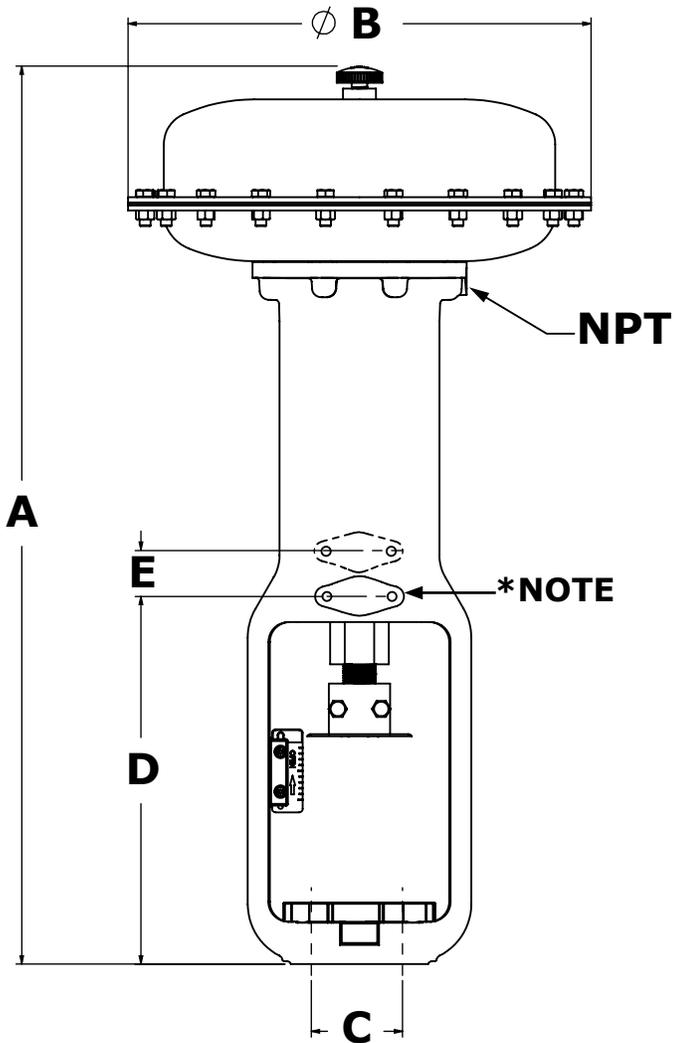
- 1 Apply Permatex® Nickel Anti-Seize (Key A) to the bottom threads of the stem (Key 300) and thread it through the upper diaphragm plate (Key 19) and into the actuator stem (Key 13).
- 2 Slide the flat washer (Key 301) onto the stem (Key 300) so that it rests on top of the upper diaphragm plate (Key 19). Slide the lock washer (Key 302) onto the stem so that it rests on top of the flat washer.
- 3 Thread the hex nut (Key 303) completely onto the stem (Key 300) and tighten it down to engage the lock washer (Key 302).
- 4 Apply Permatex® Nickel Anti-Seize (Key A) to the threads of the cap screws (Key 107) and travel stops (Key 108), use them to connect the body (Key 304) to the upper diaphragm casing (Key 100). Refer to Table 4 for recommended torque values.

- 5 Carefully lift and lower the upper diaphragm casing / body assembly (Keys 100, 304, 107, & 108) onto the actuator assembly as shown in Figure 31. Use caution not to damage the stem (Key 300) when sliding it through the body (Key 304). It is important that the holes of the upper diaphragm casing are in alignment with those of the diaphragm (Key 18) and lower diaphragm casing (Key 11).
- 6 Install the cap screws (Key 23) through the holes in the upper and lower diaphragm casings (Keys 100 & 11), if it becomes difficult to install the cap screws it may be necessary to use vise grips or pliers to pull the diaphragm (Key 18) into a more cooperative position.
- 7 Tighten all the hex nuts (Key 24) evenly in a crisscross pattern to half the torque specification listed in Table 4. Then tighten the hex nuts again, using the same alternating pattern, to the full torque specification.
- 8 Thread the hex nut (Key 305) and lock nut (Key 306) on to the stem (Key 300). Refer to ADJUSTABLE DOWN TRAVEL STOPS on Page 20 for information on adjusting the travel position.
- 9 Install the closing cap (Key 307) and elbow vent (Key 120).
- 10 Refer to the BENCH SETTING ACTUATOR section on Page 5 for instructions on adjusting the actuator after assembly is complete.



Model DFC Linear Actuator

Operation, Parts, and Instruction Manual



***NOTE:** The lower instrument mounting pad of the actuator yoke (Key 2) is the standard mounting pad and should typically be orientated to face the side of the valve with the flow arrow.

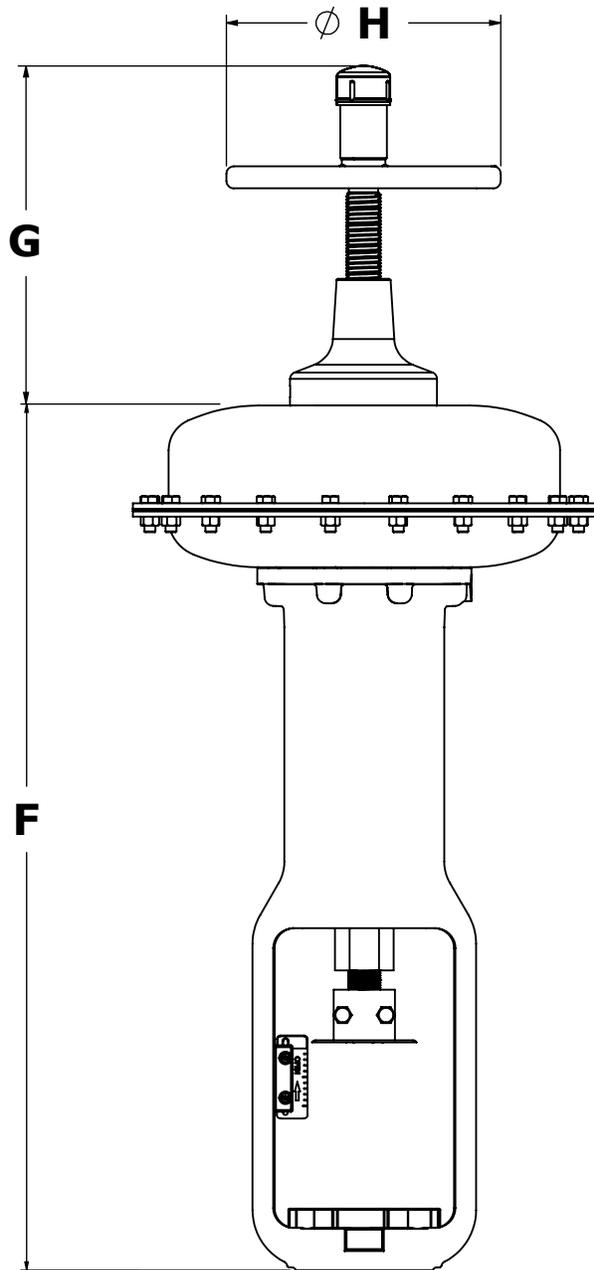


Figure 32 Model DFC Dimensions

Figure 33 Model DFC with Top-Mounted Handwheel Dimensions

Model DFC Linear Actuator

Operation, Parts, and Instruction Manual



Table 2

Model DFC Outline Dimensions (Refer to Figure 32)

Actuator Size	Dimension Reference Inch (mm)				
	A	B	C (Yoke Boss)	D	E
1046	18.81 (478)	11.38 (289)	2-1/8 (54.0)	7.58 (193)	1.50 (38.1)
1069	22.68 (576)	13.12 (333)	2-1/8 (54.0)	8.88 (226)	1.50 (38.1)
2069	23.38 (594)	13.12 (333)	2-13/16 (71.4)	9.62 (244)	1.50 (38.1)
2105	30.25 (768)	16.00 (406)	2-13/16 (71.4)	12.12 (308)	1.50 (38.1)
2156	30.25 (768)	18.62 (473)	2-13/16 (71.4)	12.12 (308)	1.50 (38.1)
3105	30.91 (785)	16.00 (406)	3-9/16 (90.5)	12.65 (321)	1.50 (38.1)
3156	30.91 (785)	18.62 (473)	3-9/16 (90.5)	12.65 (321)	1.50 (38.1)
3220	36.48 (927)	21.12 (536)	3-9/16 (90.5)	14.75 (375)	1.50 (38.1)
3220-4	42.85 (1088)	21.12 (536)	3-9/16 (90.5)	14.75 (375)	1.50 (38.1)

Table 3

Model DFC Handwheel Outline Dimensions (Refer to Figure 33)

Actuator Size	Dimension Reference Inch (mm)			
	TRAVEL	G MAX.	F	H
1046	-	-	-	-
1069	3/4 (19.1)	12.88 (327)	21.68 (551)	8.75 (222)
2069	3/4 (19.1)	12.88 (327)	22.38 (568)	8.75 (222)
2105	1-1/2 (38.1)	14.86 (377)	29.25 (743)	12.00 (305)
	2 (50.8)	15.36 (390)		
2156	1-1/2 (38.1)	14.86 (377)	29.25 (743)	12.00 (305)
	2 (50.8)	15.36 (390)		
3105	1-1/2 (38.1)	14.86 (377)	29.90 (760)	12.00 (305)
	2 (50.8)	15.36 (390)		
3156	1-1/2 (38.1)	14.86 (377)	29.90 (760)	12.00 (305)
	2 (50.8)	15.36 (390)		
3220	2 (50.8)	17.48 (444)	35.47 (901)	14.00 (356)
	3 (76.2)	18.48 (469)		
	3-1/2 (88.9)	20.69 (526)		
3220-4	4 (102)	20.94 (532)	41.85 (1063)	14.00 (356)



Model DFC Linear Actuator

Operation, Parts, and Instruction Manual

Table 4

Model DFC Actuator Torque Chart

Cap Screw - (Key 21)

Actuator Size	lbf-ft.	N•m
046	30	41
069	70	95
105, 156, 220	135	183

Cap Screw Torque (Keys 12, 107, & 108)

Actuator Size	lbf-ft.	N•m
046 to 156	30	41
220	70	95

Casing Cap Screws Torque (Keys 23 & 24)

All Sizes	lbf-ft.	N•m
Full Torque	20	27

Table 5

Side-Mounted Handwheel Mounting Bolt Torque Chart

U-BOLT

Actuator Size	lbf-ft.	N•m
ALL	55	75

MOUNTING HOOK

Actuator Size	lbf-ft.	N•m
ALL	30	41

Model DFC Linear Actuator

Side-Mounted Handwheel Mounting Instructions



SMHW INSTALLATION / MOUNTING

Before You Begin:

- Read the General and Scope section of this manual (Page 2).
- Read Safety Caution (Page 2).
- **WARNING:** Sudden movement of actuator can cause damage or injury. It helps to have the actuator de-energized (placed into the appropriate fail position). Be aware that actuator springs will be under tension.
- Use safe work practices and lock out procedures before placing valve in-line.
- Standard actuators accept 1/4" (6 mm) NPT connections.
- **WARNING:** Do not use operating pressure that exceeds the Maximum Casing Pressure. Also, be sure the operating pressure does not create a force on the actuator stem that is greater than the Maximum Allowable Output Thrust.
- **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.

Special Tools Required:

- Properly Rated Lifting Straps (2 – 4 Straps). Reference valve and actuator weights.
- Lifting Device (Example: Crane) or extra people to hold the Side-Mounted Handwheel.

Lubricants Required:

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

- 1 Secure the valve assembly in place in-line or on a flat work surface that will support the weight of the combined valve/actuator and side-mounted handwheel assembly.
- 2 Remove any positioners and/or instrumentation installed on the actuator. **NOTE:** Be aware that the upper instrument mounting pad of the actuator yoke (Figure 32) is the standard mounting location for the side-mounted handwheel and should be free of instrumentation, mounting brackets, and/or other obstructions.

CONNECTING BLOCK INSTALLATION

NOTE: It is important that the connecting block installed on the valve/actuator assembly be the side-mounted handwheel connecting block, which has been modified to accept the pins of the side-mounted handwheel lever.

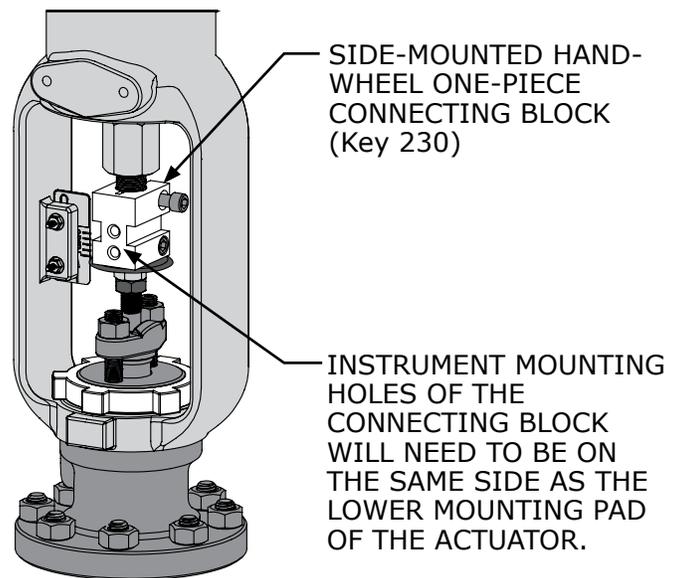
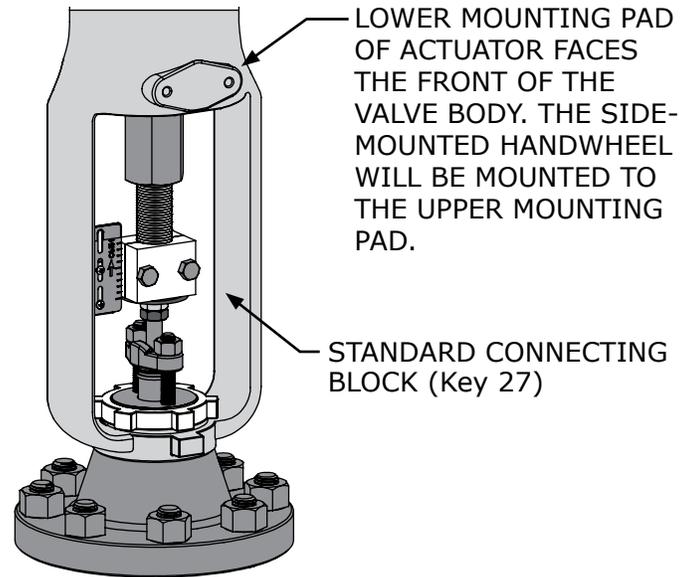


Figure 34 Connecting Block Details



Model DFC Linear Actuator

Side-Mounted Handwheel Mounting Instructions

INSTALLATION / MOUNTING (Continued)

CONNECTING BLOCK INSTALLATION (Continued)

WARNING: If a standard connecting block must be removed in order to install the side-mounted handwheel connecting block, use caution and assume that actuator springs are under constant compression even when the actuator is de-energized.

Refer to Page 9 for ACTUATOR MOUNTING instructions, follow the mounting instructions up to the beginning of the CONNECTING BLOCK INSTALLATION portion and proceed following the instructions outlined below:

FOR ONE-PIECE SIDE-MOUNTED HANDWHEEL CONNECTING BLOCK INSTALLATION:

WARNING: It is important that the valve stem not be rotated while the valve plug is seated. During stem connector installation rotating a seated valve plug can cause damage to the seating surface and stem threads.

NOTE: The threads of the actuator stem and valve stem should engage the threads of the connecting block by a distance equal to that of the diameter of the stem or greater.

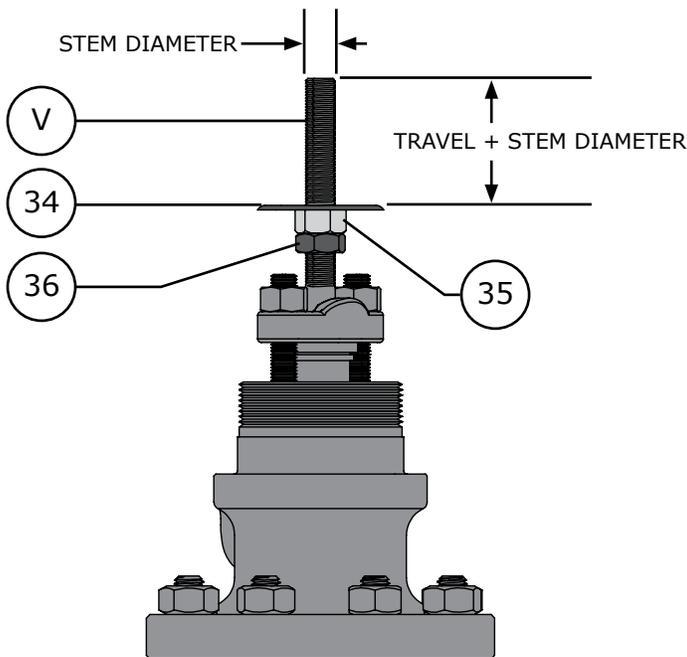


Figure 35 One-Piece Connecting Block Installation

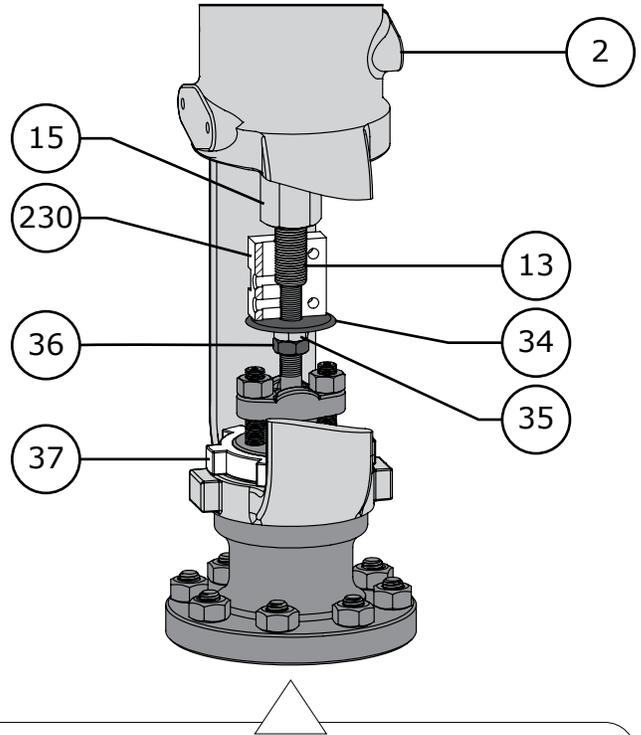


Figure 36 One-Piece Connecting Block Installation

- 1 Make sure the valve is placed into its closed position by pushing the valve stem (Key V) into the valve body.
- 2 Supply pressure will need to be applied to the actuator in order to move the actuator the appropriate length of travel. Refer to the actuator nameplate (Key 29) and apply the upper bench set operating pressure to the actuator.
- 3 Measure the distance of travel plus the length of the diameter of the valve stem down from the top of the valve stem (Key V) and mark that position with a soft felt marker. Thread the jam nut (Key 36) and hex nut (Key 35) onto the valve stem so that they are past the distance marked by felt. Refer to Figure 35.
- 4 Place the travel disc (Key 34) on top of the hex nut (Key 35) so that the concave side of the disc is facing towards the valve body. Adjust the hex nut until the top of the travel disc meets the distance marked on the stem from Step 2.
- 5 Lock the jam nut (Key 36) into the hex nut (Key 35), you will need to be able to use the hex nut to thread the valve stem into the connecting block later during the installation.

Model DFC Linear Actuator

Side-Mounted Handwheel Mounting Instructions



INSTALLATION / MOUNTING (Continued)

CONNECTING BLOCK INSTALLATION (Continued)

FOR ONE-PIECE SIDE-MOUNTED HANDWHEEL CONNECTING BLOCK INSTALLATION (Continued):

- 6 Thread the one-piece side-mounted handwheel connecting block (Key 230) completely on to the actuator stem. Refer to Figure 38 for correct position and alignment of the connecting block.
- 7 Raise the valve stem until it is possible to begin threading the valve stem into the side-mounted handwheel connecting block (Key 230), the distance the valve stem is raised should be the required length of travel plus the length of the valve stem diameter. **NOTE:** Depending on the length of travel required, it may be necessary to lower the actuator stem (Key 13) until the connecting block meets the top of the valve stem.
- 8 Using the hex nut (Key 35) that was locked in place in Step 5 and the appropriate size of open end wrench, begin to thread the valve stem (Key V) into the side-mounted handwheel connecting block (Key 230) until the travel disc (Key 34) makes contact with the connecting block. Make adjustments as necessary to have the connecting block oriented as shown in Figure 38.

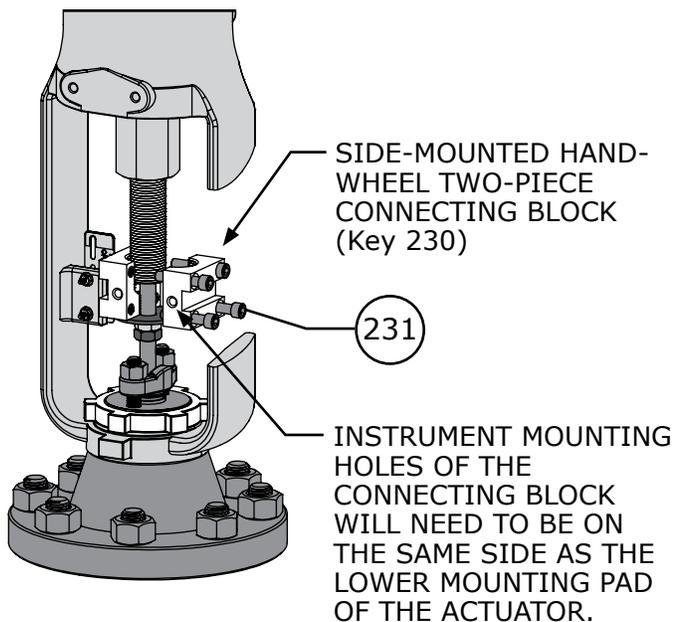


Figure 37 Two-Piece Connecting Block Details

- 9 Secure the connecting block (Key 230) in place with the socket-head cap screws (Key 231).
- 10 Re-position the travel scale (Key 30) so that the travel disc (Key 34) is aligned with the top mark (open position) of the travel scale.
- 11 Stroke the actuator and valve to verify that the travel and travel scale are accurate. If the travel is not correct it may be necessary to repeat the stem connector installation or bench set procedures.

THE SIDE-MOUNTED HANDWHEEL CONNECTING BLOCK SHOULD BE ORIENTED AS SHOWN.

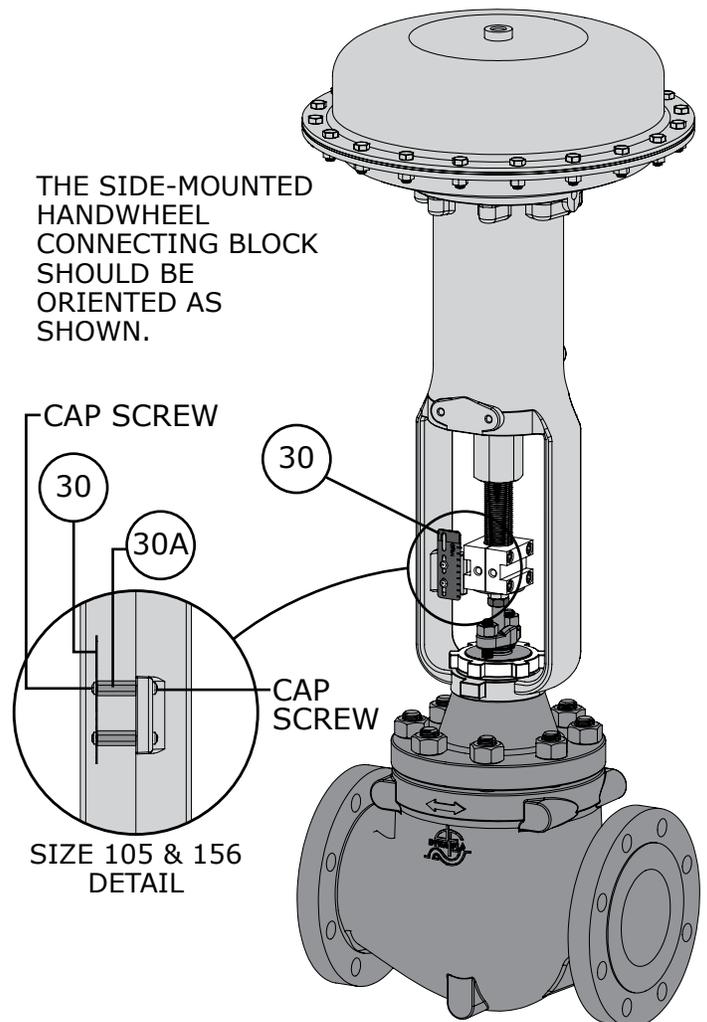


Figure 38 Side-Mounted Handwheel Connecting Block



Model DFC Linear Actuator

Side-Mounted Handwheel Mounting Instructions

INSTALLATION / MOUNTING (Continued)

CONNECTING BLOCK INSTALLATION (Continued)

FOR TWO-PIECE SIDE-MOUNTED HANDWHEEL CONNECTING BLOCK INSTALLATION:

Install the two-piece side-mounted handwheel connecting block (Key 230) the same as the standard connecting block (refer to Figures 37 & 38 for proper side-mounted handwheel connecting block orientation).

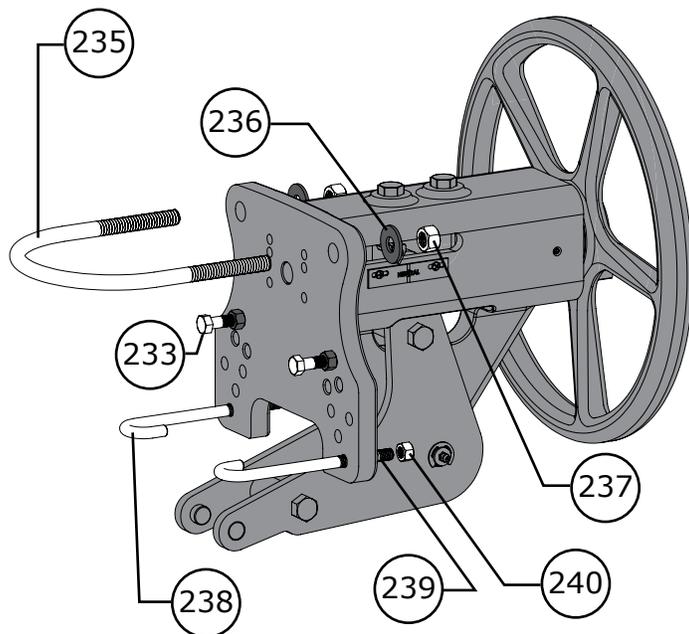


Figure 39 Side-Mounted Handwheel Mounting Fittings

SIDE-MOUNTED HANDWHEEL MOUNTING

The following mounting instructions assume that the spring and diaphragm actuator has already been bench set appropriately and mounted to your valve with the appropriate connecting block (Key 230).

NOTE: It is important that the connecting block installed on the valve/actuator assembly be the side-mounted handwheel connecting block (Key 230), which has been modified to accept the pins of the side-mounted handwheel lever (Keys 214 & 215). Information regarding side-mounted handwheel connecting block installation can be found on Page 3, CONNECTING BLOCK INSTALLATION.

- 1 Secure the valve assembly in-line or on a flat work surface that will support the weight of the combined valve/actuator and side-mounted handwheel assembly. Refer to the appropriate product sales bulletins or product name-plates for weights.
- 2 Remove any positioners and/or instrumentation installed on the actuator. **NOTE:** Be aware that the upper instrument mounting pad of the actuator yoke (refer to Figure 41) is the standard mounting location for the side-mounted handwheel and should be free of instrumentation, mounting brackets, and/or other obstructions.
- 3 Confirm that the actuator is in its FAIL POSITION (de-energized) and adjust the handwheel on the side-mounted handwheel until the pointer (Key 213) sits roughly at center position in the view window of the handwheel body (Key 200) (refer to Figure 40). Adjustments will need to be made to the handwheel (223) and pointer position during mounting in order for proper alignment during Step 6.
- 4 Remove any mounting fittings that may be attached to the side-mounted handwheel body during shipping. These fittings will include the u-bolt (Key 235), mounting hooks (Key 238), and jack screws (Key 233). Refer to Figure 39. **NOTE:** Dowel pins (Key 232) will be shipped stored in a bag along with other fittings.
- 5 Apply Permatex Nickel Anti-Seize (Key A) to the threads of the dowel pins (Key 232) and thread them into the upper instrument mounting pad of the actuator. Refer to Figure 41.

Model DFC Linear Actuator

Side-Mounted Handwheel Mounting Instructions

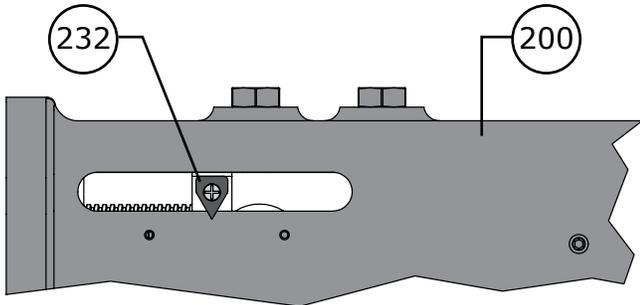


Figure 40 Suggested Pointer Start Position

INSTALLATION / MOUNTING (Continued)

SIDE-MOUNTED HANDWHEEL MOUNTING (Continued)

- Using an appropriately rated lifting device (such as a crane) or a second person as help, hoist the side-mounted handwheel assembly into position. Gently slide the pins of the levers (Keys 214 & 215) into the grooves of the side-mounted handwheel connecting block (Key 230), the mounting plate of the side-mounted handwheel body should be kept parallel to the mounting pad of the actuator. The dowel pins (Key 232) will act as locator pins to properly position the side-mounted handwheel onto the actuator. The levers should move as little as possible while the dowel pins are positioned into the closest mounting holes of the side-mounted handwheel body. Refer to Figures 42 & 43.

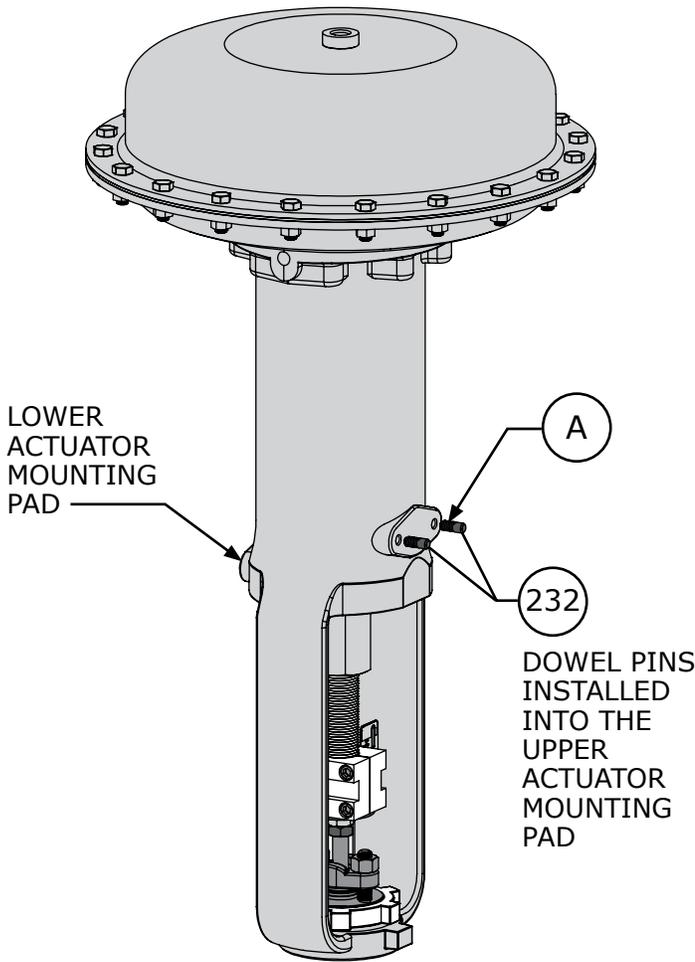


Figure 41 Dowel Pin Installation

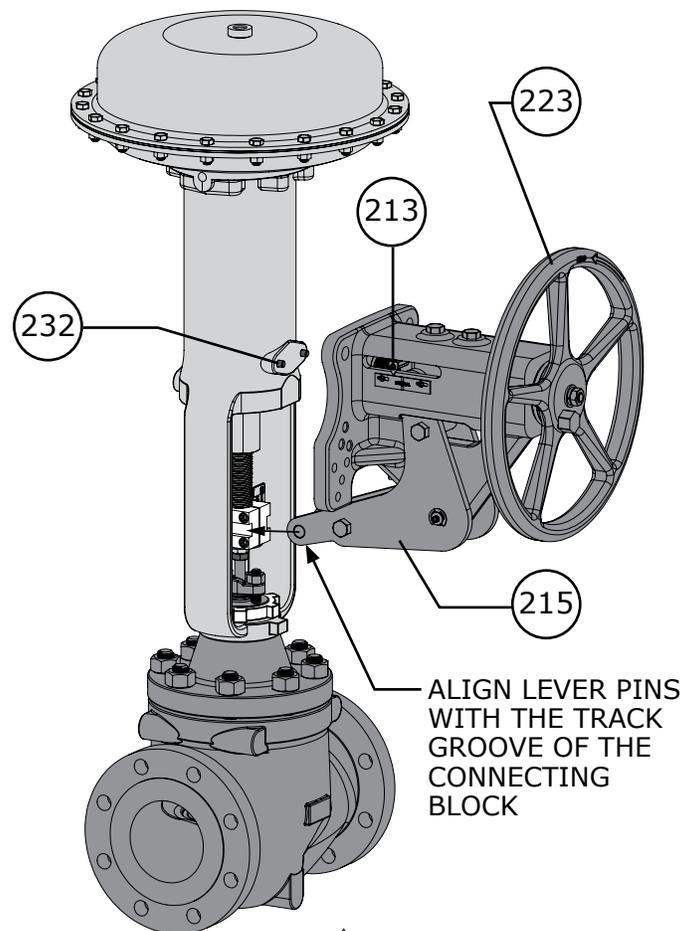


Figure 42 Side-Mounted Handwheel Mounting Positioning



Model DFC Linear Actuator

Side-Mounted Handwheel Mounting Instructions

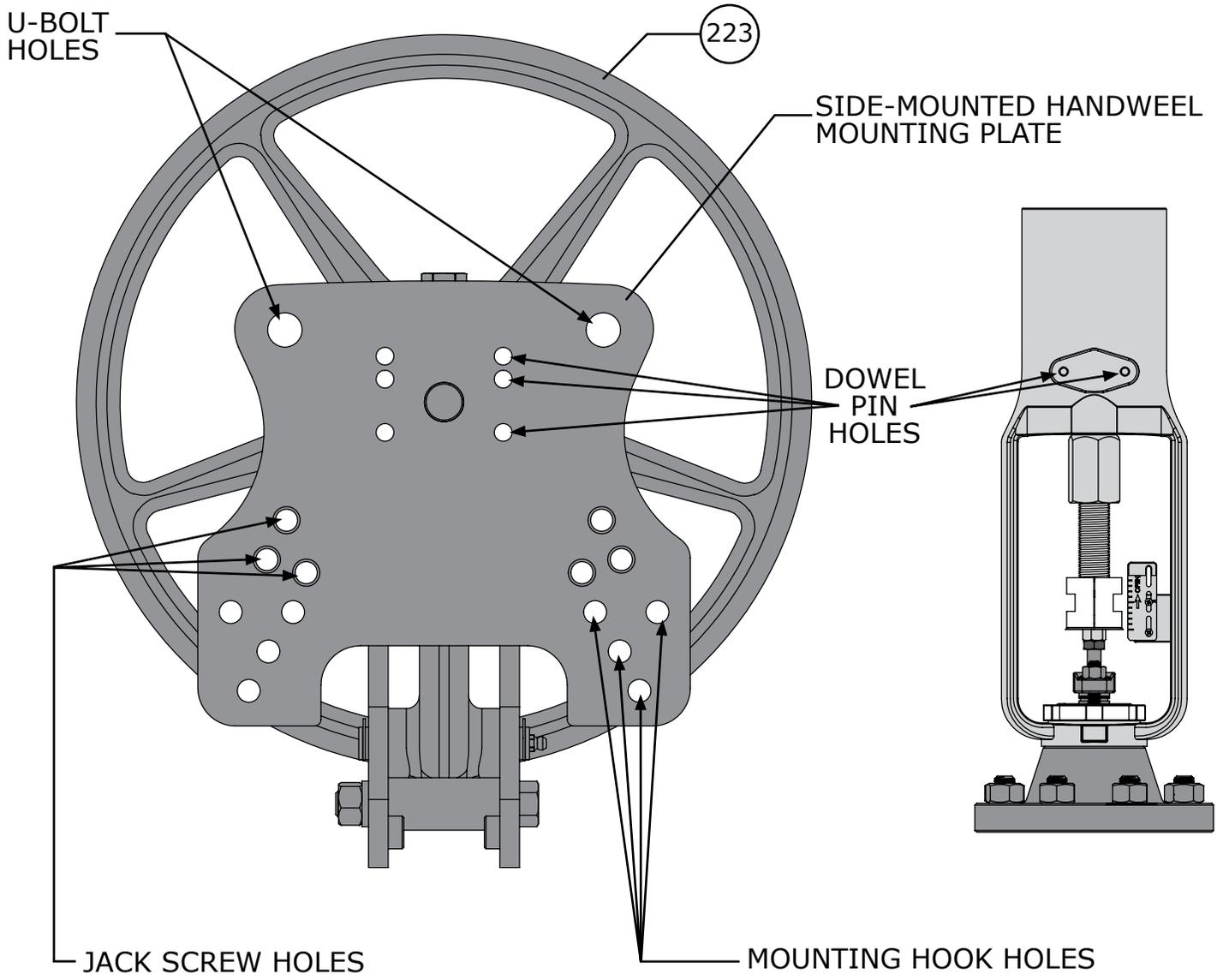


Figure 43 Side-Mounted Handwheel Mounting Hole Diagram

Model DFC Linear Actuator

Side-Mounted Handwheel Mounting Instructions



INSTALLATION / MOUNTING (Continued)

SIDE-MOUNTED HANDWHEEL MOUNTING (Continued)

- 7 Thread the hex nuts (Key 234) completely onto the jack screws (Key 233). Install the jack screws into the holes of the side-mounted handwheel body (Key 200) that places them most squarely against the legs of the actuator yoke. Refer to Figures 44 & 45.
- 8 Install the u-bolt (Key 235), washers (Key 236), and hex nuts (Key 237). Hand tighten the hex nuts used to secure the bolt. The jack screws (Key 233) may need to be adjusted in order to install the u-bolt. Refer to Figure 45.

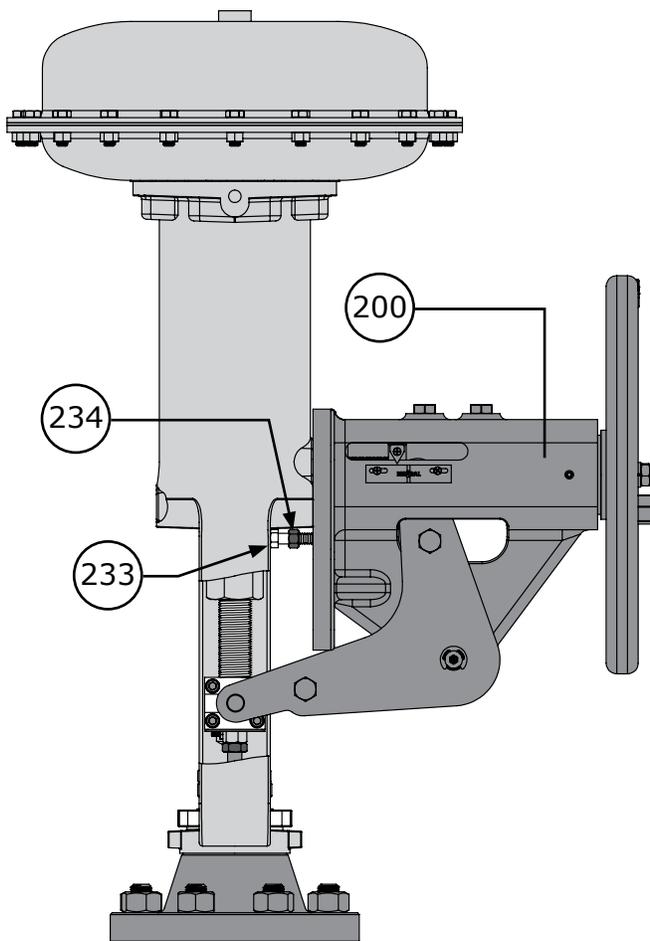


Figure 44 Jack Screw Installation

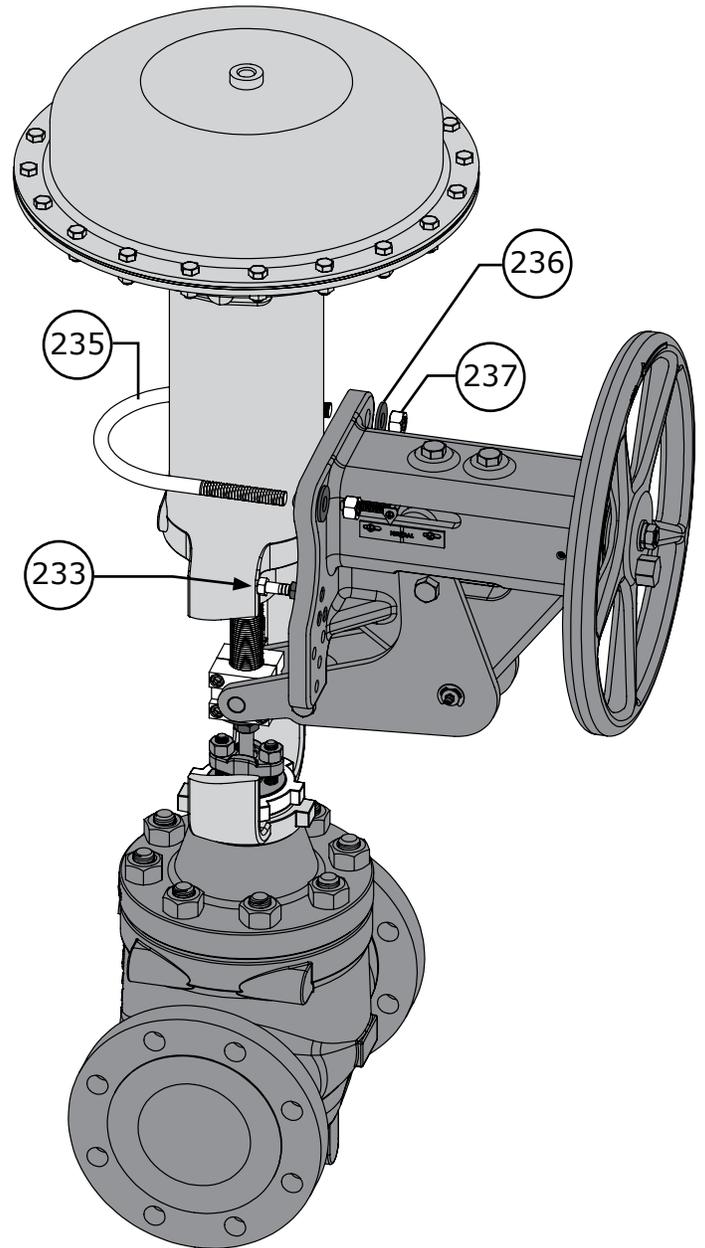


Figure 45 U-Bolt Installation



Model DFC Linear Actuator

Side-Mounted Handwheel Mounting Instructions

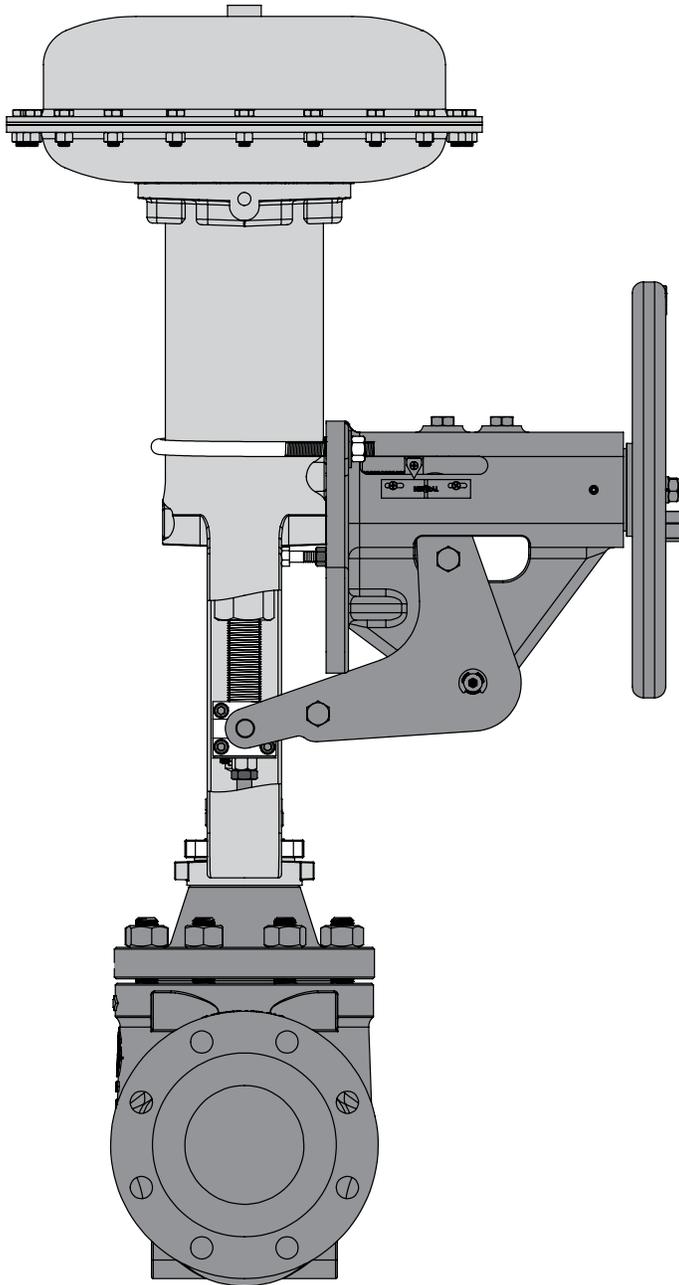


Figure 46 Properly Adjusted Jack Screws

INSTALLATION / MOUNTING (Continued)

SIDE-MOUNTED HANDWHEEL MOUNTING (Continued)

- 9 Adjust the jack screws (Key 233) until the mounting plate of the handwheel body is parallel to the mounting pad of the actuator. When adjusted properly there should be no uneven gaps between the body of the handwheel and the yoke of the actuator. Refer to Figure 46.
- 10 Install the mounting hooks (Key 238) into the holes of the handwheel body allowing for the most secure positioning to hold on to the legs of the actuator yoke. Install the lock washers (Key 239) and hand tighten the hex nuts (Key 240) onto the mounting hooks, make sure to adjust the mounting hooks evenly so that the side-mounted hand wheel body is positioned square and flush to the actuator yoke. Refer to Figures 47 & 48.
- 11 Torque the hex nuts (Keys 237 & 240) evenly and in an alternating pattern to the torque specifications listed in Table 5, Page 32.

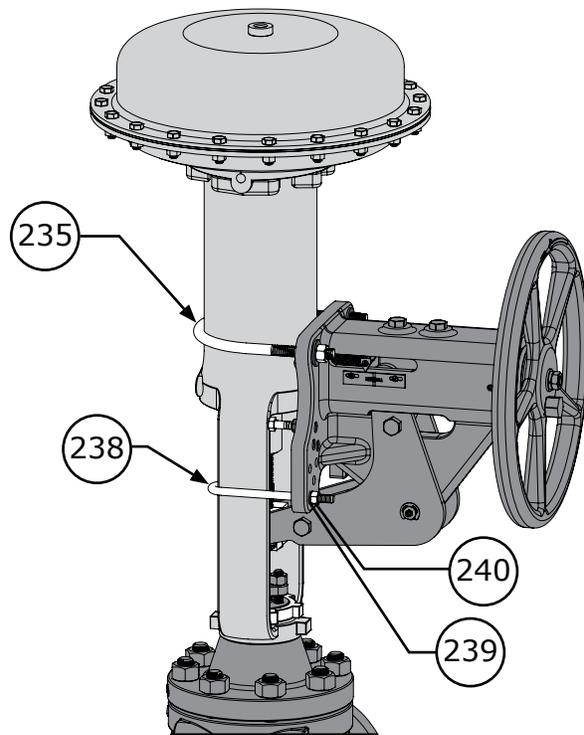


Figure 47 Mounting Hook Installation

Model DFC Linear Actuator

Side-Mounted Handwheel Mounting Instructions

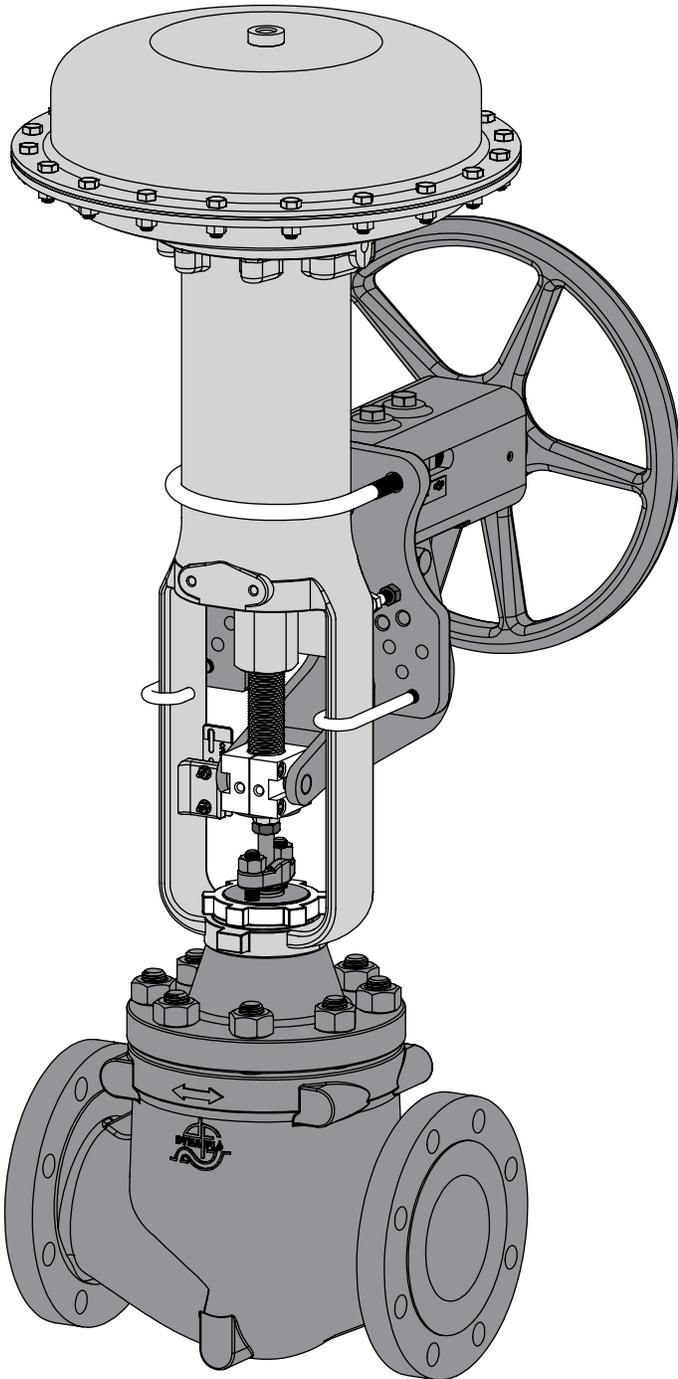


Figure 48 Mounting Hook Installation (Back View)

SMHW INSTALLATION / MOUNTING

(Continued)

ADJUSTING HANDWHEEL FOR NEUTRAL POSITION

Proceed with the following instructions only after the side-mounted handwheel has been properly mounted to the actuator.

These instructions will outline the process necessary to set the neutral position of the side-mounted handwheel and how to properly install the indicator plate (Key 210). These instructions assume that the indicator plate has not yet been installed onto the side-mounted handwheel body.

- 1 Rotate the handwheel (Key 223) either left or right until the lever pin that runs in the groove track of the operating nut (Key 206) comes into contact with the back face of the operating nut. The lever pin should make contact with the face of the operating nut but not move it, as soon as tension on the handwheel can be felt stop rotating the handwheel. Refer to Figure 50.
- 2 Rotate the handwheel (Key 223) in the opposite direction of the tension mentioned in the previous step 1 full turn.
- 3 Using two machine screws (Key 211), install the indicator plate (Key 210) so that the pointer is centered on the NEUTRAL indicator line. Figure 49.



Model DFC Linear Actuator

Side-Mounted Handwheel Mounting Instructions

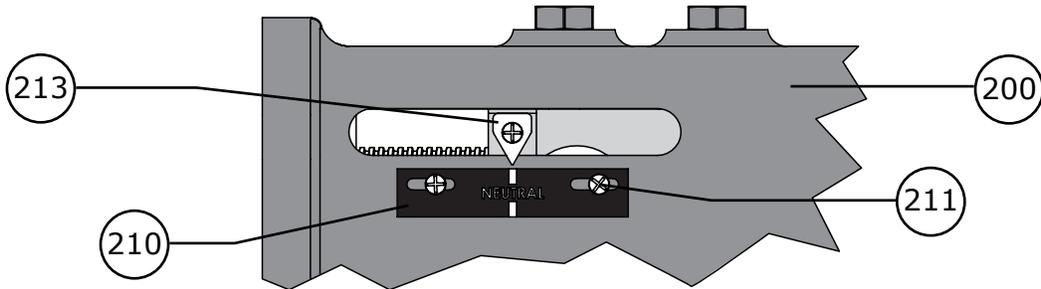


Figure 49 Indicator Plate Installation Diagram

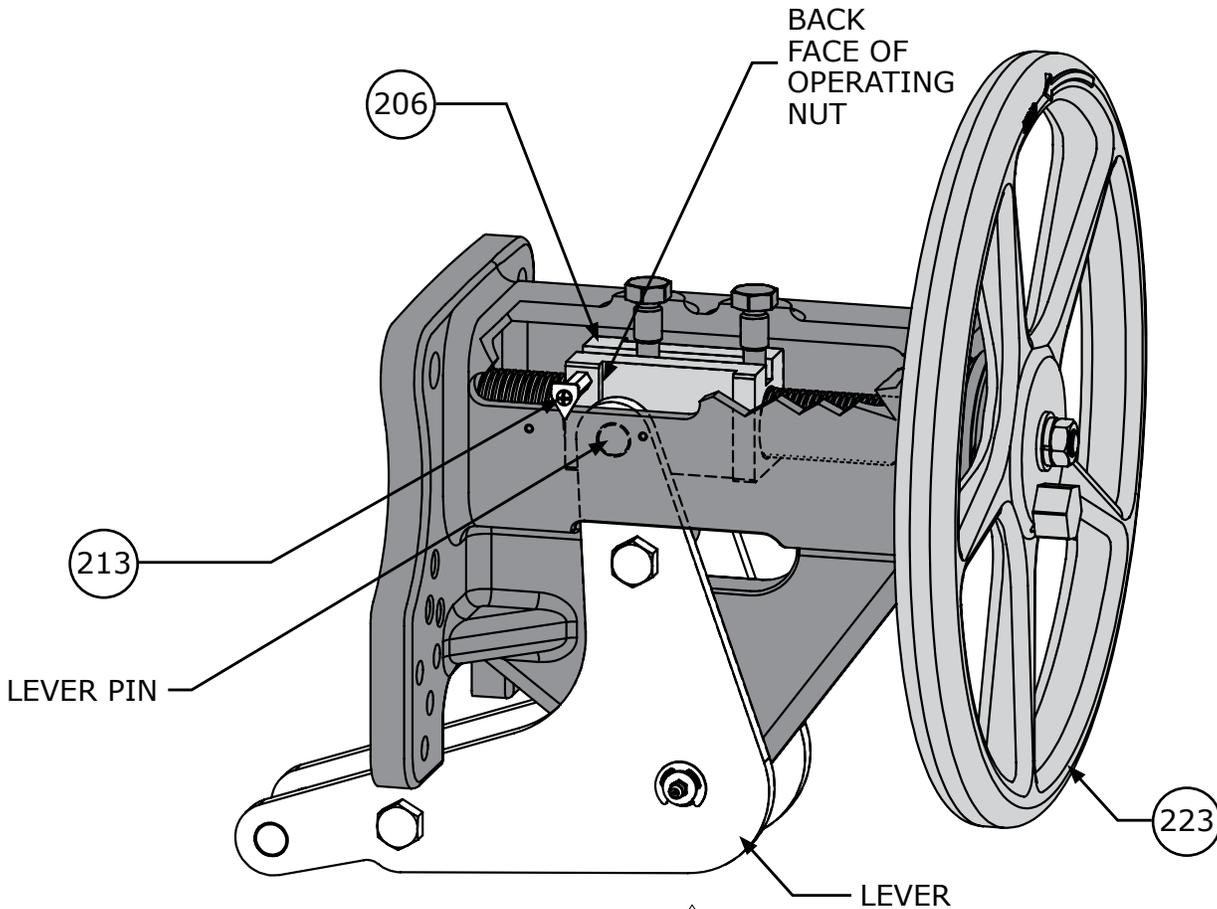


Figure 50 DFC Neutral Position Adjustment Diagram

Model DFC Linear Actuator

Side-Mounted Handwheel Disassembly



SMHW DISASSEMBLY

Before You Begin:

- Read the General and Scope section of this manual (Page 2).
- Read Safety Caution (Page 2).
- Warning: Sudden movement of actuator can cause damage or injury. It helps to have the actuator de-energized (placed into the appropriate fail position). Be aware that actuator springs will be under tension.
- Use safe work practices and lock out procedures before placing valve in-line.
- Standard actuators accept 1/4" (6 mm) NPT connections.
- **WARNING:** Do not use operating pressure that exceeds the Maximum Casing Pressure. Also, be sure the operating pressure does not create a force on the actuator stem that is greater than the Maximum Allowable Output Thrust.
- **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.

Special Tools Required:

- Spanner wrench.

NOTE: For maintenance purposes, the Side-Mounted Handwheel can be disassembled while still mounted to the actuator. For complete disassembly it is not necessary to remove the handwheel body (Key 200) from the yoke (Key 2).

SIDE-MOUNTED HANDWHEEL ASSEMBLY REMOVAL

- 1 To remove the handwheel from the actuator, first place the handwheel into the NEUTRAL position.
- 2 Loosen and remove the mounting hooks (Key 238), lock washers (Key 239) and hex nuts (Key 240).
- 3 Using a lifting device, support the weight of the side-mounted handwheel. Remove the hex nuts (Key 237), washers (Key 236), and u-bolt (Key 235).
- 4 Carefully slide the side-mounted handwheel off the actuator.
- 5 Remove the jack screws (Key 233), hex nuts (Key 234), and dowel pins (Key 232) if necessary.

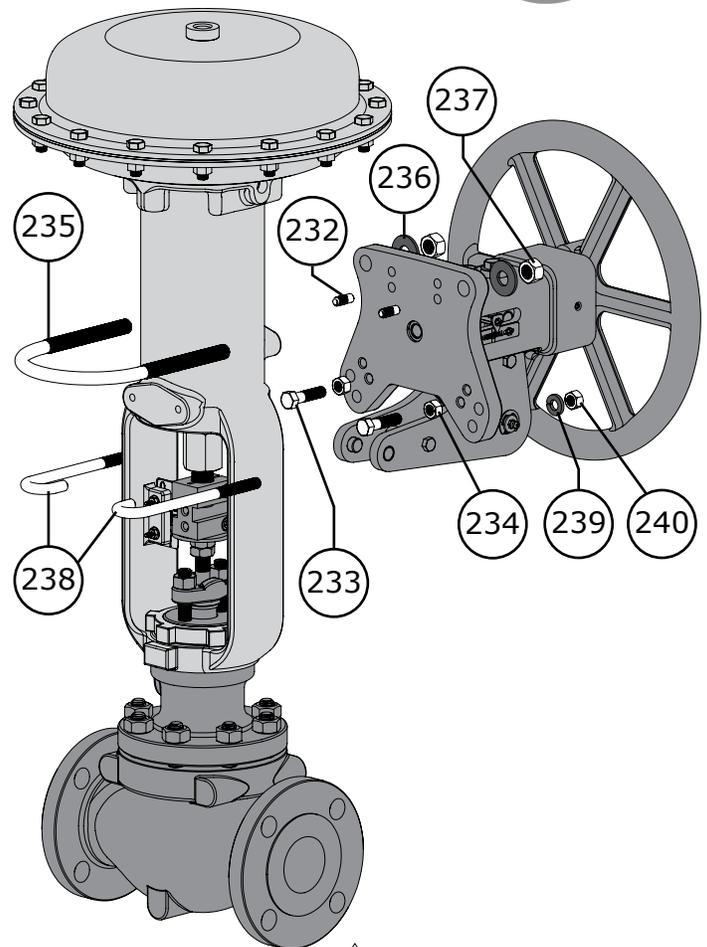


Figure 51 SMHW Assembly Removal

HANDWHEEL REMOVAL

For Model SMHW100 Handwheels:

NOTE: SMHW100 handwheels (Key 223) do not have a spring cap (Key 226), use caution when removing the handwheel as the ball (Key 224) and spring (Key 225) can fall out.

- 1 Remove the jam nut (Key 229), lockwasher (Key 228), and washer (Key 227).
- 2 Remove the handwheel (Key 223). **CAUTION:** The ball (Key 224) and spring (Key 225) can fall out.
- 3 Collect the ball (Key 224) and spring (Key 225).



Model DFC Linear Actuator Side-Mounted Handwheel Disassembly

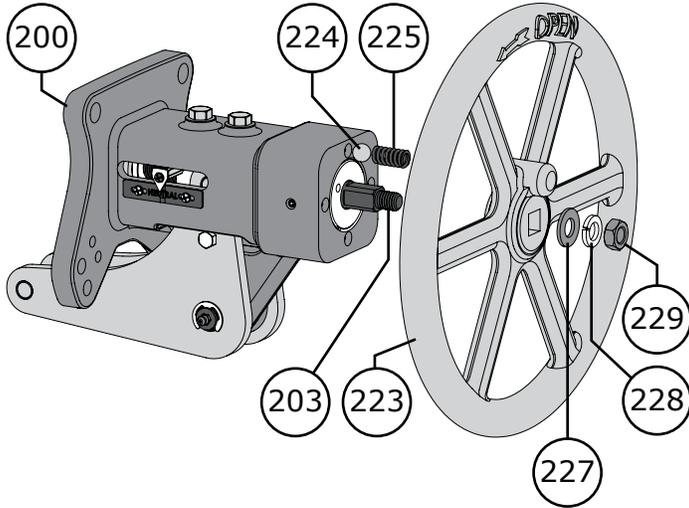


Figure 52 Size 069 Handwheel Removal

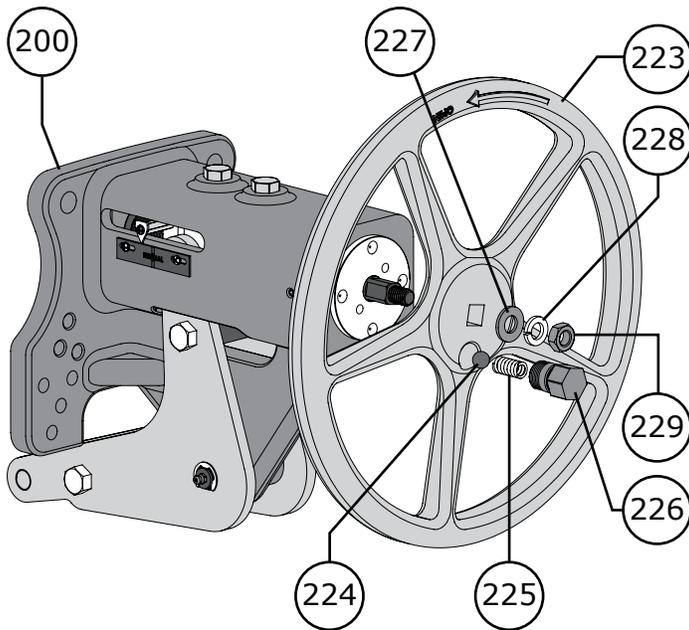


Figure 53 Size 105 Removal

SMHW DISASSEMBLY (Continued)

HANDWHEEL REMOVAL

For Model SMHW200 Handwheels:

- 1 Remove the spring cap (Key 226), spring (Key 225), and ball (Key 224).
- 2 Remove the jam nut (Key 229), lockwasher (Key 228), and washer (Key 227).
- 3 Remove the handwheel (Key 223).

LEVER REMOVAL

- 1 Remove the hex nuts (Key 222), lockwashers (Key 221), cap screws (Key 220), and spacers (Key 219). Refer to Figure 54.
- 2 Remove the retaining ring (Key 217) and drive out the lever pivot pin (Key 216). Remove the levers (Keys 214 & 215). Refer to Figure 55.

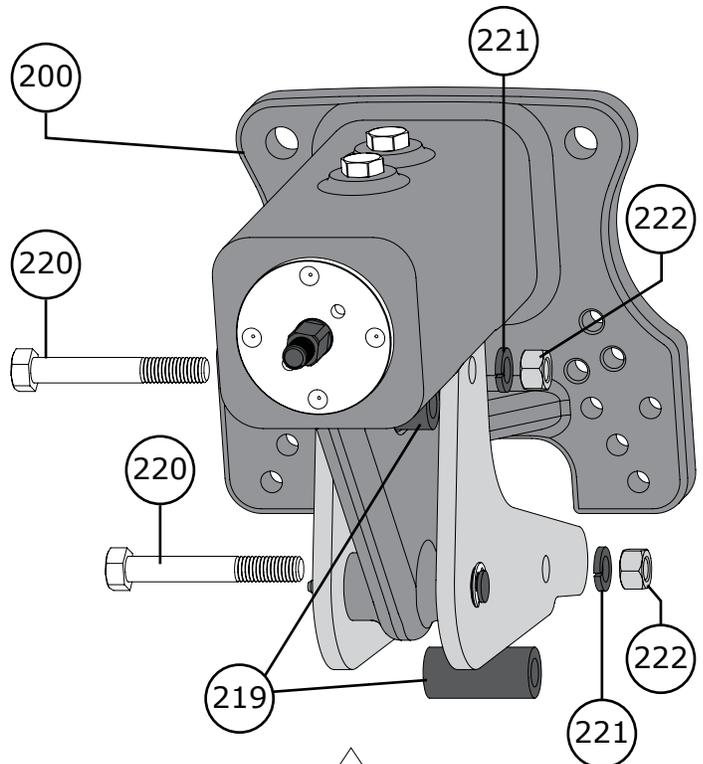


Figure 54 SMHW Spacer Removal

Model DFC Linear Actuator

Side-Mounted Handwheel Disassembly

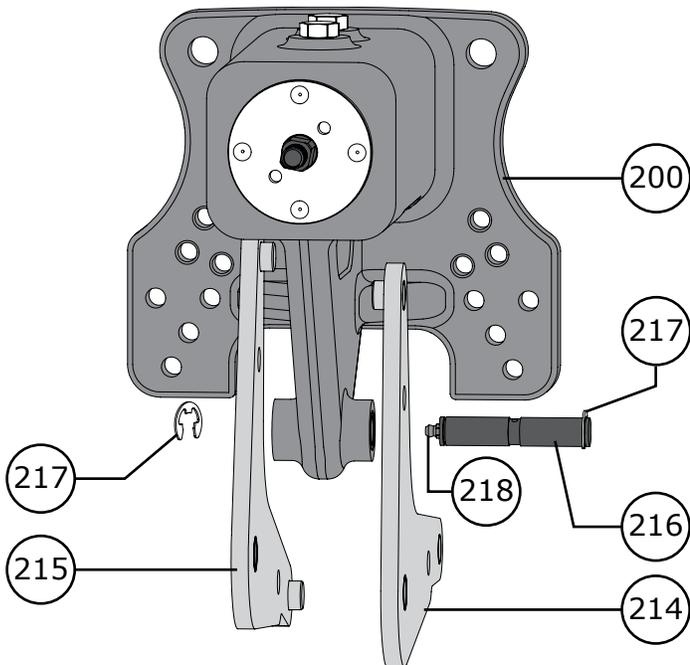


Figure 55 SMHW Lever Removal

SMHW DISASSEMBLY (Continued)

HANDWHEEL BODY DISASSEMBLY

- 3 Remove the machine screw (Key 211), pointer (Key 213), and pointer stem (Key 212).
- 4 Using a hex wrench, remove the set screw (Key 209).
- 5 Remove the bearing retainer (Key 208). It may be necessary to use a spanner wrench in order to remove the retainer.
- 6 Remove the first bearing (Key 201).
- 7 Remove the guide bolts (Key 207).
- 8 Remove the handwheel screw (Key 203) / operating nut (Key 206) assembly. Separate the operating nut from the handwheel screw if necessary. **For SMHW100:** It is not necessary to remove the spring pin (Key 205) and shaft stop (Key 204).
- 9 **For SMHW100:** Remove the bushing (Key 202) from inside the second bearing (Key 201).

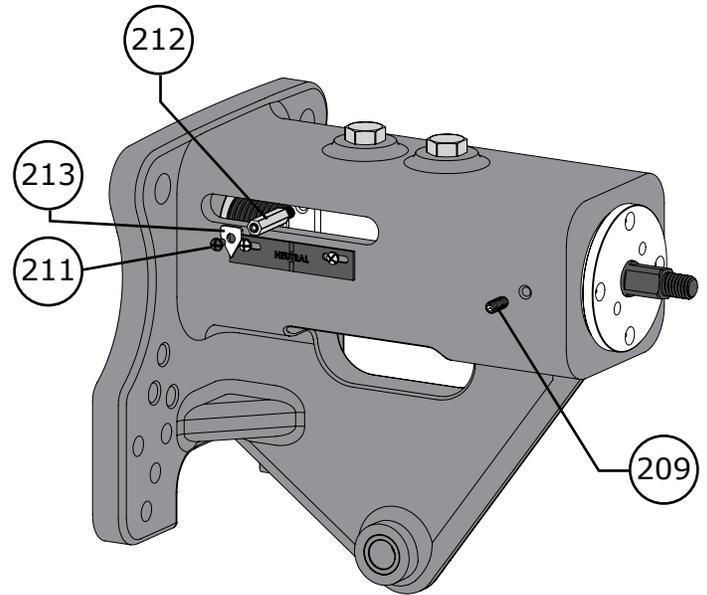


Figure 56 Pointer and Set Screw Removal

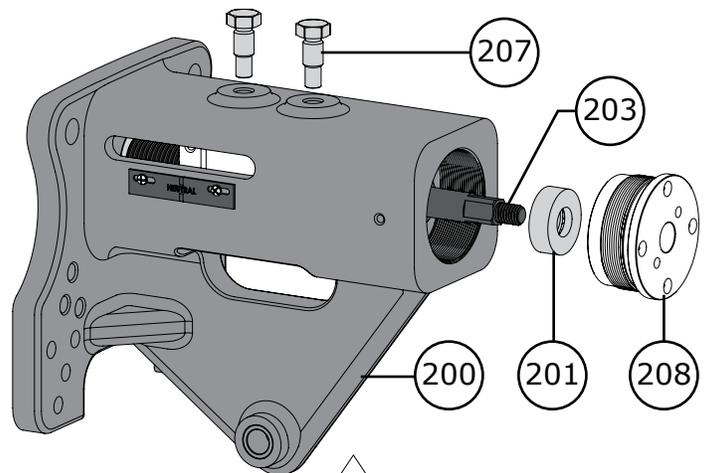


Figure 57 Bearing Retainer Removal

- 10 Remove the second bearing (Key 201) from inside the handwheel body (Key 200).
- 13 Clean and inspect all parts (especially threads and contact surfaces) for damage. Replace or repair parts as necessary.

NOTE: For information on removing the connecting block (Key 230) Refer to ACTUATOR DISASSEMBLY on Page 11.



Model DFC Linear Actuator Side-Mounted Handwheel Disassembly

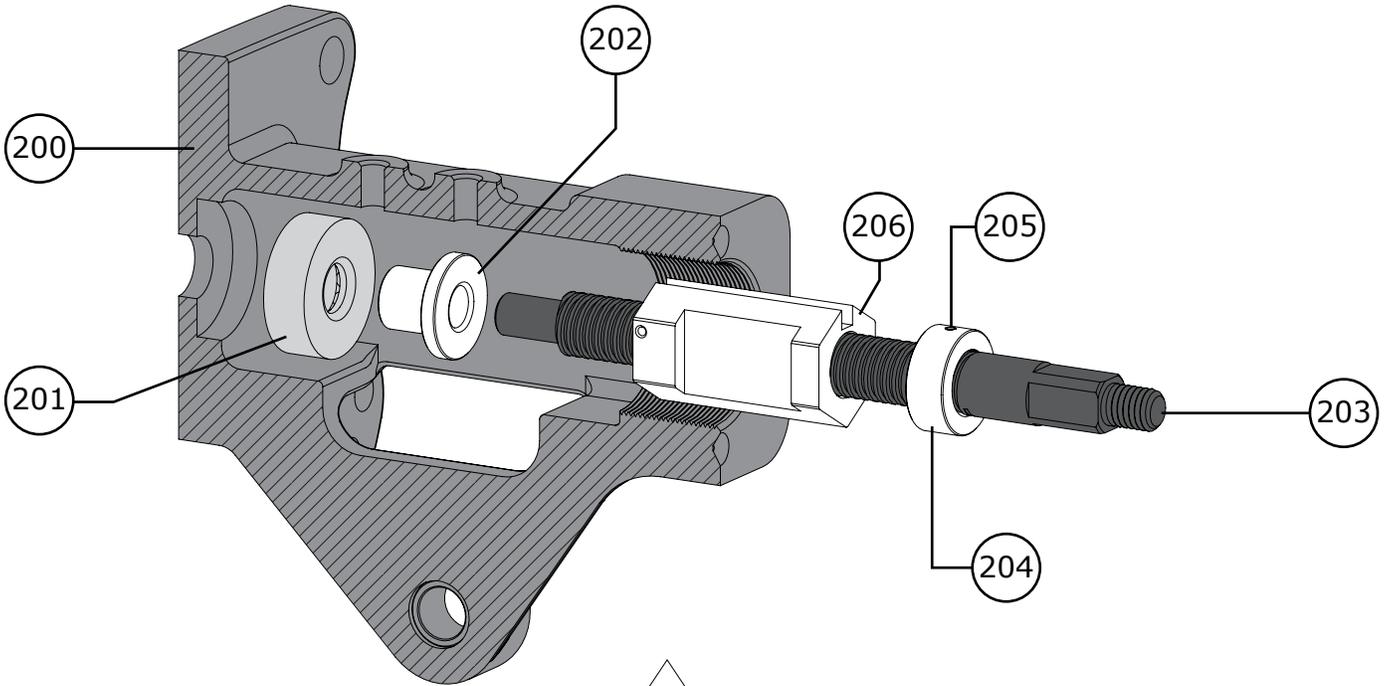


Figure 58 Size 069 Handwheel Screw Removal

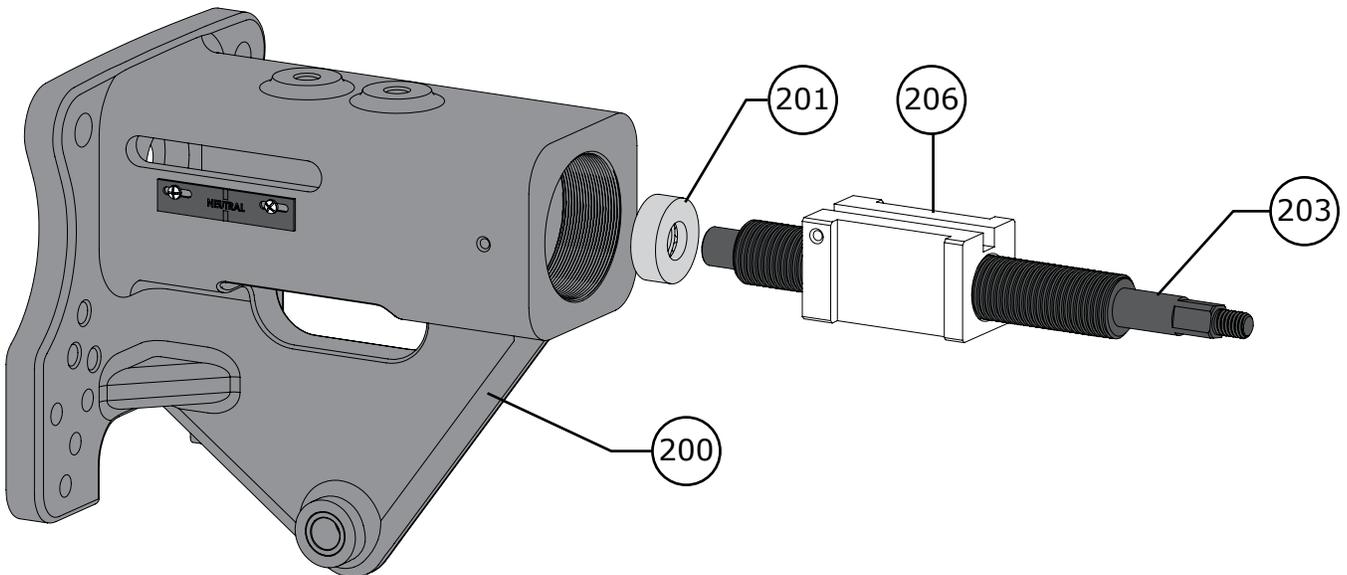


Figure 59 Size 105 & 156 Handwheel Screw Removal

Model DFC Linear Actuator

Side-Mounted Handwheel Assembly



SMHW ASSEMBLY

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.
- Standard actuators accept 1/4" (6 mm) NPT connections.
- **WARNING:** Do not use operating pressure that exceeds the Maximum Casing Pressure. Also, be sure the operating pressure does not create a force on the actuator stem (Key 13) that is greater than the Maximum Allowable Output Thrust. Refer to Table 1.
- **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.
- Clean and inspect all parts.
- Replace or repair damaged parts. Replace all soft parts (Seals, o-rings, gaskets).

Lubricants Required:

- Permatex® Nickel Anti-Seize or equivalent (Key A)
- Mobil Unirex™ Lotemp Grease or Equivalent (Key F)

HANDWHEEL BODY ASSEMBLY

- 1 Pre-pack the bearings (Key 201) with Mobil Unirex™ Lotemp Grease (Key F) and set them aside in a clean area.
- 2 If the handwheel body (Key 200) is no longer mounted to the actuator yoke (Key 2), rest the handwheel body mounting pad side down on a work surface that will support the assembled weight of the handwheel.
- 3 Install the first bearing (Key 201) into the bearing track of the handwheel body (Key 200) so that the fillet of the bearing is facing up. Refer to Figures 60 and 61.
- 4 **For Size 069:** Lubricate the inside and outside surface of the bushing (Key 202) and install it into the bearing from Step 3. Refer to Figure 61.
- 5 Lubricate the threads of the handwheel screw (Key 203) with Mobil Unirex™ Lotemp Grease (Key F) and thread the operating nut (Key 206) onto the handwheel screw as shown in Figures 61, 62, & 63. **NOTE:** The operating nut and handwheel screw are reverse threaded.

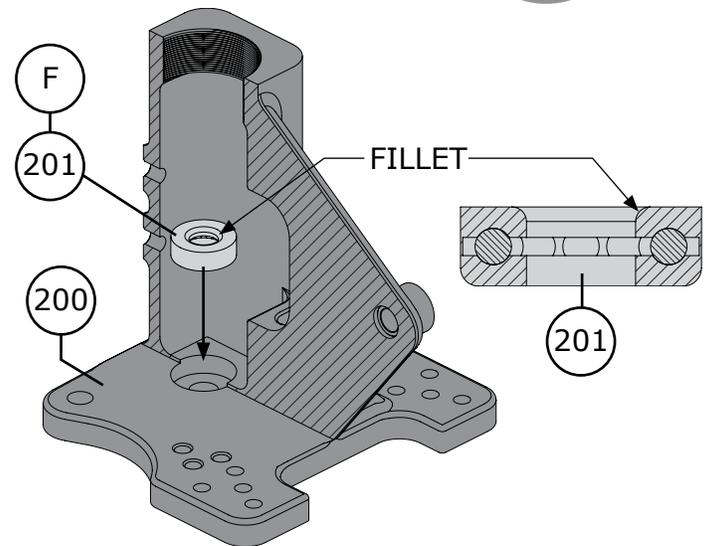


Figure 60 First Bearing Installation

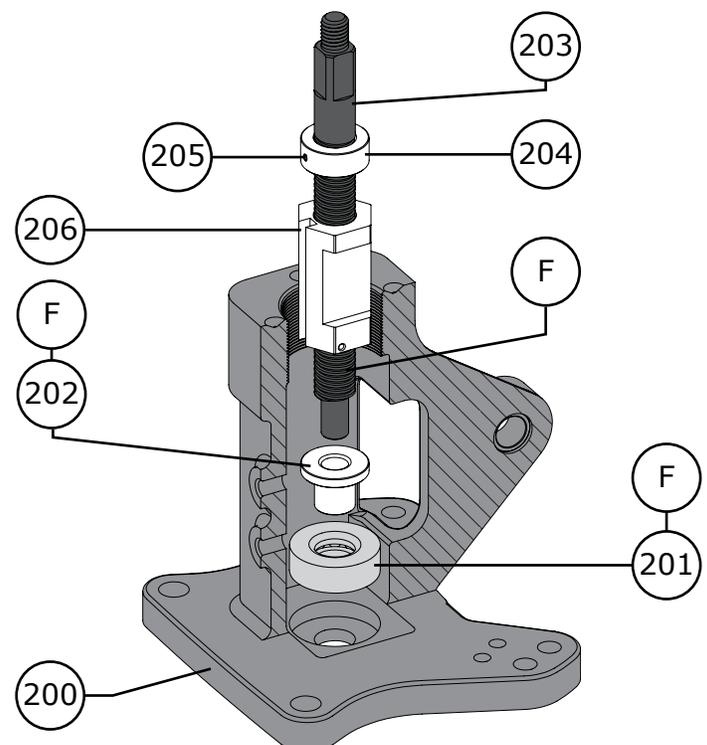


Figure 61 Size 069 Bearing & Bushing Installation



Model DFC Linear Actuator Side-Mounted Handwheel Assembly

SMHW ASSEMBLY (Continued)

HANDWHEEL BODY ASSEMBLY (Continued)

- 6 Set the handwheel screw (Key 203) / operating nut (Key 206) assembly into the handwheel body (Key 200) as shown in Figures 61 and 62.
- 7 Lubricate the threads of the guide bolts (Key 207) with Permatex® Nickel Anti-Seize (Key A) and thread them into the handwheel body (Key 200) so that they position themselves into the groove on top of the operating screw. Refer to Figure 63.
- 8 Install the second bearing (Key 201) onto the recess of the bearing retainer (Key 208) so that the fillet of the bearing faces up as shown in Figure 64.
- 9 Lubricate the threads of the bearing retainer (Key 208) with Permatex® Nickel Anti-Seize (Key A) and thread it into the top of the handwheel body (Key 200). It may be necessary to use a spanner wrench to tighten the bearing retainer completely into the handwheel body. Once the bearing retainer is completely threaded in place, loosen the bearing retainer ¼ turn. Refer to Figure 65.

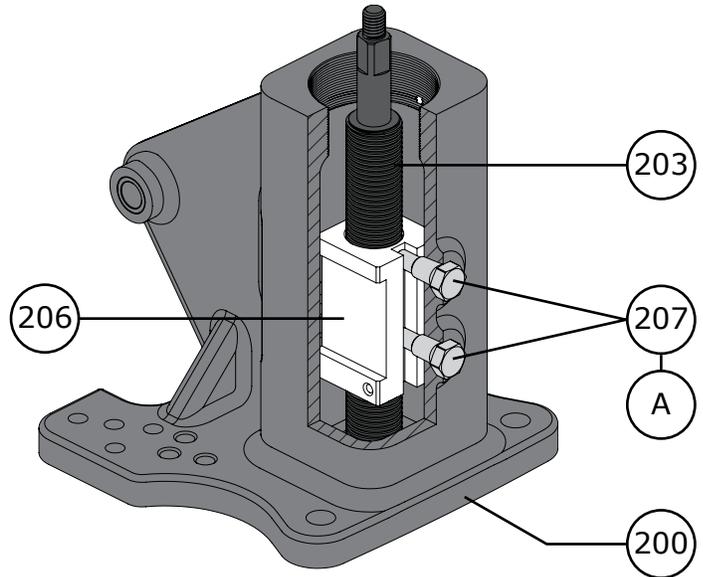


Figure 63 Guide Bolt Installation

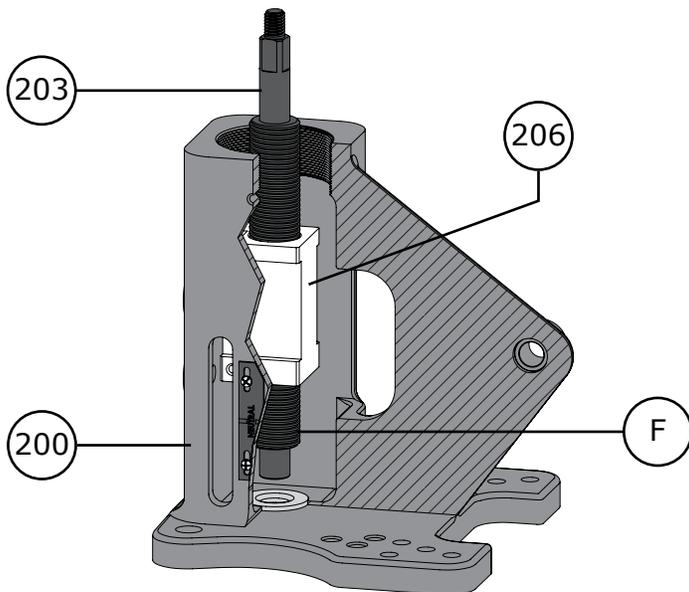


Figure 62 Size 105 & 156 Handwheel Screw Installation

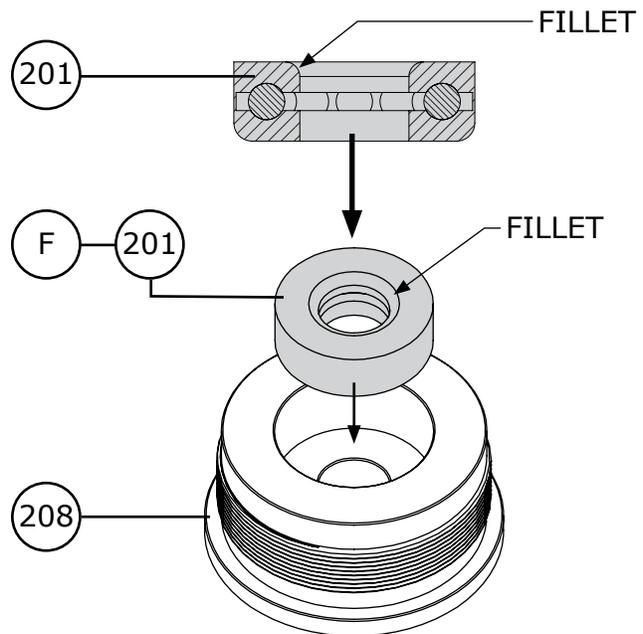


Figure 64 Second Bearing Preparation

Model DFC Linear Actuator

Side-Mounted Handwheel Assembly

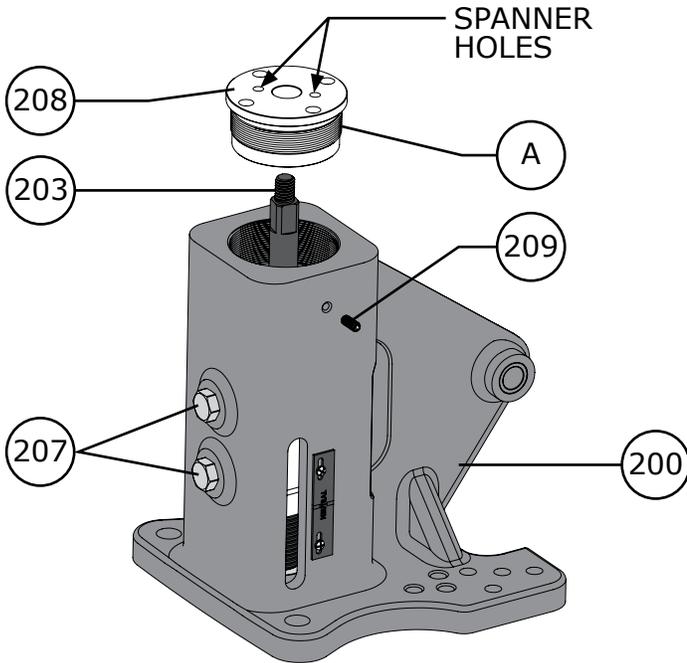


Figure 65 Bearing Retainer Installation

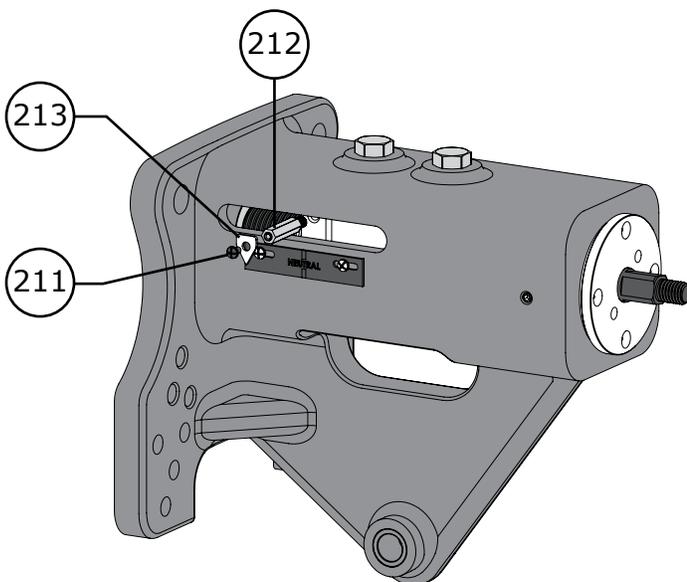


Figure 66 Pointer Installation

SMHW ASSEMBLY (Continued)

HANDWHEEL BODY ASSEMBLY (Continued)

- 10** Using a hex wrench, install the set screw (Key 209). Do not over tighten.

POINTER INSTALLATION

- 11** Using the machine screws (Key 211), loosely install the indicator plate on to the handwheel body (Key 200). Refer to Figure 66.
- 12** Install the pointer stem (Key 212) into the operating nut (Key 206).
- 13** Place the pointer (Key 213) onto the pointer stem (Key 212) and secure it in place with a machine screw (Key 211).

LEVER INSTALLATION

- 14** Install the zerk fitting (Key 218) into the lever pivot pin (Key 216). Clip a retaining ring (Key 217) on to the pivot pin at the opposite end from the zerk fitting.
- 15** Set the right lever (Key 214) (right and left levers are marked with either a 'L' or 'R') into the groove of the operating nut (Key 206) and secure it in place by sliding the lever pivot pin (Key 216) zerk fitting first through the lever and into the handwheel body (Key 200). Refer to Figure 68.
- 16** Set the left lever (Key 215) into the groove of the operating nut (Key 206) and onto the lever pivot pin (Key 216). Install the second retaining ring (Key 217) onto the lever pivot pin.
- 17** Install the spacers (Key 219) in between the levers (Keys 214 & 215). Secure the spacers in place using a cap screw (Key 220), lockwasher (Key 221), and hex nut (Key 222).
- 18** Grease the lever pivot pin (Key 216) through the zerk fitting (Key 218) using Mobil Unirex™ Lotemp Grease (Key F).



Model DFC Linear Actuator Side-Mounted Handwheel Assembly

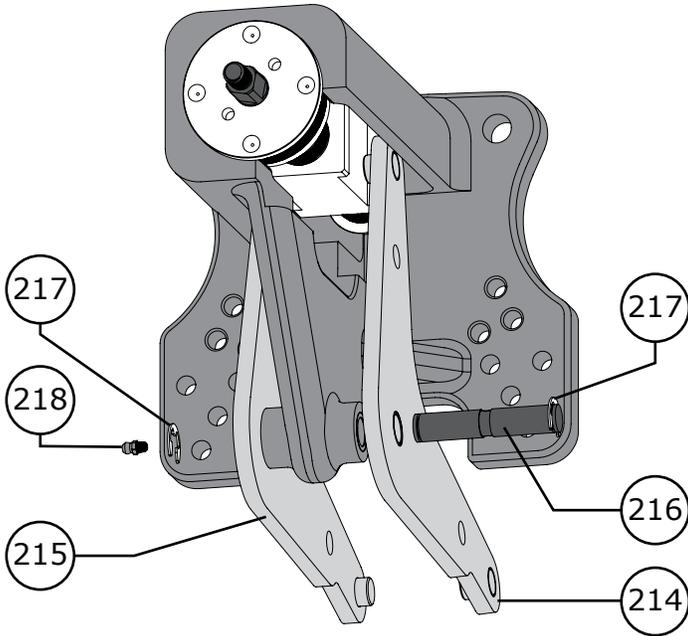


Figure 67 *Lever Installation*

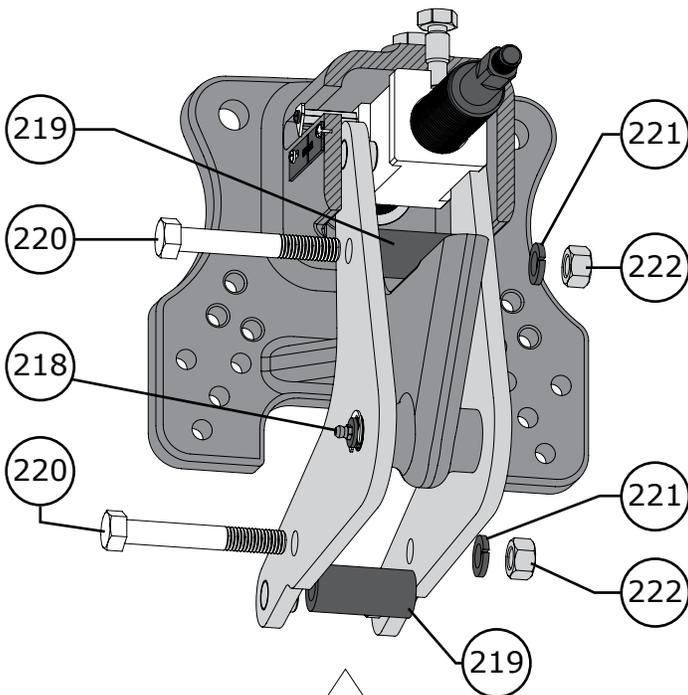


Figure 68 *Spacer Installation*

SMHW ASSEMBLY (Continued)

HANDWHEEL INSTALLATION

NOTE: All lettering on the handwheel (Key 223) should face away from the bearing retainer (Key 208).

For Model Size 069 Side-Mounted Handwheels:

- 1 Apply Mobil Unirex™ Lotemp Grease (Key F) to the spring (Key 225) and the ball track of the bearing retainer (Key 208). Set the spring into the spring pocket of the handwheel (Key 223).
- 2 Place the handwheel (Key 223) onto the handwheel screw (Key 203) and set the ball (Key 224) on to the spring (Key 225) as you push the handwheel tight to the face of the handwheel body (Key 200).
- 3 Install the washer (Key 227), lockwasher (Key 228), and jam nut (Key 229) onto the handwheel screw (Key 203). Tighten the jam nut completely.
- 4 Rotate the handwheel (Key 223) until the ball (Key 224) drops into the track of the handwheel body (Key 200).

For Model Size 105 & 156 Side-Mounted Handwheels:

- 1 Lubricate the ball track of the bearing retainer (Key 208) with Mobil Unirex™ Lotemp Grease (Key F).
- 2 Slide the handwheel (Key 223) over the handwheel screw (Key 203) so that the backside of the handwheel rests against the face of the bearing retainer.
- 3 Install the washer (Key 227), lockwasher (Key 228), and jam nut (Key 229) onto the end of the handwheel screw (Key 203). Tighten the jam nut completely.
- 4 Apply Mobil Unirex™ Lotemp Grease (Key F) to the spring (Key 225).
- 5 Set the ball (Key 224) and spring (Key 225) into the pocket of the handwheel (Key 223). Secure the ball and spring in place using the spring cap (Key 226), tighten the spring cap completely.
- 6 Rotate the handwheel (Key 223) until the ball (Key 224) drops into the track of the bearing retainer (Key 208).

Model DFC Linear Actuator

Side-Mounted Handwheel Assembly

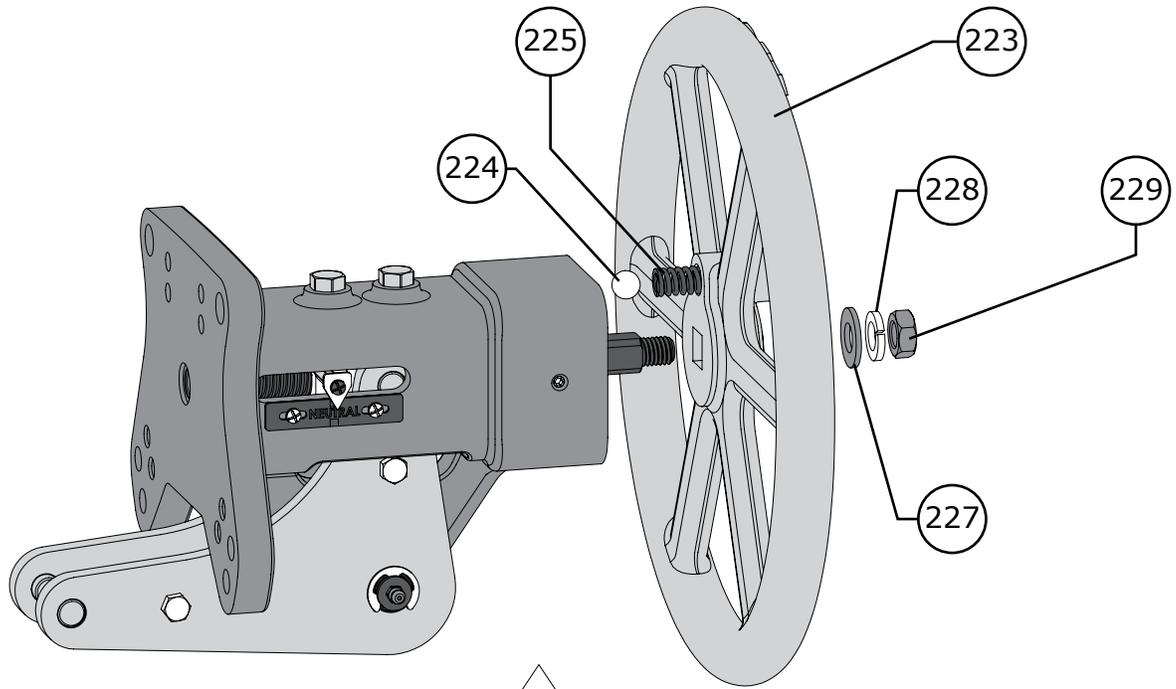


Figure 69 Size 069 Handwheel Screw Detail

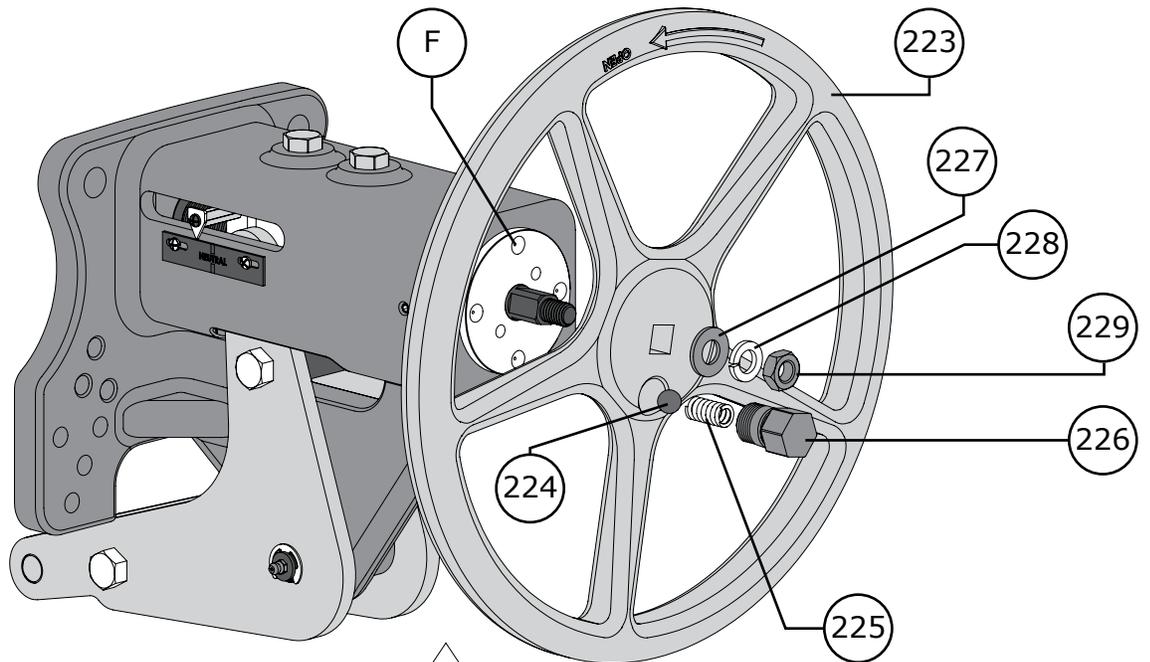


Figure 70 Size 105 & 156 Handwheel Screw Detail



Model DFC Linear Actuator

Size 3220 Integral SMHW Disassembly

SIZE 3220 SMHW OPERATION

The Size 3220 Side-Mounted Handwheel is usually used as a manual actuator. A sleeve (Key 611) in the actuator assembly opens the valve by moving the valve stem when the handwheel is turned counter-clockwise. Turning the handwheel clockwise past the neutral position will always close the valve.

The following instructions provide information on the disassembly and re-assembly of a Size 3220 Side-Mounted Handwheel. Perform the disassembly only as far as necessary to complete the required maintenance.

SIZE 3220 SMHW DISASSEMBLY

Before You Begin:

- Read the General and Scope section of this manual (Page 2).
- Read Safety Caution (Page 2).
- **WARNING:** Sudden movement of actuator can cause damage or injury. It helps to have the actuator de-energized (placed into the appropriate fail position). Be aware that actuator springs will be under tension.
- Use safe work practices and lock out procedures before placing valve in-line.
- Standard actuators accept 1/4" (6 mm) NPT connections.
- **WARNING:** Do not use operating pressure that exceeds the Maximum Casing Pressure. Also, be sure the operating pressure does not create a force on the actuator stem (Key 612) that is greater than the Maximum Allowable Output Thrust. Refer to Table 1.
- **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.
- 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. Refer to the appropriate valve instruction manual.

Special Tools Required:

- Properly Rated Lifting Straps (2 – 4 Straps). Reference valve and actuator weights.
- Lifting Device (Example: Crane) or extra people to hold the Side-Mounted Handwheel.

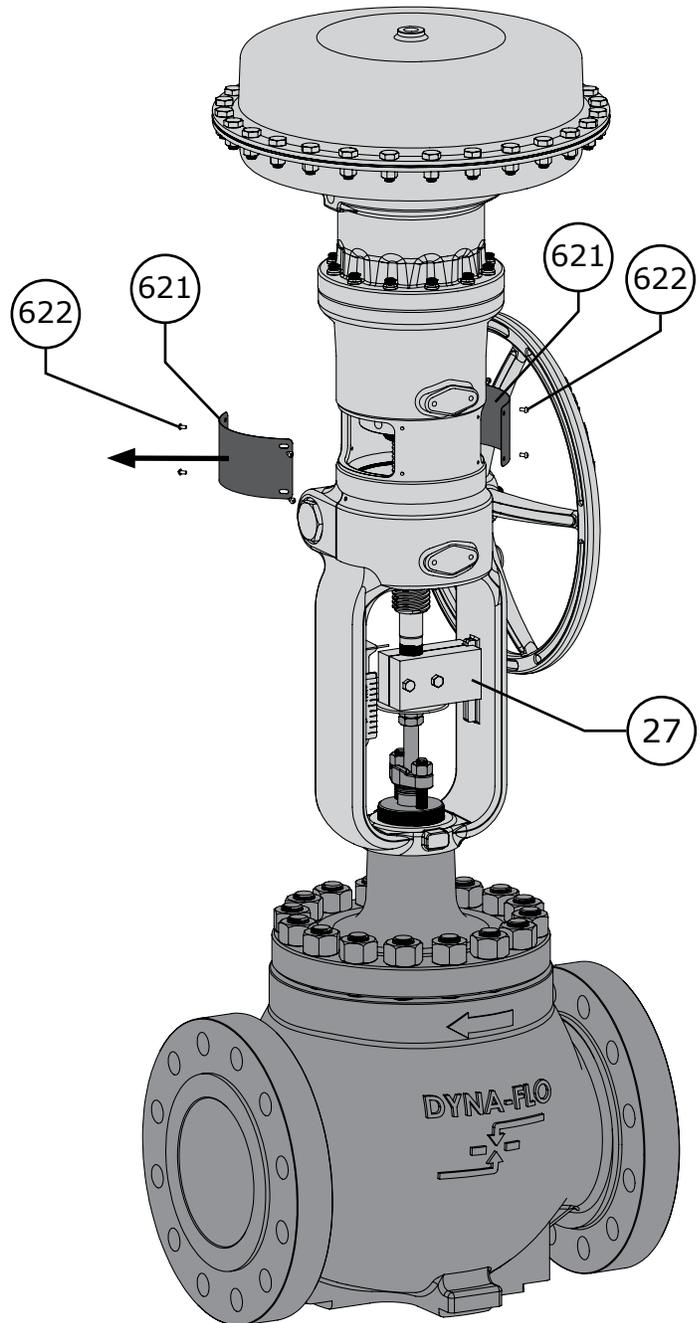


Figure 71 Cover Band Removal

Model DFC Linear Actuator

Size 3220 Integral SMHW Disassembly

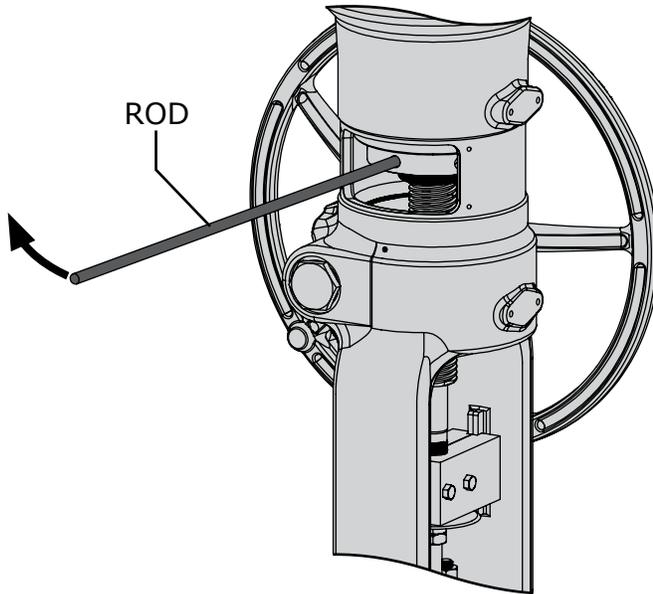


Figure 72 Spring Tension Removal

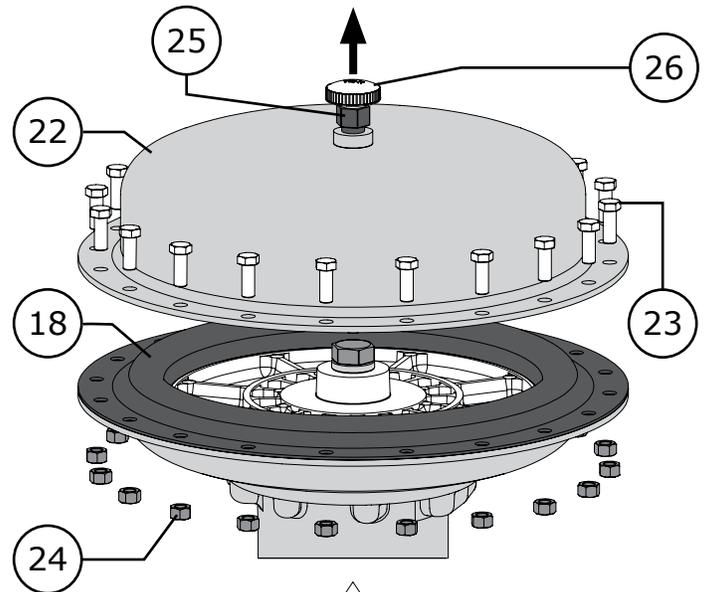


Figure 73 Upper Diaphragm Casing Disassembly

SIZE 3220 SMHW DISASSEMBLY (Continued)

- 1 Disconnect any tubing, piping, or instrumentation from the actuator.
- 2 Remove the cover band screws (Key 622) and cover bands (Key 621). Refer to Figure 71.
- 3 Using a 1/2" diameter metal rod, remove all spring tension by turning the spring adjuster (Key 614) clockwise (to the left). Refer to Figure 72.
- 4 It is recommended to separate the actuator from the valve, but not necessary. Refer to ACTUATOR DISASSEMBLY, Step 3, Page 11 for actuator removal instructions.
- 5 Remove the casing cap screws (Key 23) and nuts (Key 24), then remove the upper diaphragm casing (Key 22). Refer to Figure 73.
- 6 Carefully remove the cap screw (Key 21) and travel stop spacer (Key 20) from the top of the actuator stem (Key 612). **NOTE:** It may be beneficial to re-install the connecting block assembly (Keys 27 & 28) to the actuator stem (Key 612) in order to keep the actuator stem from twisting during cap screw removal.

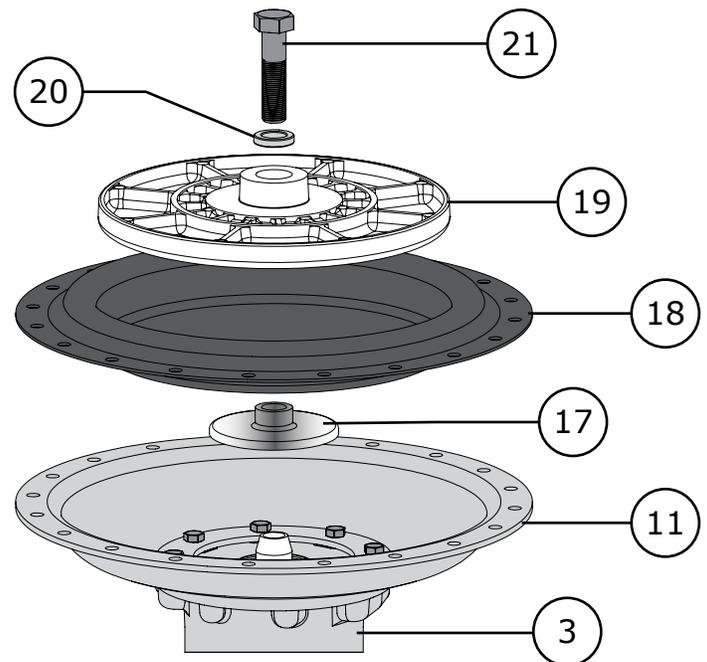


Figure 74 Upper Diaphragm Casing Detail



Model DFC Linear Actuator

Size 3220 Integral SMHW Disassembly

SIZE 3220 SMHW DISASSEMBLY (Continued)

- 7 Remove the upper diaphragm plate (Key 19), diaphragm (Key 18), and lower diaphragm plate (Key 17). Refer to Figure 74.
- 8 Remove the cap screws (Key 12) and remove the lower diaphragm casing (Key 11).
- 9 Remove the casing o-ring (Key 10).
- 10 Remove the socket head cap screws (Key 4) and separate the spring case adapter assembly (Keys 3, 5, 6, 7) from the yoke (Key 600).
- 11 Carefully remove the snap ring (Key 8) and remove the bushing (Key 5) from the spring case adapter (Key 3). Refer to Figure 76.
- 12 Using a pick set, carefully remove the o-rings (Keys 6 & 7) from the bushing (Key 5). Refer to Figure 77.

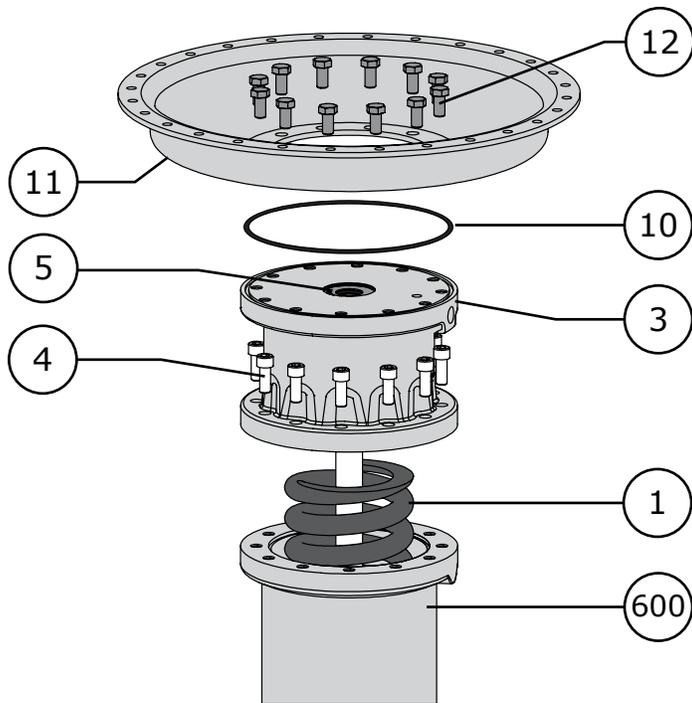


Figure 75 3220 SMHW Lower Casing/Adapter Removal

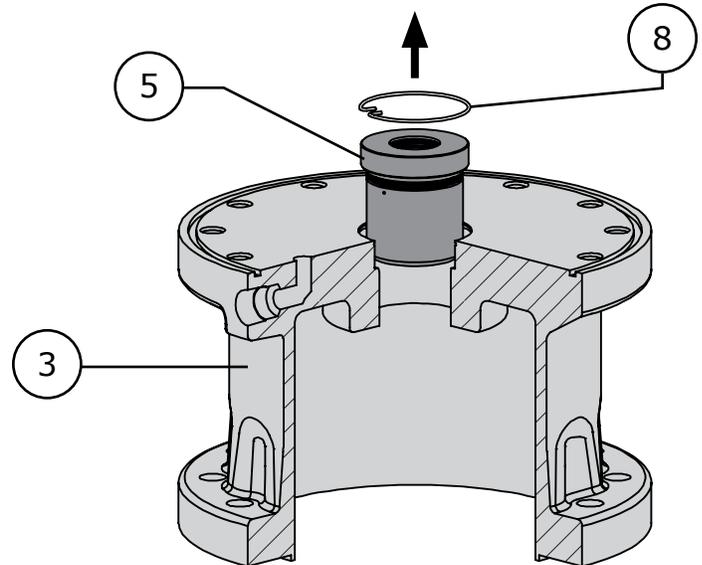


Figure 76 3220 SMHW Bushing Removal

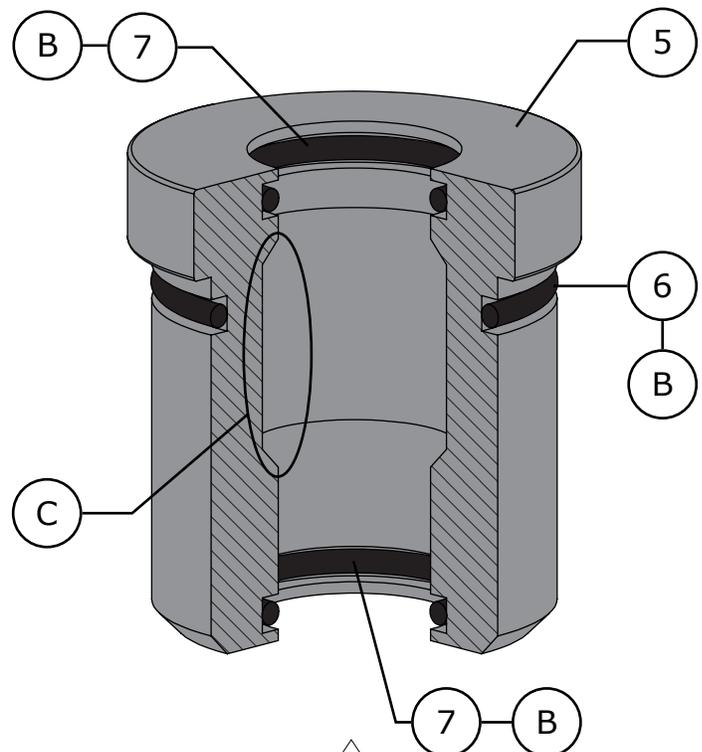


Figure 77 Bushing / O-Ring Detail

Model DFC Linear Actuator

Size 3220 Integral SMHW Disassembly

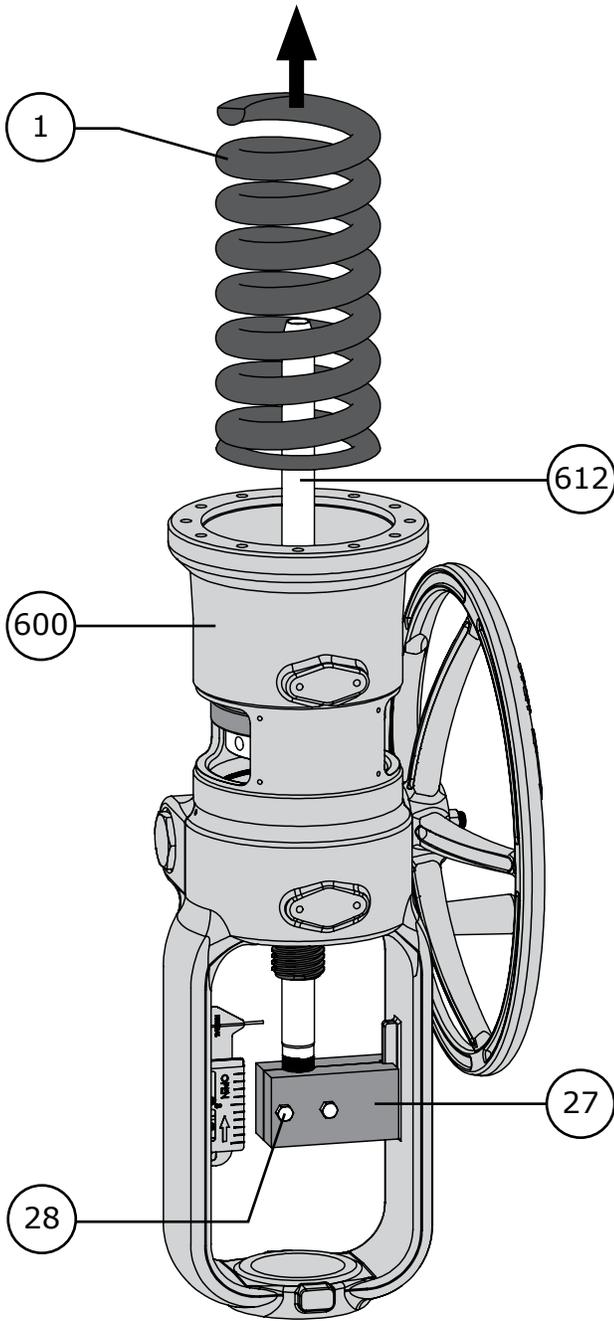


Figure 78 Spring Removal

SIZE 3220 SMHW DISASSEMBLY (Continued)

- 13** Remove the actuator spring (Key 1).
- 14** Remove the stem connector cap screws (Key 28) and remove the stem connector (Key 27) if still attached to the actuator stem (Key 612). Refer to Figure 79.
- 15** Remove the actuator stem (Key 612) by pulling it up and out of the yoke (Key 600). **NOTE:** The spring seat (Key 617), spring adjuster (Key 614), thrust bearing (Key 616), spring adjuster screw (Key 613), and roll pin (Key 618) are all attached to the actuator stem and will be removed along with it. Be careful when pulling the actuator stem assembly out the yoke. Refer to Figure 80.
- 16** If necessary, separate the actuator stem assembly (Keys 612, 613, 614, 615, 616, 617, 618) by removing the spring seat (Key 617) and thrust bearing (Keys 615 & 616). Then, using a punch, remove the roll pin (Key 618) and separate the spring adjuster (Key 614), spring adjuster screw (Key 613), and actuator stem (Key 612). Refer to Figure 80.

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

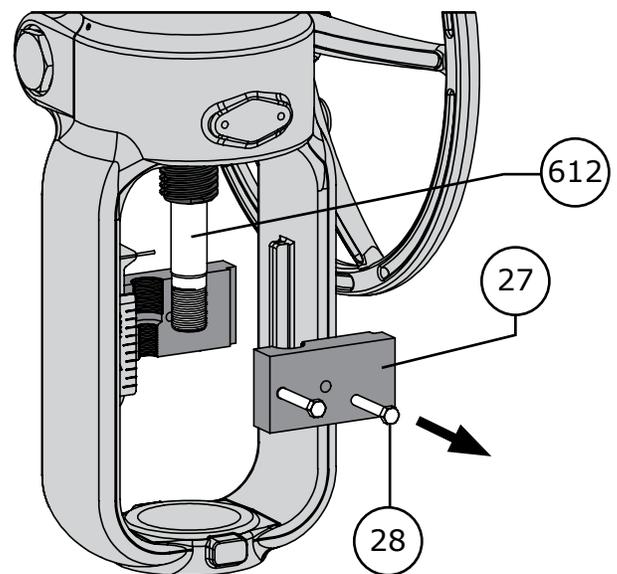


Figure 79 Connecting Block Removal



Model DFC Linear Actuator

Size 3220 Integral SMHW Disassembly

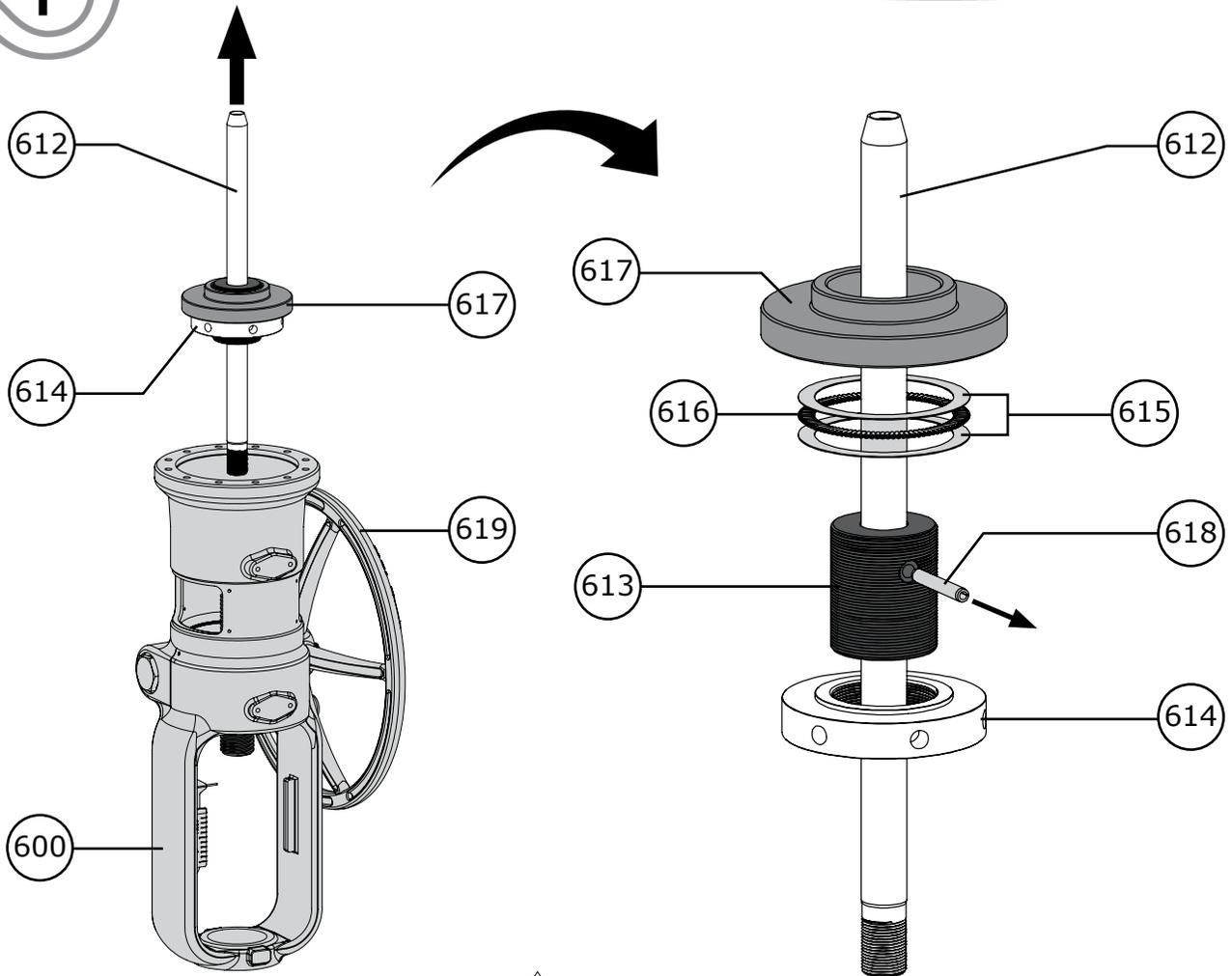


Figure 80 Actuator Stem Assembly Removal and Disassembly

SIZE 3220 SMHW DISASSEMBLY (Continued)

- 17** Rotate the handwheel (Key 619) so that the lower sleeve (Key 611) is moved out the bottom of the yoke (Key 600). **NOTE:** DO NOT move the neutral indicator scale (Key 620). Refer to Figure 81.
- 18** Loosen the two retainer flange set screws (Key 606) until the bearing retainer flange (Key 605) can be unscrewed and removed. Refer to Figures 82 & 83).
- 19** Remove the thrust bearing/races (Keys 602 & 603), worm gear (Key 604), and second thrust bearing and races (Keys 602 & 603). Refer to Figure 83.

- 20** Continue with the following disassembly instructions only if necessary (if parts are worn or damaged). Remove the handwheel nut (Key 229), lockwasher (Key 228), flat washer (Key 227), and the handwheel (Key 619). **CAUTION:** When removing the handwheel, DO NOT lose the ball (Key 224) or spring (Key 225). Refer to Figure 84.
- 21** Loosen the worm shaft retainer set screws (Key 606) and remove the worm shaft retainers (Keys 607 & 610). **NOTE:** The ball bearings (Key 608) can stick in the shaft retainers after removal, remove them if necessary. Remove the worm shaft (Key 609). Refer to Figure 85.
- 22** Clean and inspect all parts (especially threads and contact surfaces) for damage. Replace or repair parts as necessary.

Model DFC Linear Actuator

Size 3220 Integral SMHW Disassembly

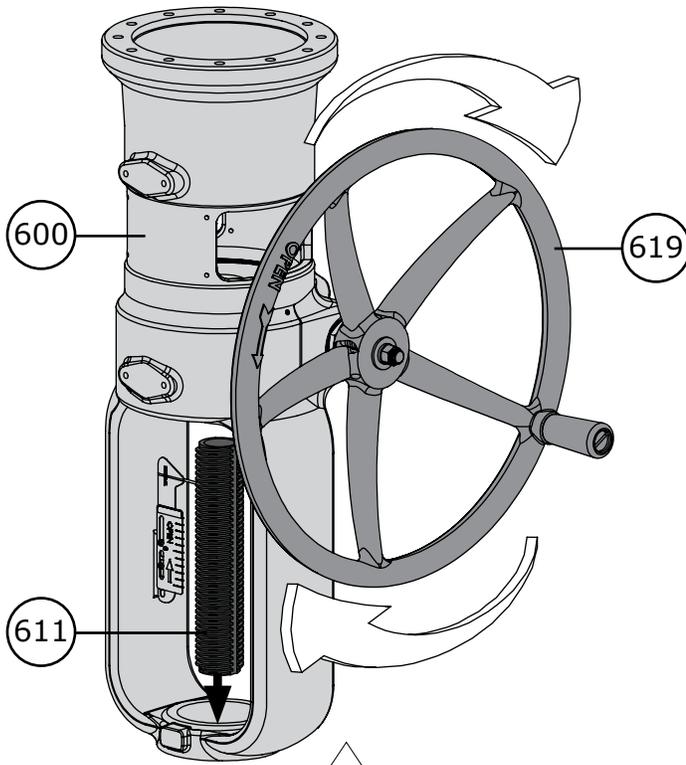


Figure 81 Lower Sleeve Removal

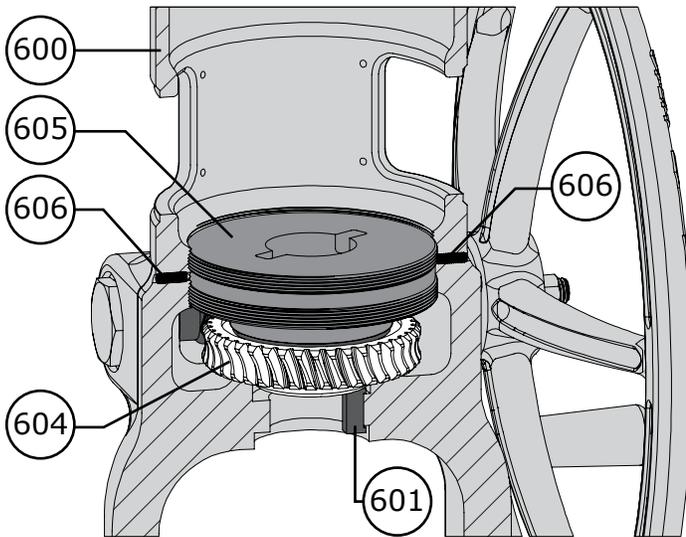


Figure 82 Retainer Flange Removal - Part 1

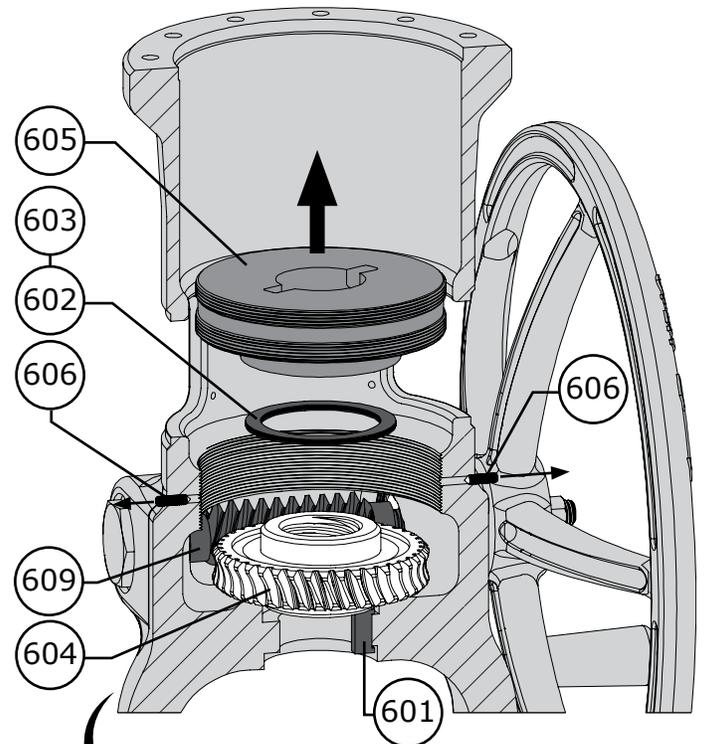


Figure 83 Retainer Flange Removal - Part 2

Model DFC Linear Actuator

Size 3220 Integral SMHW Assembly

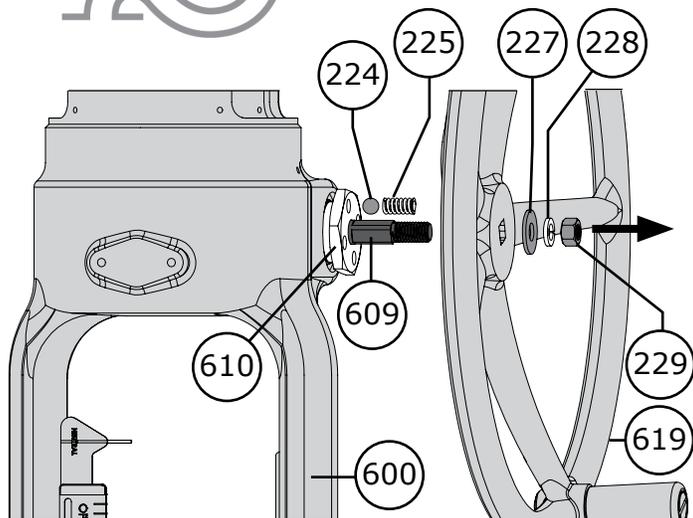


Figure 84 Handwheel Removal

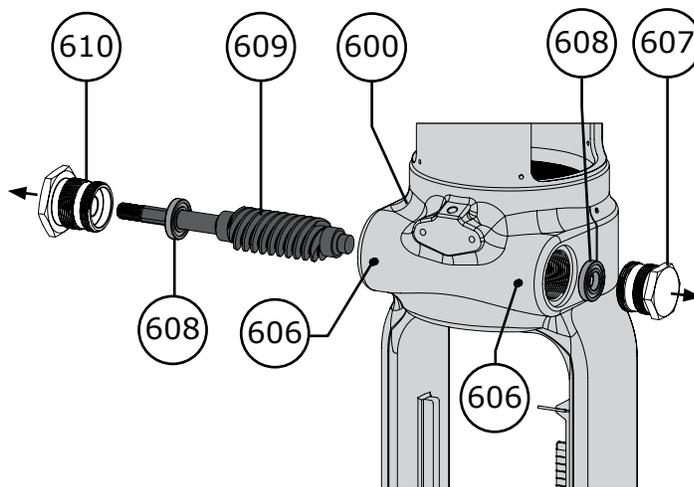


Figure 85 Worm Shaft Removal

SIZE 3220 SMHW ASSEMBLY

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.
- Standard actuators accept 1/4" (6 mm) NPT connections.
- **WARNING:** Do not use operating pressure that exceeds the Maximum Casing Pressure. Also, be sure the operating pressure does not create a force on the actuator stem (Key 612) that is greater than the Maximum Allowable Output Thrust. Refer to Table 1.
- **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.
- Clean and inspect all parts.
- Replace or repair damaged parts. Replace all soft parts (Seals, o-rings, gaskets).

Lubricants Required:

- Permatex® Nickel Anti-Seize or equivalent (Key A)
- Dow Corning Molykote® 111 or equivalent (Key B)
- Lubriplate® No. 105 Grease or equivalent (Key C)
- Mobil Unirex™ Lotemp Grease or Equivalent (Key D)

- 1 Pack the ball bearings (Key 608) with Mobil Unirex™ Lotemp Grease (Key D) and insert one bearing into the back retainer flange (Key 607) and the other into the front retainer flange (Key 610). Refer to Figure 86.
- 2 Install the back retainer flange/ball bearing assembly (Keys 607 & 608) into the yoke (Key 600) and align the slot in the retainer with the set screw (Key 606). Tighten the set screw into the retainer to lock it in place. Refer to Figure 87.
- 3 Apply Mobil Unirex™ Lotemp Grease (Key D) to threads of the worm shaft (Key 609) and install the shaft into the yoke (Key 600) so that the end of the shaft fits tightly into the ball bearing/retainer flange assembly (Keys 607 & 608).
- 4 Install the front worm shaft retainer (Key 610) over the worm shaft (Key 609) and thread it into the yoke (Key 600) as shown in Figure 87. Align the slot in the retainer with the set screw (Key 606) and tighten the set screw into the retainer locking it in place.
- 5 Set the spring and ball (Keys 224 & 225) in to the handwheel (Key 619). Slide the handwheel onto the worm shaft (Key 609). Install the flat washer (Key 227), lock washer (Key 228), and nut (Key 229) onto the worm shaft and tighten the nut.

Model DFC Linear Actuator

Size 3220 Integral SMHW Assembly

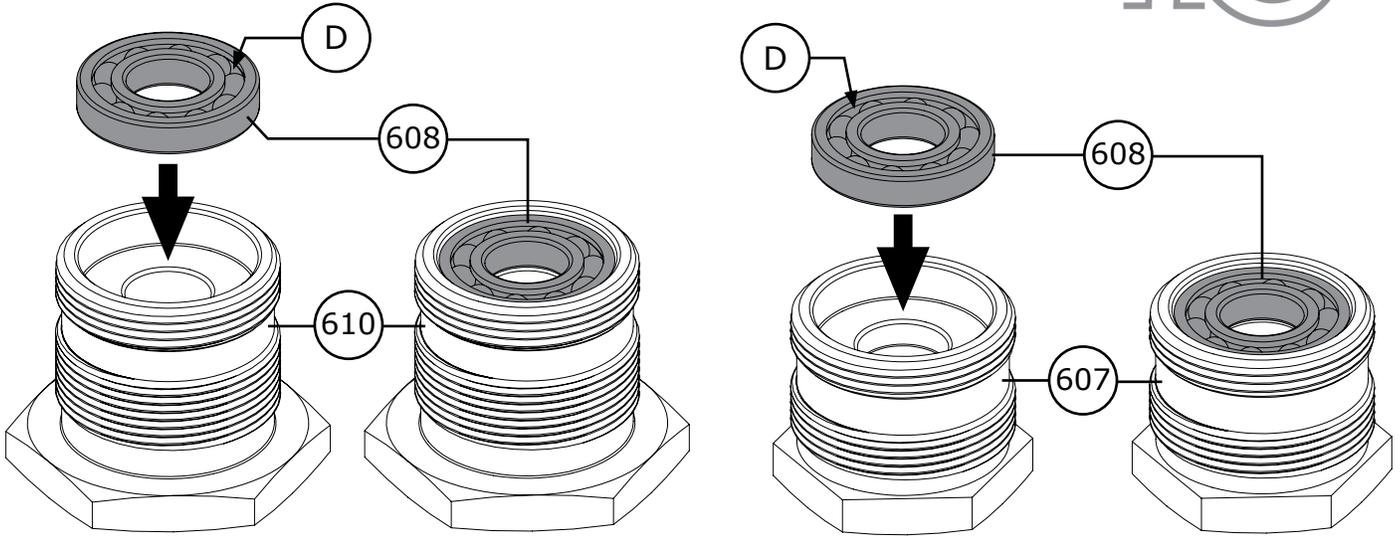


Figure 86 Ball Bearing Packing and Installation

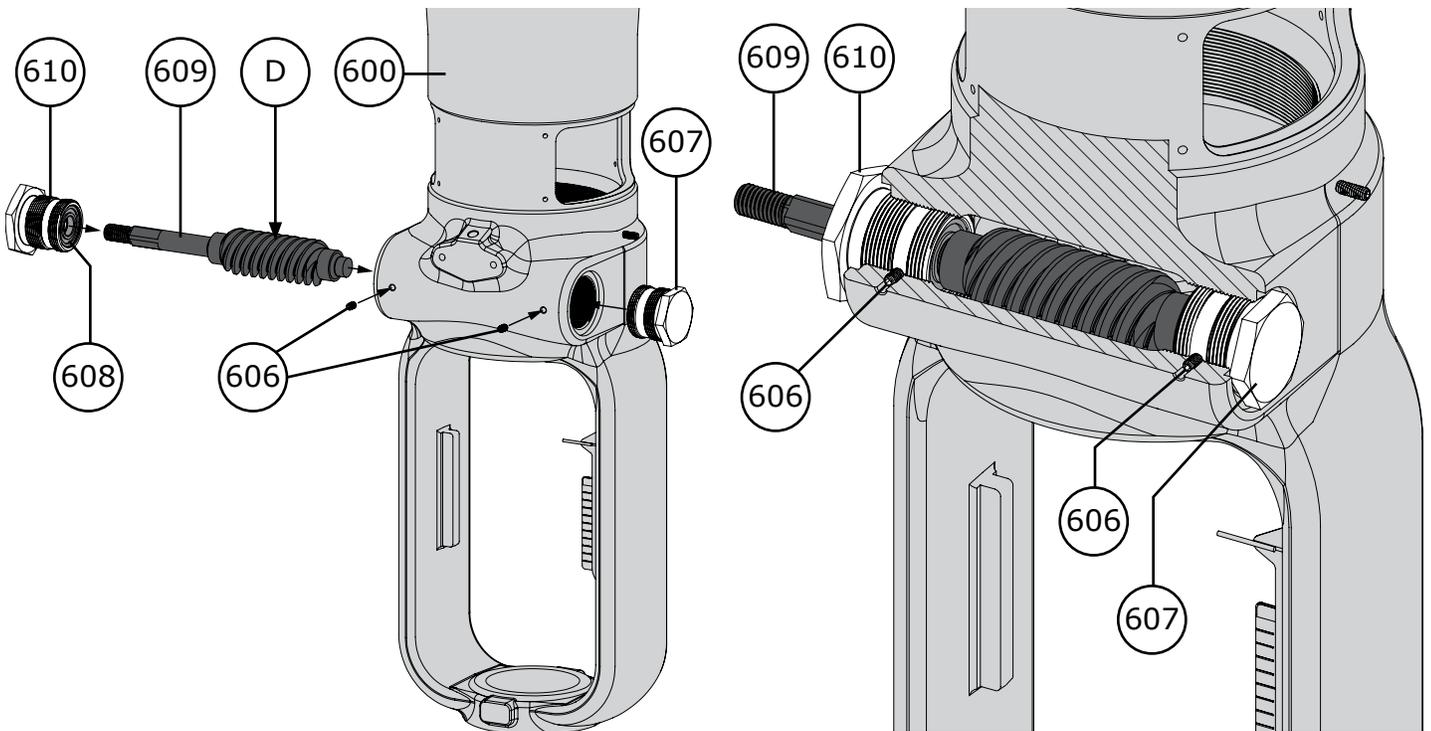


Figure 87 Worm Shaft Installation



Model DFC Linear Actuator

Size 3220 Integral SMHW Assembly

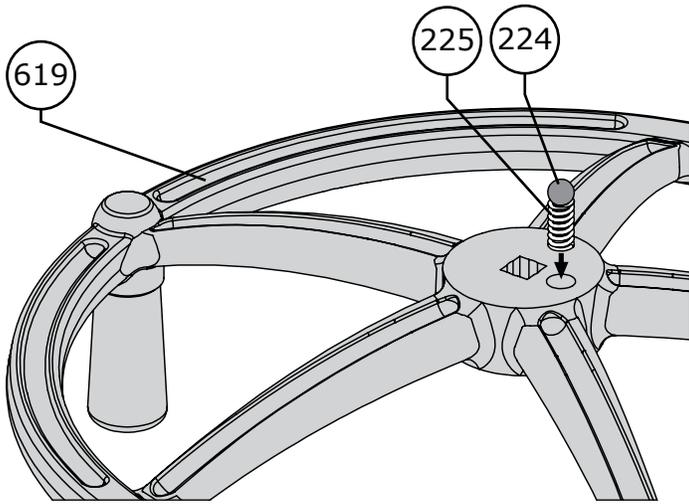


Figure 88 Handwheel Spring and Ball Installation

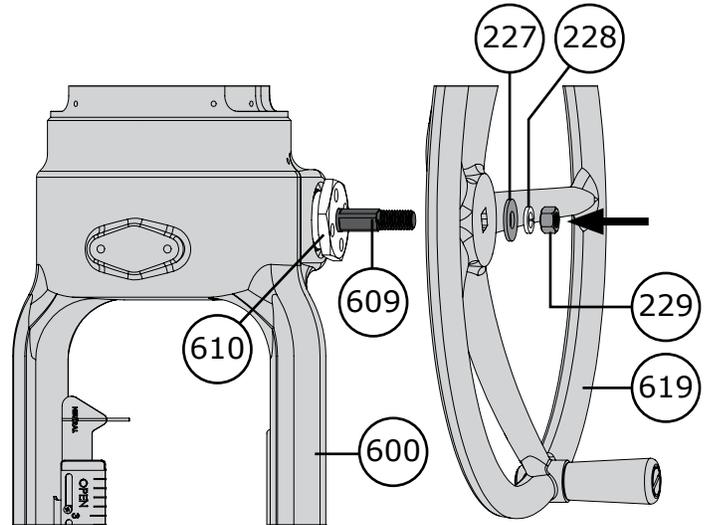


Figure 89 Handwheel Installation

SIZE 3220 SMHW ASSEMBLY (Continued)

- 6 If the key (Key 601) was removed, re-install it. Refer to Figure 91.
- 7 Pack the thrust bearing (Key 603) with grease (Key D) and apply grease (Key D) to one side of the bearing races (Key 602) and Lubriplate® No. 105 Grease (Key C) to the other as shown in Figure 90. Install the bearing assembly into the yoke (Key 600) as shown in Figure 91.
- 8 Apply Mobil Unirex™ Lotemp Grease (Key D) to threads of the worm gear (Key 604) and install the gear into the yoke (Key 600) so that the teeth of the gear mesh with those of the worm shaft (Key 609). Refer to Figure 91.
- 9 Pack another thrust bearing (Key 603) with grease as described in Step 7 and install it on top of the worm gear (Key 604).
- 10 A channel is cut in the middle of the threads for the bearing retainer flange (Key 605). Thread the bearing retainer flange into the yoke (Key 600) so that the channel in the bearing retainer flange aligns with the set screws (Key 606). Tighten the set screws. Refer to Figure 93.

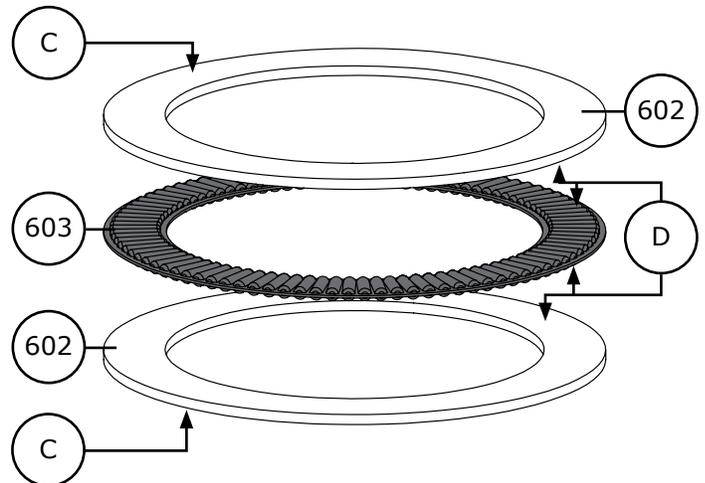


Figure 90 Thrust Bearing Preparation

Model DFC Linear Actuator

Size 3220 Integral SMHW Assembly

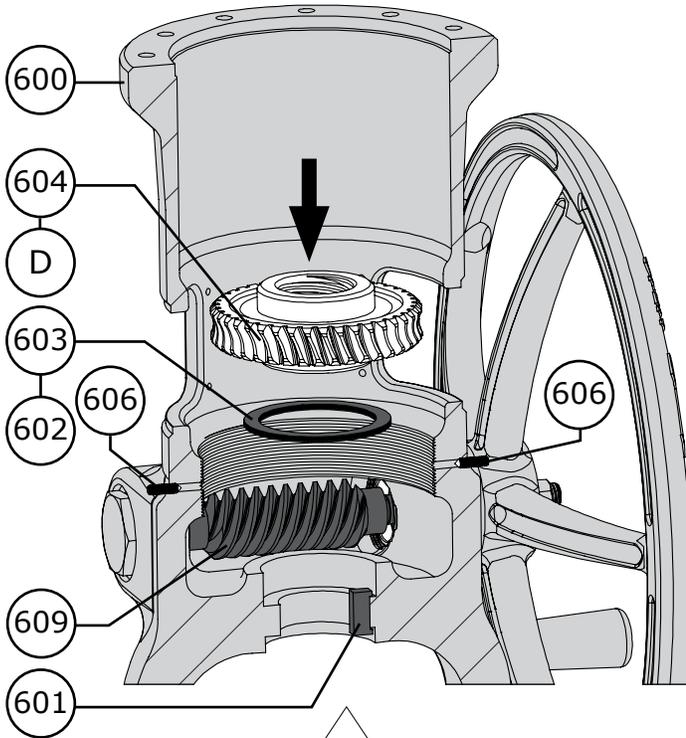


Figure 91 Worm Gear Installation - Steps 7 & 8

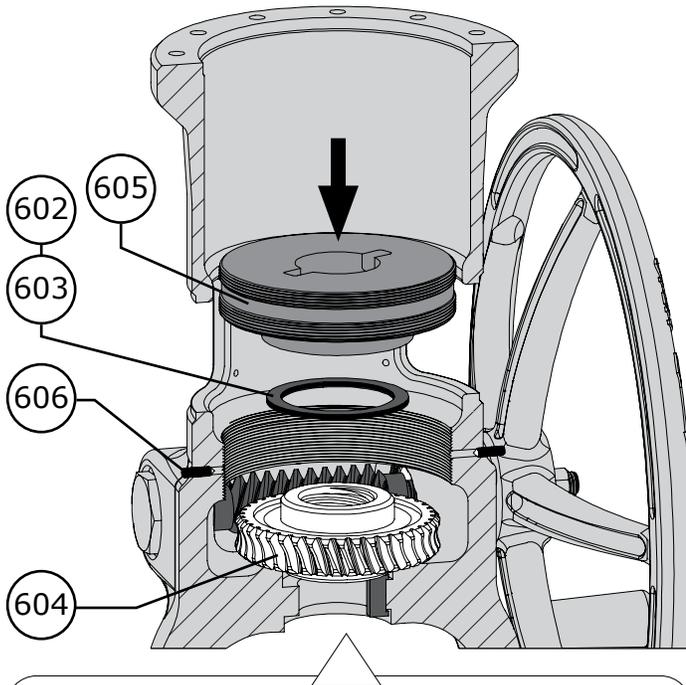


Figure 92 Bearing Retainer Flange Installation - Steps 9 & 10

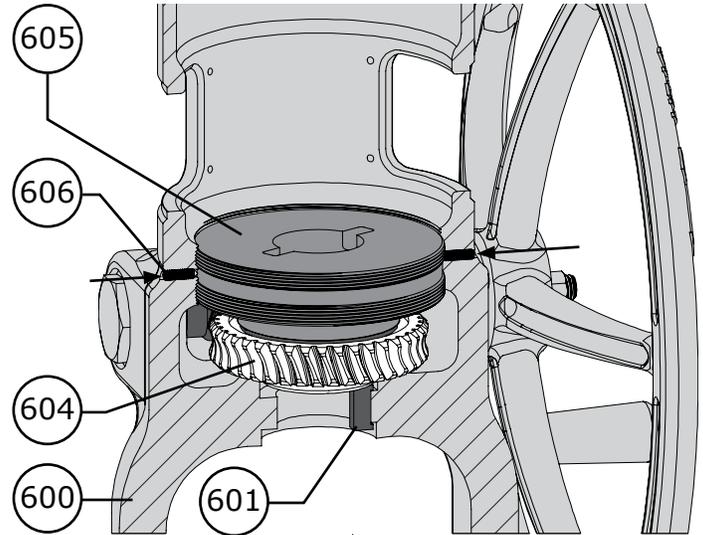


Figure 93 Set Screw Tightening - Step 10

SIZE 3220 SMHW ASSEMBLY (Continued)

11 Coat the threads of the lower sleeve (Key 611) with Mobil Unirex™ Lotemp Grease (Key D). The lower sleeve has a milled groove running up the side, position the milled groove to align with the key (Key 601) and insert the lower sleeve into the bearing retainer flange (Key 605). Turn the handwheel (Key 619) and feed the lower sleeve through the worm gear (Key 604) so that the groove in the lower sleeve engages the key in the yoke (Key 600). Keep turning the handwheel until the bottom of the lower sleeve protrudes 3.19" (81 mm) below the surface of the yoke.

NOTE: The bottom of the lower sleeve should be even with the extension on the neutral indicator (Key 620). Refer to Figure 94.

12 If the actuator stem assembly (Keys 612, 613, 614, 615, 616, 617, 618) was removed from the actuator and not disassembled, proceed to Step 13.

If the actuator stem assembly was disassembled:

A Slide the spring adjuster screw (Key 613) on to the actuator stem (Key 612) and align the hole in the screw with that of the actuator stem. Install the roll pin (Key 618) to secure the parts.

B Apply anti-seize (Key A) to the threads of the spring adjuster screw (Key 613) and thread on the spring adjuster (Key 614).



Model DFC Linear Actuator

Size 3220 Integral SMHW Assembly

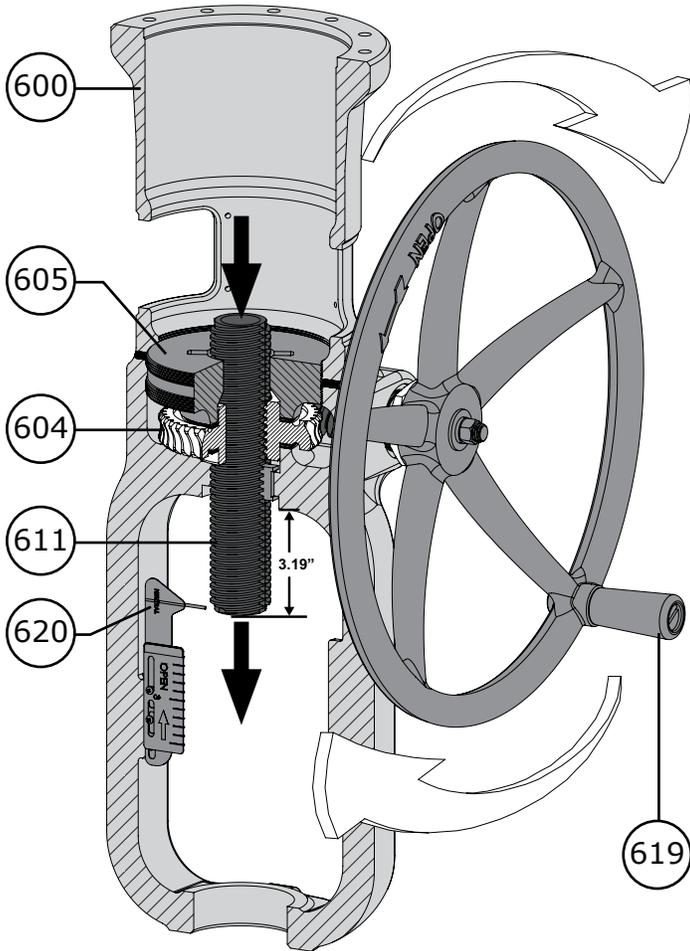


Figure 94 Lower Sleeve Installation - Step 11

SIZE 3220 SMHW ASSEMBLY (Continued)

12 (Continued):

- C** Pack the final thrust bearing (Key 616) with grease as described in Step 7 and set the bearing assembly (Keys 615 & 616) on top of the spring adjuster (Key 614).
- D** Install the spring seat (Key 617) on top of the bearing assembly (Keys 615 & 616). Proceed to Step 13.

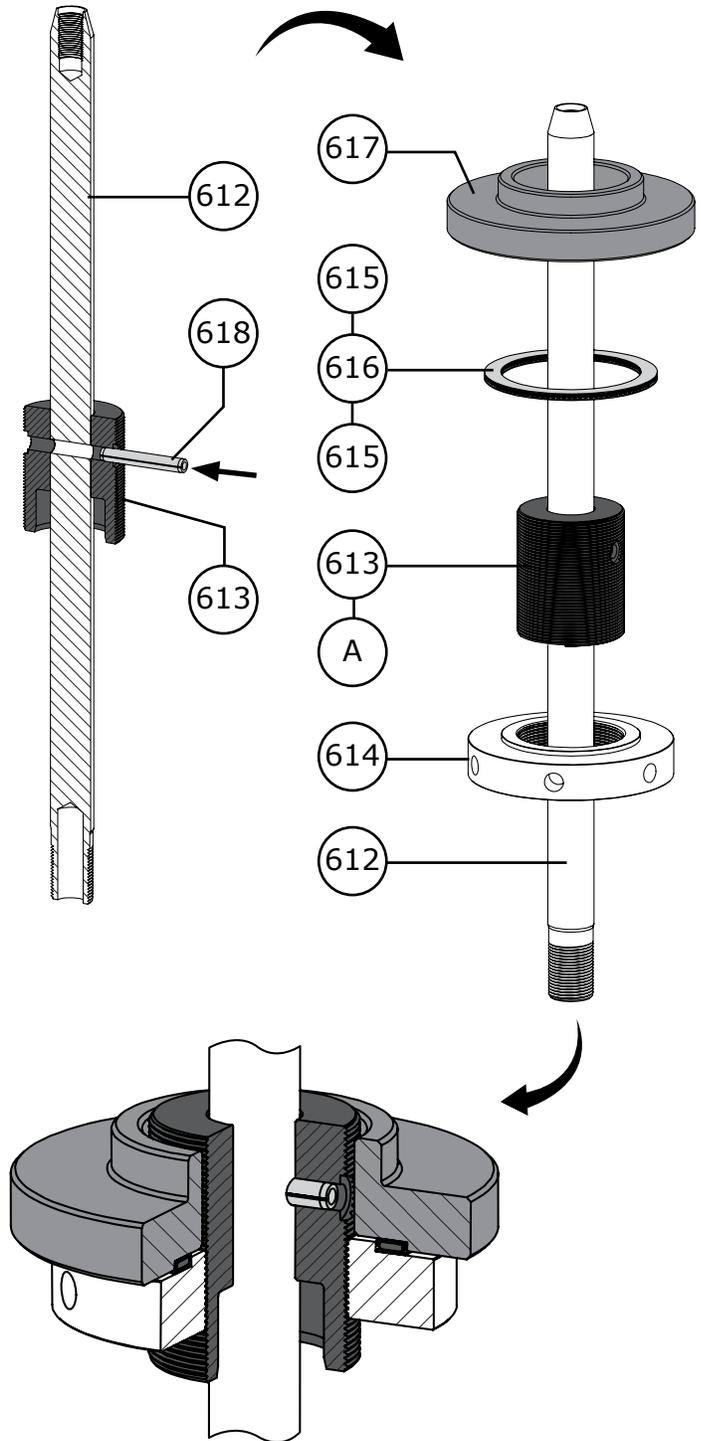


Figure 95 Actuator Stem Sub-Assembly - Step 12

Model DFC Linear Actuator

Size 3220 Integral SMHW Assembly



SIZE 3220 SMHW ASSEMBLY (Continued)

13 Insert the actuator sub-assembly (Keys 612, 613, 614, 615, 616, 617, 618) into the yoke (Key 600) so that the actuator stem (Key 612) slides through the lower sleeve (Key 611) until the lower sleeve slides into the adjusting screw (Key 613). If possible during installation, try to position the actuator stem over the valve stem if the actuator was left mounted to the valve. Refer to Figure 96.

NOTE: The threads of the actuator stem (Key 612) and valve stem (Key V) should engage the threads of the connecting block (Key 27) by a distance equal to that of the diameter of the stem or greater. Refer to Figure 10.

14 If the actuator is still mounted to the valve and the required amount of stem engagement has been met, clamp both stems between the connecting block (Key 27) and secure it in place with the stem connector cap screws (Key 28). **NOTE:** The top of the stem connector should not be closer than 1/8" (3.2 mm) to the bottom of the lower sleeve (Key 611) when the actuator stem is in the retracted position. Positioning the stem connector as mentioned will provide 1/8" (3.2 mm) of free travel for the lower sleeve in either direction during manual operation. Refer to Figure 96, GAP.

15 Install the actuator spring (Key 1).

16 Apply Dow Corning Molykote® 111 (Key B) to the o-rings (Keys 6 & 7) and install them into the bushing (Key 5), refer to Figure 77. Install the bushing into the spring case adapter (Key 3) and secure it in place using the snap ring (Key 8). Refer to Figures 76 & 75.

17 Lift and lower the spring case adapter (Key 3) over the actuator spring (Key 1) and onto the yoke (Key 600). Be careful when inserting the actuator stem (Key 612) into the bushing (Key 5) while installing the spring case adapter. Align the bolt holes of the spring case adapter with those of the yoke and apply Permatex® Nickel Anti-Seize (Key A) to the threads of the socket head cap screws (Key 4) and install them. Tighten the cap screws. Refer to Figure 75 or 97.

18 Apply Dow Corning Molykote® (Key B) to the casing o-ring (Key 10) and install it in to the groove on top of the spring case adapter (Key 3). Refer to Figure 98.

19 Set the lower diaphragm casing (Key 11) on top of the spring case adapter (Key 3). Apply Permatex® Nickel Anti-Seize (Key A) to the threads of the cap screws (Key 12) and install them through the lower diaphragm casing and into the spring case adapter. Tighten the cap screws to the torque specification listed in Table 4. Refer to Figure 98.

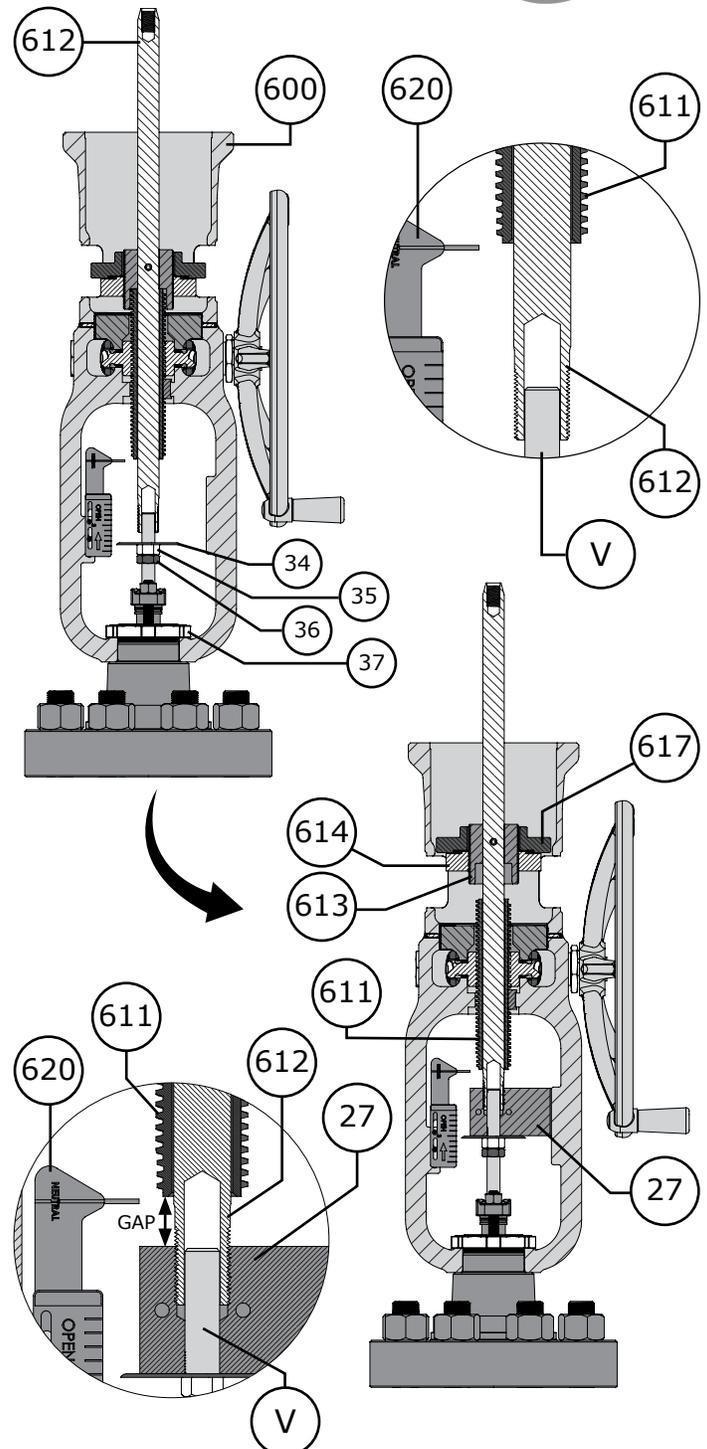


Figure 96 Valve and Actuator Stem Connection



Model DFC Linear Actuator

Size 3220 Integral SMHW Assembly

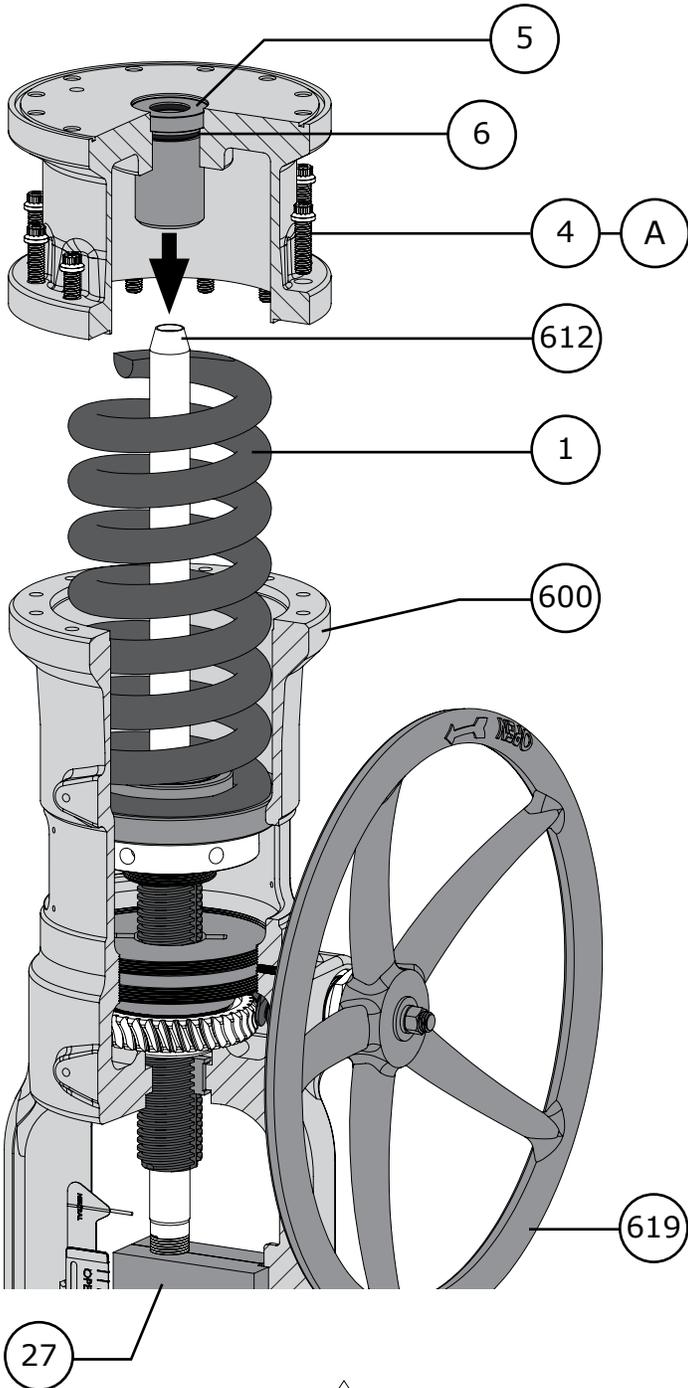


Figure 97 Spring and Spring Case Adapter Installation

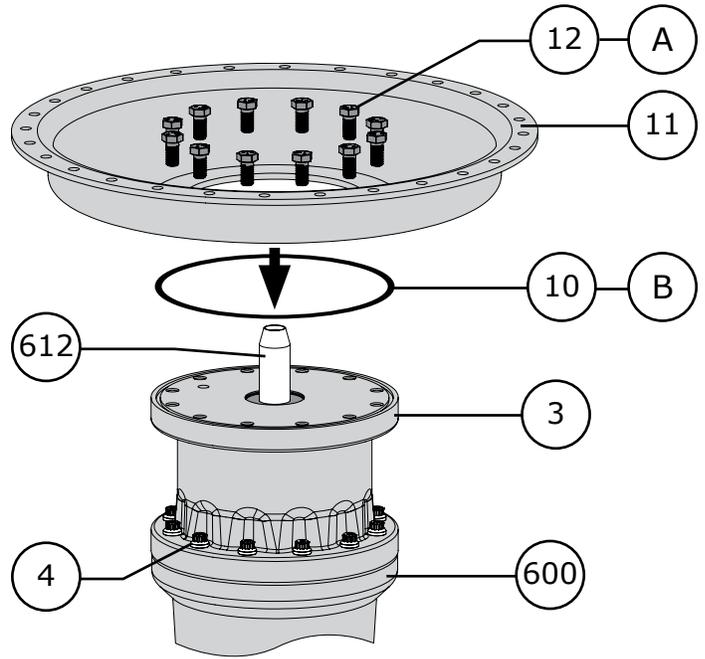


Figure 98 Lower Diaphragm Casing Installation

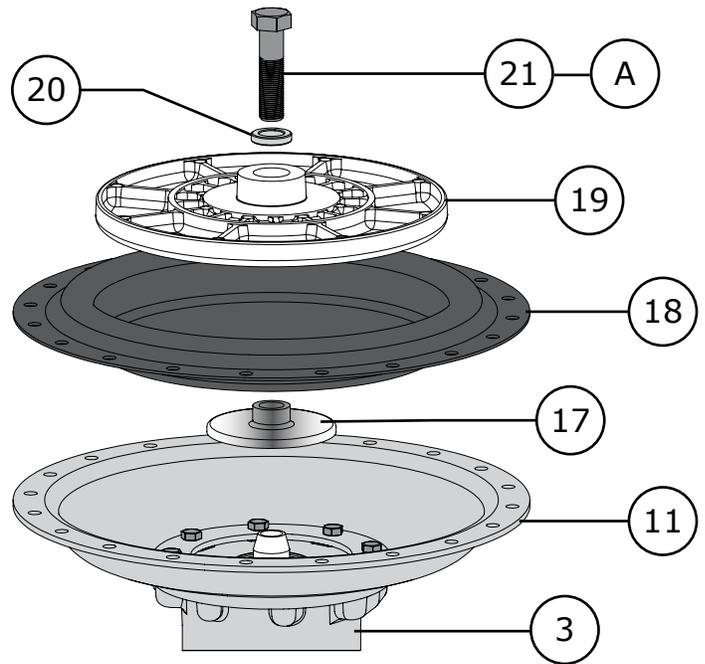


Figure 99 Diaphragm Casing Parts Installation Detail

Model DFC Linear Actuator

Size 3220 Integral SMHW Assembly

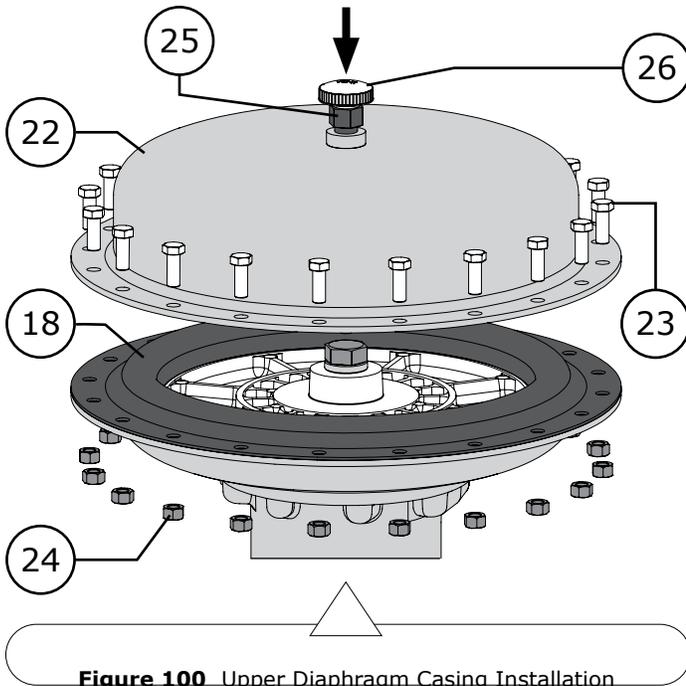


Figure 100 Upper Diaphragm Casing Installation

- 24** Tighten all the hex nuts (Key 24) evenly in a crisscross pattern to half the torque specification listed in Table 4. Then tighten the hex nuts again, using the same alternating pattern, to the full torque specification.
- 25** Install the reducer bushing (Key 25) and vent (Key 26) if they were removed or damaged.
- 26** Refer to the BENCH SETTING ACTUATOR section on Page 5 for instructions on adjusting the actuator after assembly is complete.

SIZE 3220 SMHW ASSEMBLY (Continued)

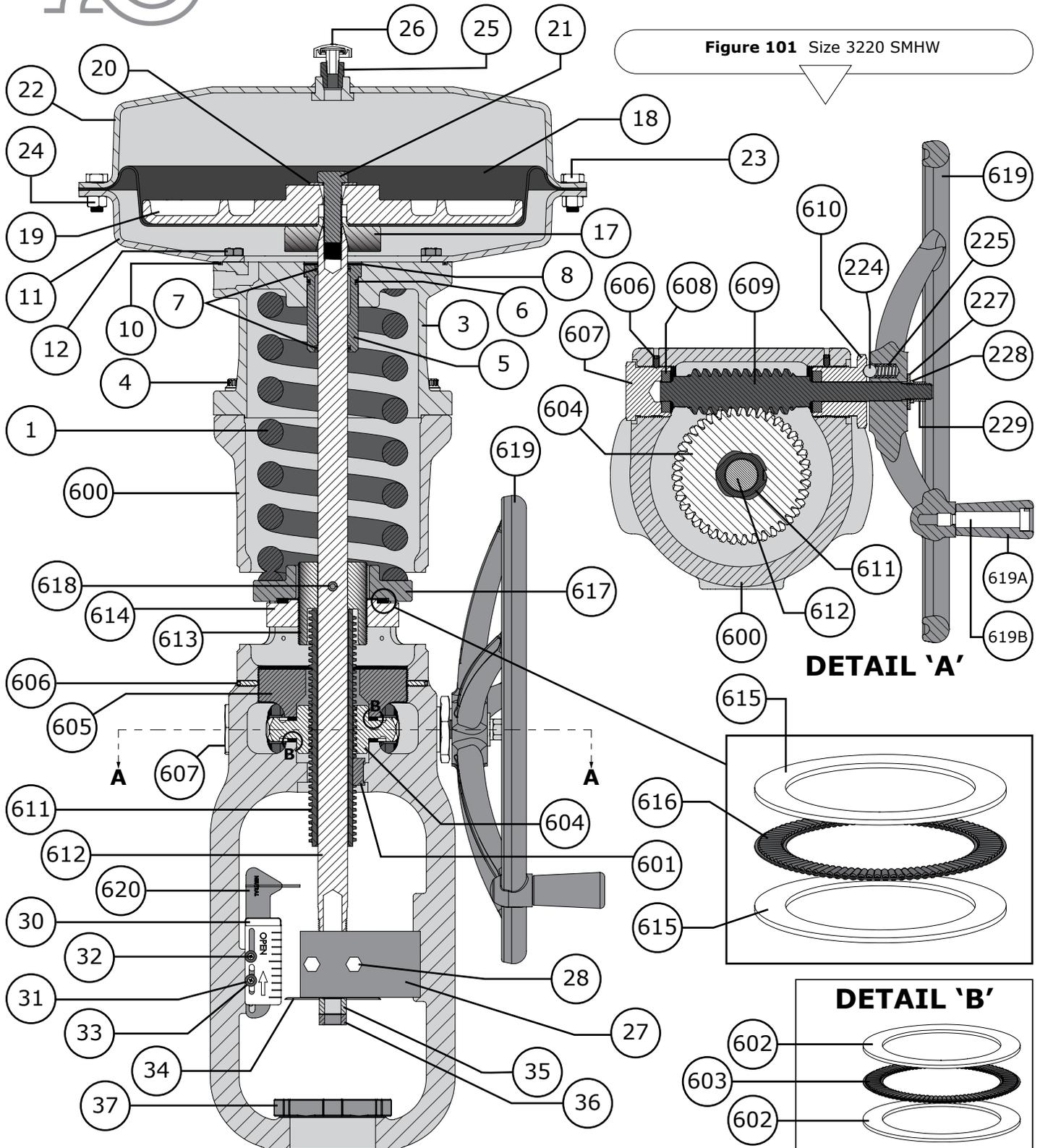
- 20** Apply Permatex® Nickel Anti-Seize (Key A) to the threads of the cap screw (Key 21). Install the lower diaphragm plate (Key 11), diaphragm (Key 18), diaphragm plate (Key 19), spacer (Key 20), and cap screw (Key 21) as shown in Figure 99. Tighten the cap screw to the torque specification listed in Table 4. **NOTE:** If the actuator is not already attached to the valve, it may be necessary to temporarily install the connecting block (Key 27) in order to keep the actuator stem (Key 612) from rotating during cap screw (Key 21) tightening.
- 21** Align the holes in the diaphragm (Key 18) with those of the lower diaphragm casing (Key 11).
- 22** Place the upper diaphragm casing (Key 22) on top of the actuator assembly and align the holes with those of the lower diaphragm casing (Key 11) and diaphragm (Key 18).
- 23** Install the cap screws (Key 23) through the holes in the upper and lower diaphragm casings (Keys 11 & 22), if it becomes difficult to install the cap screws it may be necessary to use vise grips or pliers to pull the diaphragm (Key 18) into a more cooperative position.



Model DFC Linear Actuator

Size 3220 Integral SMHW Assembly

Figure 101 Size 3220 SMHW



Model DFC Linear Actuator

Operation, Parts, and Instruction Manual



Parts

Key	Description	Part Number
1	Spring	Refer to Table 7
2	Yoke, Cast Iron	
	Size 1046	3E80141904D
	Size 1069	3E88461904D
	Size 2069	3E82081904D
	Sizes 2105 & 2156	3E90081904D
	Sizes 3105 & 3156	3E84591904D
	Size 3220	3N13031904D
3	Spring Case Adapter, Size 3220-4 Actuators, Cast Iron	2N88941904D
4	Socket Head Cap Screw, Spring Case Adapter, Stainless Steel (12 Required)	SCC18.812.134
5	Bushing, Brass	
	Size 046	1E79121401D
	Size 069	1E68281401D
	Sizes 105 & 156	1E84571401D
	Size 220	1N1316X005D
6	O-ring, Nitrile, Outside of Bushing	
	Sizes 046 & 069	1C41570699D
	Sizes 105, 156, & 220	1E84580699D
7	O-ring, Nitrile, Inside of Bushing (2 Required)	
	Size 046	1E59140699D
	Size 069	1D23750699D
	Sizes 105 & 156	1C56220699D
	Size 220	1E73690699D
8	Snap Ring, S30200	
	Sizes 046 & 069	1E80133702D
	Sizes 105, 156, & 220	1E84563899D
9	Gasket, Yoke/Lower Diaphragm Casing, Composition	
	Sizes 046 & 069	1E80120402D
	Sizes 105 & 156	1E84540402D
10	O-ring, Yoke/Lower Diaphragm Casing, Nitrile	
	Size 220	1D26910699D
11	Lower Diaphragm Casing, Steel	
	Size 046	2E80112506D
	Size 069	2E68262506D
	Size 105	3E84532506D
	Size 156	3E84772506D
	Size 220	2N13102506D
12	Cap Screw, Yoke/Lower Diaphragm Casing, Zinc Plated Steel	
	Sizes 046 & 069 (6 Required)	H5CZ38.034

Key	Description	Part Number
	Sizes 105 & 156 (8 Required)	H5CZ38.034
	Size 220 (12 Required)	H5CZ12.100
13	Actuator Stem, S17400	
	Size 1046	2E8016X174D
	Size 1069	3E8847X174D
	Size 2069	2E8209X174D
	Sizes 2105 & 2156	2J3328X174D
	Sizes 3105 & 3156	2E8461X174D
	Size 3220	2N13172174D
	Size 3220-4	21A3812X01D
14	Spring Seat, Zinc Plated Steel	
	Size 046	1U42562657D
	Size 069	1R17992312D
	Sizes 105 & 156	1R18002312D
	Size 220	1N12961905D
15	Spring Adjuster, Zinc Plated Steel	
	Size 046	1E80172410D
	Size 069	1E82102410D
	Sizes 105 & 156	1E84622410D
	Size 220	1N13182410D
16	Spacer, Zinc Plated Steel	
	Size 1069	SPC078-112-056D
	Size 2105	SPC118-162-050D
	Size 3220	SPC130-186-050D
		SPC130-186-150D
	Size 3220-4	SPC130-186-175D
17	Lower Diaphragm Plate, Zinc Plated Steel	
	Size 046	1E79134402D
	Size 069	1F88582409D
	Sizes 105 & 156	1F89092409D
	Size 220	1N13152409D
18	Diaphragm, Nitrile/Nylon	
	Size 046	2E80000220D
	Size 069	2E66990220D
	Size 105	2E85960220D
	Size 156	2E85980220D
	Size 220	2N13090220D
19	Upper Diaphragm Plate	
	Size 046 - Cast Iron	2E88041904D
	Size 069 - Aluminum	31B2029X01D
	Size 105 - Aluminum	41B2030X01D
	Size 156 - Cast Iron	2E84751904D
	Size 220 - Cast Iron	2N12701904D



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Operation, Parts, and Instruction Manual

Parts (Continued)

Key	Description	Part Number
20	Travel Stop Spacer , Steel	Refer to Table 6
21	Cap Screw , Steel	Refer to Table 6
22	Upper Diaphragm Casing , Steel	
	Size 046	2E80072899D
	Size 069	2E68142899D
	Size 105	3E84462899D
	Size 156	3E84672899D
	Size 220	2N12782899D
23	Cap Screw , Upper/Lower Diaphragm Casing Zinc Plated Steel	
	Size 046 (12 Required)	H5FZ38.100
	Size 069 (16 Required)	H5FZ38.100
	Size 105 (20 Required)	H5FZ38.100
	Size 156 (24 Required)	H5FZ38.100
	Size 220 (28 Required)	H5FZ38.114
24	Hex Nut , Upper/Lower Diaphragm Casing Zinc Plated Steel	
	Size 046 (12 Required)	NHFZ38
	Size 069 (16 Required)	NHFZ38
	Size 105 (20 Required)	NHFZ38
	Size 156 (24 Required)	NHFZ38
	Size 220 (28 Required)	NHFZ38
25	Reducer bushing , S31600/S31603 Dual Grade	
	Size 220 (2 Required)	1C37902623D
26	Vent , Plastic/S30400	Y602-1BD
27	Connecting Block , Zinc Plated Steel	
	Sizes 1046 & 1069	18A1243X01D
	Size 2069	18A1668X01D
	Sizes 2105 & 2156	18A1671X01D
	Sizes 3105 & 3156	18A1672X01D
	Size 3220	18A1675X01D
	Size 3220 SMHW	DFCO1001X1D
28	Cap Screw , Connecting Block, Zinc Plated Steel Included as part of the Connecting Block (2 Required)	
29	Nameplate , S30400	NAMEXSRCTD
30	Travel Scale , S30400	Refer to Table 6
30A	Travel Scale Spacer , S31600/S31603 Dual Grade (2 Required)	DFC70307X1D
31	Flat Washer , Travel Scale, 18-8 (2 Required)	
	Size 220 (2 Required)	1E8730X001D

Key	Description	Part Number
32	Travel Scale Screw , Travel Scale, 18-8 (2 Required)	
	Sizes 1046, 1069, 2105, 2156	DFCOTSS632D
	Sizes 3105, 3156, 3220, 3220-4	DFCOTSS832D
33	Travel Scale Nut , 18-8 (2 Required)	
	Sizes 1046, 1069, 2105, 2156	DFCOTSN632D
	Sizes 3105, 3156, 3220, 3220-4	DFCOTSN832D
34	Travel Disc , S30400	
	Sizes 1046 & 1069	1E79313899D
	Sizes 2069, 2105, & 2156	1E80753899D
	Sizes 3105, 3156, & 3220 SMHW	1E83283899D
	Sizes 3220 & 3220-4	1B97183899D
35	Hex Nut , Zinc Plated Steel Part of Valve Assembly	
36	Jam Nut , Zinc Plated Steel Part of Valve Assembly	
37	Yoke Lock Nut , Zinc Plated Steel Part of Valve Assembly	

Model DFC Linear Actuator

Operation, Parts, and Instruction Manual



Parts (Continued)

Top-Mounted Handwheel (Refer to Figure 28)

Key	Description	Part Number
100	Upper Diaphragm Casing, Steel	
	Size 069	2E80632506D
	Size 105	3E83162899D
	Size 156	2E84742506D
	Size 220	2N12712506D
101	Flat Washer, Zinc Plated Steel	
	Size 220 with 2" to 3" Travel	FWZ34
102	Extension Rod Connector, Zinc Plated Steel	
	Size 069	DFC60112X1D
	Sizes 105, 156, & 220	1N83833101D
103	Extension Rod, Carbon Steel	
	Size 069	DFC60108X1D
	Sizes 105 & 156	DFC14108X1D
	Size 220	DFC30108X1D
104	Anti-Rotation Guide Plate, Steel	
	Size 069	DFC60106X1D
	Size 105, 156, & 220	DFC30106X1D
105	Socket Head Cap Screw, 18-8 (4 Required)	
	Sizes 069, 105, 156, & 220	TORQUEMTR3D
106	Body, Steel	
	Size 069	DFC60101X1D
	Sizes 105 & 156	DFC14101X1D
	Size 220	DFC30101X1D
107	Cap Screw, Carbon Steel	
	Size 069 (3 Required)	H5CZ38.034
	Sizes 105, & 156 (4 Required)	H5CZ38.034
	Size 220 (9 Required)	H5CZ12.034
108	Upper Travel Stop, Carbon Steel (Refer to Table 8)	
109	Adjusting Screw, Bronze	
	Size 069	DFC60109X1D
	Sizes 105 & 156	DFC14109X1D
	Sizes 220	DFC30109X1D
110	Handwheel, Cast Iron	
	Size 069	DFC60111X1D
	Sizes 105 & 156	DFC54111X1D
	Sizes 220	DFC14111X1D

Key	Description	Part Number
111	Retaining Ring, Zinc Plated Steel	
	Size 069	DFC60107X1D
	Sizes 105, 156, & 220	DFC30107X1D
112	Bearing Seat, Zinc Plated Steel	
	Size 069	DFC60105X1D
	Sizes 105, 156, & 220	DFC30105X1D
113	Thrust Bearing, Steel	
	Size 069	DFO60105X1D
	Sizes 105, 156, & 220	DFO30105X1D
114	Thrust Washer, Zinc Plated Steel	
	Size 069	DFO60104X1D
	Sizes 105, 156, & 220	DFO30104X1D
115	Lock Nut, Zinc Plated Steel	
	Size 069	DFC60110X1D
	Size 105, 156, & 220	DFC30110X1D
116	Castle Nut, 18-8	
	Size 069 (Nyloc Nut)	LHC18.8.38
	Sizes 105, 156, & 220	NHSFZ34
117	Cotter Pin, Steel	
	Sizes 105, 156, & 220	DFC30104X1D
118	Top Cap, Polyvinyl Chloride	
	Size 069	DFC60103X1D
	Sizes 105 & 156	DFC14103X1D
	Size 220 with 2" & 3" Travel	DFC30115X1D
	Size 220 with 3-1/2" & 4" Travel	DFC30215X1D
119	Machine Screw, 18-8	MPPS632X516
120	Elbow Vent, Plastic/S30400	Y602-12D



Model DFC Linear Actuator

Operation, Parts, and Instruction Manual

Parts (Continued)

Side-Mounted Handwheel Parts

Key	Description	Part Number
200	Body , Cast Iron	
	Size 069	3F6572000AD
	Sizes 105 & 156	3F1446000AD
201	Bearing , 2 Required	
	All Sizes	1D36139901D
202	Bushing , Zinc Plated Steel	
	Size 069	1F65792409D
203	Handwheel Screw , Bronze	
	Size 069	1F6584000AD
	Sizes 105 & 156	1F5486X414D
204	Shaft Stop , Steel	
	Size 069	Part of Key 203
205	Spring Pin , Steel	
	Size 069	Part of Key 203
206	Operating Nut , Steel	
	Size 069	1F65902409D
	Sizes 105 & 156	2F54852409D
207	Guide Bolt , Stainless Steel, 2 Required	
	Size 069	1F65753513D
	Sizes 105 & 156	1F15523513D
208	Bearing Retainer ,	
	Size 069 (Brass)	1F65801401D
	Sizes 105 & 156 (SST)	1D38522409D
209	Set Screw , S30400, All Sizes	1A34472418D
210	Indicator Plate , S30400	
	Size 069	1F93641199D
	Sizes 105 & 156	1D35741199D
211	Machine Screw , Zinc Plated Steel, 3 Required	
	Size 069	1A8664X00AD
	Sizes 105 & 156	MPPS632X716
212	Pointer Stem , S31600/S31603 Dual Grade	
	Size 069	DFC70206X1D
	Sizes 105 & 156	DFC70306X1D
213	Pointer , S30400	
	All Sizes	1F15753601D

Key	Description	Part Number
214	Right Lever , Steel	
	Size 069	DFC70201R1D
	Sizes 105 & 156	DFC70301R1D
215	Left Lever , Steel	
	Size 069	DFC70201L1D
	Sizes 105 & 156	DFC70301L1D
216	Pivot Pin , S41600	
	Size 069	1F65813523D
	Sizes 105 & 156	1F15623523D
217	E-Type Retaining Ring , Steel, 2 Required	
	All Sizes	1F59942898D
218	Zerk Fitting , Zinc Plated Steel	
	All Sizes	DFO30110X1D
219	Spacer , Zinc Plated Steel, 2 Required	
	Size 069	DFC70202X1D
	Sizes 105 & 156	DFC70305X1D
220	Cap Screw , 18-8, 2 Required	
	Size 069	H18.8C14.212
	Sizes 105 & 156	H18.8C12.312
221	Lockwasher , 18-8, 2 Required	
	Size 069	LW18.8.014
	Sizes 105 & 156	LW18.8.012
222	Hex Nut , 18-8, 2 Required	
	Size 069	NH18.8C14
	Sizes 105 & 156	NH18.8C12
223	Handwheel , Cast Iron	
	Size 069	2D35851905D
	Sizes 105 & 156	2D40501904D
224	Ball , S30200	
	All Sizes	1A34273299D
225	Spring , S30200	
	All Sizes	0D00591601D
226	Spring Cap , Steel	
	Size 105 & 156	1D38512409D
227	Flat Washer , 18-8	
	All Sizes	FW18.8.12
228	Lockwasher , 18-8	
	All Sizes	LW18.8.012

Model DFC Linear Actuator

Operation, Parts, and Instruction Manual



Parts (Continued)

Side-Mounted Handwheel Parts (Continued)

Key	Description	Part Number
229	Jam Nut, 18-8	
	Sizes 069, 105, & 156	NHJ18.8C12
	Size 220	1A78052899D
230	Connecting Block, Steel	
	Size 069	1F65922514D
	Size 2105 & 2156	2F1678000AD
	Size 3105 & 3156	2F1672000AD
231	Socket-Head Cap Screw, Steel, Part of Key 230	
232	Dowel Pins, S31600/S31603 Dual Grade, 2 Required	
	Size 069	1D41982899D
	Size 105 & 156	1D4198X001D
233	Jack Screws, 18-8, 2 Required	
	Size 069	H18.8C38.112
	Size 105 & 156	H18.8C12.200
234	Hex Nut, 18-8, 2 Required	
	Size 069	NH18.8C38
	Size 105 & 156	NH18.8C12
235	U-Bolt, Steel	
	Size 069	UBOLT X0001D
	Size 105 & 156	SMHW2001X1D
236	Flat Washer, 18-8, 2 Required, Part of Key 235	
237	Hex Nut, 18-8, 2 Required, Part of Key 235	
238	Mounting Hook, Zinc Plated Steel, 2 Required	
	Size 069	10A8522X01D
	Size 105 & 156	18A9147X01D
239	Lockwasher, 18-8, 2 Required	
	All Sizes	LW18.8.038
240	Hex Nut, 18-8, 2 Required	
	All Sizes	NH18.8C38

Parts (Continued)

Type 4 Up Stop (Refer to Figure 29)

Key	Description	Part Number
400	Body, Cast Iron	
	Size 069	DFO60101X1D
	Sizes 105 & 156	DFO20101X1D
	Sizes 220	DFO30101X1D
401	Adjusting Screw, Bronze	
	Size 069	DFC60509X1D
	Sizes 105 & 156	DFC50509X1D
	Sizes 220	DFC50602X1D
402	Lock Nut, S31600/S31603 Dual Grade	
	Size 069	DFC60510X1D
	Sizes 105 & 156	DFC50510X1D
	Sizes 220	DFC60610X1D
403	Closing Cap, Carbon Steel	
	Size 069	1F59781401D
	Sizes 105 & 156	DFC50103X1D
	Sizes 220	DFO30503X1D
107	Cap Screw, Carbon Steel	
	Size 069 (6 Required)	H5CZ38.034
	Size 105 & 156 (8 Required)	H5CZ38.034
	Size 220 (12 Required)	H5CZ12.034

Parts (Continued)

Type 5 Up Stop (Refer to Figure 30)

Key	Description	Part Number
500	Travel Stop, S31600/S31603 Dual Grade	
	Size 046 & 069	DFCTSSX031D
	Sizes 105 & 156	DFCTSSX001D
	Size 220	DFCTSSX051D
501	Lock Nut, Zinc Plated Steel (Includes Key 500)	
	Size 069, 105, & 156	NHJCZ58
	Size 220	NHJFZ78
502	Upper Diaphragm Casing, Steel	
	Size 046	2F48622506D
	Size 069	2F75342899D
	Sizes 2105 & 3105	3V86062899D
	Sizes 2156 & 3156	1K13102506D
	Size 220	DFC30601X1D



Model DFC Linear Actuator

Operation, Parts, and Instruction Manual

Parts (Continued)

Type 3 Down Stop (Refer to Figure 31)

Key	Description	Part Number
300	Stem	
	Size 046	DFC60113X1D
	Size 069 - 18-8	1F75363503D
	Sizes 105 & 156 - S30400	DFC50102X1D
	Size 220	DFC30502X1D
301	Flat Washer, Zinc Plated Steel	
	Size 046	FWZ38
	Size 069	FWZ12
	Sizes 105, 156 & 220	FWZ34
302	Lock Washer, Zinc Plated Steel	
	Size 046	LWZ38
	Size 069	LWZ12
	Sizes 105, 156, & 220	LWZ34
303	Hex Nut, Zinc Plated Steel	
	Size 046	NHH2HF38
	Size 069	NHFZ12
	Sizes 105, 156, & 220	NHFZ34
304	Body, Cast Iron	
	Size 046	1K72351901D
	Size 069	1K72351901D
	Size 105 & 156	DFC50101X1D
	Size 220	DFO30501X1D
305	Hex Nut, Zinc Plated Steel	
	Size 046	NHH2HF38
	Size 069	NHFZ12
	Sizes 105, 156, & 220	NHFZ34
306	Jam Nut, Zinc Plated Steel	
	Size 046	NHJFZ38
	Size 069	NHJFZ12
	Sizes 105, 156, & 220	NHJFZ34
307	Top Cap, Carbon Steel	
	Size 046	1F59781401D
	Size 069	1F59781401D
	Sizes 105 & 156	DFC50103X1D
	Size 220	DFO30503X1D

Parts (Continued)

Size 3220-4 Integral Handwheel

(Refer to Figure 101)

Key	Description	Part Number
600	Yoke, Cast Iron	4N89011904D
601	Key, Steel	1N88802509D
602	Bearing Race, Steel, 4 Required	1N88889901D
603	Thrust Bearing, Steel, 2 Required	1N88879901D
604	Worm Gear, Bronze	DFC30701X1D
605	Bearing Retainer Flange, Steel	1N88921904D
606	Socket Set Screw, 18-8	
	4 Required	SSC18.8.14.012CT
607	Back Worm Retainer	
	Zinc Plated Steel	1N88832449D
608	Ball Bearing, Steel, 2 Required	1A33922899D
609	Worm Shaft, Steel	DFC30702X1D
610	Front Worm Retainer	
	Zinc Plated Steel	1N88842409D
611	Lower Sleeve, Steel	2N88822409D
612	Stem, S17400	2N89062422D
613	Spring Adjusting Screw	
	Zinc Plated Steel	1N88972409D
614	Spring Adjuster, Zinc Plated Steel	1N88692439D
615	Needle Bearing Race, Steel	
	2 Required	1N88869901D
616	Needle Bearing, Steel, 1 Required	1N88859901D
617	Spring Seat, Zinc Plated Steel	1N88711904D
618	Roll Pin, Steel	1N88982899D
619	Handwheel, Cast Iron	DFHW1700X1D
619A	Handwheel Grip, Steel	0U07562409D
619B	Handwheel Bolt, 18-8	0U07742409D
620	Handwheel Indicator, Steel	10A2446X01D
621	Cover Band, Steel, 2 Required	DFO30209X1D
622	Cover Band Screw, Steel,	
	8 Required	DFO30211X1D

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Table 6

Keys 20, 21 & 30

Actuator Size	Standard Travels inch (mm)	Cap Screw (Key 21)	Travel Stop Spacer (Key 20)	Travel Scale (Key 33)
1046	3/4 (19)	1B2275X002D	1R40852409D	1E79363899D
1069	3/4 (19)	1R4089X004D	1R40952409D	1E79363999D
	1-1/8 (29)	1R4091X003D	1R40962409D	17A9814X01D
2069	3/4 (19)	1R4089X004D	1R40952409D	1E80813899D
	1-1/8 (29)	1R4091X003D	1R40962409D	1E80823899D
	1-1/2 (38)	1R4092X002D	1R40972409D	1E80833899D
2105	3/4 (19)	1R4098X002D	1R41052409D	1E80813899D
	1-1/8 (29)	1R4099X002D	1R41082409D	1E80823899D
	1-1/2 (38)	1R4101X002D	1R41062409D	1E80833899D
	2 (51)	1R4102X001D	1R41072409D	1R44453898D
2156	3/4 (19)	1R4098X002D	1R41052409D	1E80813899D
	1-1/8 (29)	1R4099X002D	1R41082409D	1E80823899D
	1-1/2 (38)	1R4101X002D	1R41062409D	1E80833899D
	2 (51)	1R4102X001D	1R41072409D	1R44453898D
3105	3/4 (19)	1R4098X002D	1R41052409D	1E83313899D
	1-1/8 (29)	1R4099X002D	1R41082409D	1E83323899D
	1-1/2 (38)	1R4101X002D	1R41062409D	1E83333899D
	2 (51)	1R4102X001D	1R41072409D	1E83343899D
3156	3/4 (19)	1R4098X002D	1R41052409D	1E83313899D
	1-1/8 (29)	1R4099X002D	1R41082409D	1E83323899D
	1-1/2 (38)	1R4101X002D	1R41062409D	1E83333899D
	2 (51)	1R4102X001D	1R41072409D	1E83343899D
3220	3/4 (19)	1R4110X001D	1R41162409D	1H74573899D
	1-1/8 (29)	1R4111X001D	1R41152409D	1H74583899D
	1-1/2 (38)	1R4098X002D	1R41142409D	1H74593899D
	2 (51)	1R4099X002D	1R41132409D	1H74603899D
	3 (76)	1R4102X001D	1R41072409D	1H74613899D



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Table 7

Key 1 - Actuator Spring Chart

Actuator Size	Standard Travels inch (mm)	Diaphragm Pressure Range Psig (kPag)	
		3-15 (21-103)	6-30 (41-207)
1046	3/4 (19)	1E79232709D (dark grey) ¹	1E79242708D (light green) ²
1069	3/4 (19)	1E80582708D (light grey)	1E80522708D (orange)
	1-1/8 (29)	1E80532709D (dark grey)	1E80552708D (dark blue)
2069	3/4 (19)	1E80582708D (light grey)	1E80522708D (orange)
	1-1/8 (29)	1E80532709D (dark grey)	1E80552708D (dark blue)
	1-1/2 (38)	1E80562709D (dark green)	1E80582708D (light grey)
2105	3/4 (19)	1E82622708D (light green)	1E82552708D (aluminum & red)
	1-1/8 (29)	1E82612708D (dark grey)	1E82642708D (light grey)
	1-1/2 (38)	1E82662708D (orange)	1E82622708D (light green)
	2 (51)	1E82692708D (dark green)	1E82652708D (red)
2156	3/4 (19)	1E82572708D (brown)	1E82602708D (bronze)
	1-1/8 (29)	1E82622708D (light green)	1E82552708D (aluminum & red)
	1-1/2 (38)	1E82652708D (red)	1E82572708D (brown)
	2 (51)	1E82702708D (aluminum & dark blue)	1E82632708D (aluminum & dark green)
3105	3/4 (19)	1E82622708D (light green)	1E82552708D (aluminum & red)
	1-1/8 (29)	1E82612708D (dark grey)	1E82642708D (light grey)
	1-1/2 (38)	1E82662708D (orange)	1E82622708D (light green)
	2 (51)	1E82692708D (dark green)	1E82652708D (red)
3156	3/4 (19)	1E82572708D (brown)	1E82602708D (bronze)
	1-1/8 (29)	1E82622708D (light green)	1E82552708D (aluminum & red)
	1-1/2 (38)	1E82652708D (red)	1E82572708D (brown)
	2 (51)	1E82702708D (aluminum & dark blue)	1E82632708D (aluminum & dark green)
3220	3/4 (19)	1N12792708D (red)	---
	1-1/8 (29)	1N71932708D (white)	1N12812708D (brown)
	1-1/2 (38)	1N12872708D (yellow)	1N12792708D (red)
	2 (51)	1N12842708D (light green)	1N12852708D (light blue)
	3 (76)	1N12862708D (dark grey)	1N12872708D (yellow)
NOTES:	1 - Bench Set Range is 7-15 Psig (48-103 kPag).		
	2 - Bench Set Range is 14-30 Psig (97-207 kPag).		
	Other spring selections available. Contact Dyna-Flo Control Valve Services.		

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Table 8

Key 108 - Upper Travel Stop

Actuator Size	Standard Travels inch (mm)	Travel Stop
1046	3/4 (19)	1E79252409D (Qty: 3)
1069	3/4 (19)	1E80662409D (Qty: 3)
	1-1/8 (29)	1E80672409D (Qty: 3)
2069	3/4 (19)	1E80662409D (Qty: 3)
	1-1/8 (29)	1E80672409D (Qty: 3)
	1-1/2 (38)	1E80682409D (Qty: 3)
2105	3/4 (19)	1E83182409D (Qty: 4)
	1-1/8 (29)	1E83192409D (Qty: 4)
	1-1/2 (38)	1E80642409D (Qty: 4)
	2 (51)	1E83212409D (Qty: 4)
2156	3/4 (19)	1E83182409D (Qty: 4)
	1-1/8 (29)	1E83192409D (Qty: 4)
	1-1/2 (38)	1E80642409D (Qty: 4)
	2 (51)	1E83212409D (Qty: 4)
3105	3/4 (19)	1E83182409D (Qty: 4)
	1-1/8 (29)	1E83192409D (Qty: 4)
	1-1/2 (38)	1E80642409D (Qty: 4)
	2 (51)	1E83212409D (Qty: 4)
3156	3/4 (19)	1E83182409D (Qty: 4)
	1-1/8 (29)	1E83192409D (Qty: 4)
	1-1/2 (38)	1E80642409D (Qty: 4)
	2 (51)	1E83212409D (Qty: 4)
3220	3/4 (19)	1N12882409D (Qty: 3)
	1-1/8 (29)	1N12892409D (Qty: 3)
	1-1/2 (38)	1N12902409D (Qty: 3)
	2 (51)	DFC30120X1D (Qty: 3)
	3 (76)	DFC30103X1D (Qty: 3)
3220-4	4 (102)	DFC30114X1D (Qty: 3) ¹
NOTES:	1 - USED WITH UPPER DIAPHRAGM PLATE 10A2421X01D.	

Parts Ordering

Whenever corresponding with Dyna-Flo about a DFC Actuator, refer to the nameplate (Key 29). Please order by the complete part number (as given in the part lists) of each part required. **NOTE:** Not all the available replacement part numbers are shown in this manual, if you have inquiries about parts that are not listed please contact your Dyna-Flo Sales Representative.



Model DFC Linear Actuator

MODEL NUMBERING SYSTEM

SAMPLE PART NUMBER: **DFC-2105-A0630IN-NY**

ACTION						DFC		
DFC	FAIL CLOSED						2	
DFC4	FAIL OPEN (EXTENDED TRAVEL)							
VALVE YOKE						2		
1	2-1/8 INCH	2	2-13/16 INCH	3	3-9/16 INCH			
ACTUATOR SIZE						069		
046	46 INCH ²	069	69 INCH ²	105	105 INCH ²		156	156 INCH ²
220	220 INCH ²							
PAINT						-		
-	DFPS-01 (STANDARD)			2	DFPS-02 (SEVERE SERVICE)			
3	DFPS-03 (HIGH TEMPERATURE)							
TRAVEL						A		
P	3/8 INCH	L	7/16 INCH	K	1/2 INCH		J	5/8 INCH
A	3/4 INCH	M	7/8 INCH	I	1 INCH		B	1-1/8 INCH
R	1-1/4 INCH	C	1-1/2 INCH	T	1-5/8 INCH		D	2 INCH
N	2-1/8 INCH	S	2-1/4 INCH	E	2-1/2 INCH		F	3 INCH
Q	3-3/8 INCH	G	3-1/2 INCH	H	4 INCH			
LOWER BENCH SET						06		
ACTUAL VALUE (PSI)			EXAMPLE: 03, 06, 17, 21, ETC.					
UPPER BENCH SET						30		
ACTUAL VALUE (PSI)			EXAMPLE: 27, 09, 15, 30, ETC.					
INPUT SIGNAL (AIR TO DIAPHRAGM)						I		
	0 - 18 PSIG		0 - 33 PSIG	I	3 - 15 PSIG		I	6 - 30 PSIG
HANDWHEEL AND TRAVEL STOPS						N		
N	NONE (STANDARD)			S	SIDE MOUNTED HANDWHEEL			
T	TOP MOUNTED HANDWHEEL			3	TYPE 3 DOWN STOP - DFC			
4	TYPE 4 UP STOP - DFC			5	TYPE 5 UP STOP - DFC			
CONNECTING BLOCK OPTIONS						-		
-	NONE			T	TAPPED 1/4" - 20 UNC			
B	TAPPED 3/8" - 16 UNC			F	TAPPED 5/8" - 18 UNC			
CONSTRUCTION OPTIONS						N		
N	NONE			S	STAINLESS STEEL FASTENERS			
YOKE OPTIONS						Y		
	NONE			Y	TAPPED 5/16" - 18 UNC			

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