Fisher™ 667NS2 Diaphragm Actuator Size 45, 70, and 80

Contents

Figure 1. Fisher 667NS2 Actuator with HPNS Valve

Introduction

Scope of Manual

This manual provides installation, adjustment, maintenance, and parts list information for the Fisher 667NS2 actuator (figure 1). Refer to separate instruction manuals for information regarding the control valve and accessories.

Do not install, operate, or maintain 667NS2 actuators without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your Emerson sales office before proceeding.

Table 1. Fisher 667NS2 Specifications

SPECIFICATION	UNITS	ACTUATOR SIZE		
		45	70	80
Nominal Effective Diaphragm Area	cm^2	677	1419	2065
	$Inch^2$	105	220	320
Yoke Boss		NS2		
		Sizes A, B, and C		
Acceptable Valve Stem Diameters	mm	12.7	19.1	25.4
	Inch	1/2	3/4	1
Maximum Allowable Output Thrust(1)	N	30,371	42,720	88,110
	lbf	6825	9600	19,800
Maximum Travel(2)	mm	51	76	76
	Inch	2	3	3
Maximum Excess Diaphragm Pressure(3,4)	bar	0.7 [1.7](5)	1.0	1.4
	psig	10 [25](5)	15	20
Maximum Casing Pressure for Actuator Sizing(4)	bar	4.5	3.4	4.9
	psig	65	50	70
Maximum Diaphragm Casing Pressure(3,4)	bar	4.5	3.8	4.8
	psig	65	55	70
Material Temperature Capabilities(4,6)	-40 to 82°C (-40 to 180°F) with EPDM diaphragm			

1. See also the Specifications portion of the Introduction section. Do not exceed maximum allowable valve stem load when applying maximum allowable thrust.
2. Actuator travel may be less than maximum when connected to a valve with a shorter travel. See the actuator nameplate for the actuator travel.
3. Maximum diaphragm casing pressure must not be exceeded and must not produce a force on the actuator stem greater than the maximum allowable actuator output thrust or the maximum allowable stem load.
4. The pressure and temperature limitations in this manual, and any applicable code limitation, should not be exceeded.
5. Modified Size 45 Upper Casing Excess Diaphragm Pressure Limit. See table 12, PN GE54328X0A2.
6. EPDM may be used up to 121°C (250°F), but with reduced life. Contact your Emerson sales office for more information.

Table 2. Diaphragm Casing Volumes, cm^3 ($Inch^3$)

ACTUATOR SIZE	CLEARANCE VOLUME, cm^3 ($INCH^3$)	TRAVEL, mm (INCH)						
		11 (0.4375)	16 (0.625)	19 (0.75)	29 (1.125)	38 (1.5)	51 (2)	76 (3)
45	1556 (95)	---	2786 (170)	2999 (183)	3720 (227)	4424 (270)	5408 (330)	---
70	3490 (213)	5244 (320)	5948 (363)	6424 (392)	7833 (478)	9242 (564)	11110 (678)	14879 (908)
80	9833 (600)	---	---	---	16141 (985)	18026 (1100)	20648 (1260)	25564 (1560)

Table 3. Actuator Stem Assembly Bolt Torque Values

ACTUATOR SIZE	TORQUE	
	N•m	ft•lbf
45	183	135
70	183	135
80 (key 132A)	650	480
80 (key 132B)	407	300

Table 4. Actuator Mounting Bolt Torque Values Using Nuclear Grade Anti-Seize Lubricant

ACTUATOR SIZE	ACTUATOR MOUNTING STUD BOLT TORQUE	
	N•m	ft•lbf
45	292	215
70(1)	292	215
80	292	215
80 with side-mounted handwheel actuator	426	315

1. For actuators with yoke spacers (key 209), torque applies for both body–to–yoke spacer and yoke to yoke spacer–to–actuator connections.
2. Will require a calibrated torque–wrench up to 1,000 ft•lbf

Description

The 667NS2 actuator is a reverse-acting, spring-opposed diaphragm actuator that is used for operation of automatic control valves. The 667NS2 actuator yoke construction and special yoke-to-bonnet or yoke-to-body bolting provides a high structural resonant frequency that exceeds most nuclear service seismic requirements.

Specifications

Tables 1 through 4 provide specifications for the various sizes of 667NS2 actuators discussed in this instruction manual. All torque values given are ± 5%, unless otherwise specified. See the actuator nameplate for specific information for your actuator.

Educational Services

For information on available courses for the Fisher 667NS2 actuator, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Maximum Pressure Limitations

The casing and diaphragm of 667NS2 actuators are pressure operated. This air pressure provides energy to compress the spring, to stroke the actuator, and lift the diaphragm away from the valve. The following explanations describe the maximum pressure limits for an actuator. Refer to table 1 for maximum values.

⚠ WARNING

To avoid personal injury or parts damage, do not exceed the Maximum Pressures listed in table 1. Exceeding any of the maximum pressures can result in uncontrolled movement of parts, damage to actuator parts and the control valve, and loss of control of the process. Use pressure-limiting or pressure-relieving devices to prevent casing pressure from exceeding these limits.

- Maximum Diaphragm Pressure for Actuator Sizing: This is the maximum pressure that can be applied at less than full travel of the actuator. If this stroking pressure is exceeded before the upper diaphragm plate contacts the travel stop, damage to the stem or other parts might result.

- Maximum Excess Diaphragm Pressure: Additional pressure may be added when the actuator is at full travel. If the Maximum Excess Diaphragm Pressure is exceeded, damage to the diaphragm or diaphragm casing might result.

Because the actuator has traveled its specified travel, and the diaphragm head is physically stopped from movement, the energy from any additional air pressure is transmitted to the diaphragm and diaphragm casings. The amount of air pressure that can be added once the actuator has traveled to the stops is limited by the resultant adverse effects that may occur. Exceeding this limiting factor could result in leakage or casing fatigue due to the deformation of the diaphragm casing.

⚠ WARNING

To avoid personal injury or parts damage, do not exceed the Maximum Diaphragm Casing Pressure listed in table 1. The Maximum Diaphragm Casing Pressure must not produce a force on the actuator stem greater than the maximum allowable actuator output thrust or the maximum allowable stem load.

- Maximum Diaphragm Casing Pressure: If the Maximum Diaphragm Casing Pressure is exceeded, damage to the diaphragm, diaphragm casing, or actuator might result. For some actuator sizes, the maximum casing pressure is the sum of the maximum stroking pressure plus a pressure margin to allow for typical regulator settings and/or relief valve tolerances. For other actuator sizes, the value is lower than the sum of the two pressures.

Principle of Operation

The 667NS2 actuator positions the valve plug in response to varying pneumatic loading pressure on the actuator diaphragm. Figure 2 shows the operation of these actuators. The actuator stem moves up as the loading pressure is increased on the bottom of the diaphragm. As the loading pressure is decreased, the spring forces the actuator stem down.

The spring and diaphragm have been selected to meet the requirement of the application and, in service, the actuator should produce full travel of the valve with the diaphragm pressure as indicated on the nameplate.

A side-mounted handwheel assembly is available on this actuator, used as an auxiliary manual actuator. The manual operator is normally in a neutral position, allowing the actuator to function normally as if the manual operator was not on the actuator. When the handwheel is rotated counterclockwise, a geared sleeve moves up and contacts a collar on the actuator shaft. Continued rotation of the handwheel will move the actuator and valve stem to the up position. Rotating the handwheel clockwise will move the geared sleeve down, and will contact the valve-actuator stem connector. This will prevent upward movement of the plug/stem of the valve. By rotating the handwheel to a position between neutral and either full open or full closed, the side-mounted handwheel can be used as an adjustable up or down travel stop.

Lifting Guidelines

⚠ WARNING

Failure to follow these lifting guidelines and accepted lifting and rigging practices could result in property damage and personal injury or death.

All lifting and rigging must be completed in accordance with federal/national/provincial, state and local regulations and applicable lifting and rigging equipment standards. Only personnel trained in proper lifting and rigging practices shall perform valve/actuator assembly lifting, rigging and installation. Because each lift will be unique, the method of lifting the valve assembly, the correct location for attaching and lifting the valve assembly, and what the valve assembly will do when lifted shall be considered for each lift.

Lifting and rigging equipment used to lift, install or remove a valve assembly or component must be properly selected and sized for the weight and configuration of the valve assembly or component being lifted. The weight of the complete valve assembly, including attached accessories, must be taken in consideration for this purpose. The lifting and rigging equipment must be properly maintained and inspected for damage before each use.

If the valve is supplied with an actuator or handwheel, do not use the actuator or handwheel to lift the complete valve assembly. Lifting lugs attached to the actuator must not be used to lift the complete valve assembly unless clearly marked as being rated to support the complete valve assembly weight.

Lifting lugs or other lifting equipment attached to the valve or actuator must never be used to lift or support the weight of attached piping.

CAUTION

Care must be taken when lifting the valve/actuator assembly to ensure all accessories and tubing are not damaged in the process. Accessories and tubing may need to be removed prior to lifting to prevent damage and properly reinstalled before use. Protect valve flange faces, butt weld ends, and other connection surfaces from damage during lifting.

The quantity of eyebolts for lifting purpose is the minimum recommendation. More eyebolts can be used per customer experience. When tightening the eyebolts and nuts, do not exceed the torque that is specified on the diaphragm casing cap screws and nuts (keys 119 and 120) in the following sections, to avoid damage on the diaphragm.

Lifting Valve/Actuator Assembly

To lift the valve/actuator assembly, eyebolts should be used. Insert four 3/8 inch shouldered pattern eyebolts positioned 90 degrees apart on the diaphragm casing flange for size 45 and 70. Use six 7/16 inch shouldered pattern eyebolts positioned 60 degrees apart on the diaphragm casing flange for size 80. Two nuts are required with one on each side of the diaphragm casing flange. A longer strap is recommended, so that the angle between the straps connecting each eyebolt can be smaller, which helps the eyebolts hold more weight. The eyebolt should be ASTM A489-K04800 or stronger material. Use protective pads between the strap and casing to help prevent damage to the painted surface. A single hoist lift point on the strap will balance and lift the valve/actuator assembly in a level manner. For bellows seal valve, the valve/actuator assembly should be lifted using one or more lifting straps that are rigged to choke around the actuator under the diaphragm casing. If necessary, use additional slings around the valve inlet and outlet or around actuator legs for body stabilization.

Lifting Valve Only

For guidance on lifting only the valve, please refer to the instruction manual for the applicable valve.

Lifting Actuator Only

Note

For actuators with yoke spacers (key 209), when lifting the yoke spacer and actuator assembly together, follow the previous instructions for lifting the valve/actuator assembly.

To lift the actuator and accessories, eyebolts should be used. Insert two 3/8-inch shouldered pattern eyebolts positioned 180 degrees apart on the diaphragm casing flange for size 45 and 70. Use four 7/16-inch shouldered pattern eyebolts positioned 90 degrees apart on the spring casing for size 80. Two nuts are required with one on each side of the diaphragm casing flange. The eyebolt material should be ASTM A489-K04800 or stronger material. Use protective pads between the strap and casing to help prevent damage to the painted surface. A single hoist lift point on the strap will balance and lift the actuator in a level manner.

Installation

The diaphragm actuator is normally shipped mounted on a valve body. Follow the valve body instructions when installing the control valve in the pipeline. For information on mounting valve accessories, refer to the appropriate valve accessories instruction manual.

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

If the control valve and actuator are installed with the actuator in any position other than vertical, the actuator may not conform with safety-related qualifications. Nonvertical orientation should be part of existing qualification analysis on file at the plant site to ensure conformance with safety-related qualifications. Certain nonvertical orientations can cause water to collect in the yoke and actuator spring areas, eventually causing degradation in product performance.

Note

The 667NS2 actuator is intended to mount directly to HPNS valve bodies, as in the cases of valve sizes NPS 1 through NPS 6. On the NPS 1/2, however, the actuator mounts to the yoke spacer (figure 5) which mounts to the valve body. On the NPS 8 valves, the actuator mounts directly to the bonnet.

If the actuator and control valve body are separate, mount the standard 667NS2 actuator, or 667NS2 actuator with side-mounted handwheel, by following the procedures in the Mounting the Actuator on the Valve section of this manual.

Mounting the Actuator on the Valve

CAUTION

The 667 actuator spring load pushes the stem down out of the actuator yoke, and it can come in contact with the valve stem during actuator mounting. If the valve stem is allowed to remain in the up position (towards the actuator) during actuator mounting, it can interfere with the actuator stem during mounting. It is possible to damage valve stem threads or bend the valve stem. Be sure the valve stem is pushed down (into the valve body), away from the actuator while mounting.

It may be necessary to apply a temporary loading pressure to the actuator to move the actuator stem away from the valve during installation.

If it is not possible to provide a temporary loading pressure, be very careful when lowering the actuator over the valve stem to prevent damage to valve stem and threads.

⚠ WARNING

When moving the actuator stem with loading pressure applied, exercise caution to keep hands and tools out of the actuator stem travel path. If the loading pressure is accidentally disconnected, personal injury and property damage may result if something is caught between the actuator stem and other control valve parts.

Refer to figure 2. The steps below apply to standard 667NS2 actuator and 667NS2 actuator with side-mounted handwheel.

1. Provide a vise or some other method of supporting the valve and the weight of the actuator during assembly. Push the valve stem down away from the actuator while mounting the actuator.
2. Thread the stem locknuts (key 115) all the way onto the valve stem.
3. Coat the threads of the actuator mounting studs (key 101) with Nuclear Grade anti-seize lubricant (key 27) up to the deformed thread. Thread the actuator mounting studs (key 101) into the valve body until the deformed thread prevents further insertion.

Note

For actuators with yoke spacers (key 209) (when lifting the actuator and yoke spacer together) follow previous instructions for lifting the entire valve/actuator assembly.

4. Place the actuator on top of the valve with the Fisher logo on the same side as the Fisher logo on the bonnet. If the assembly has a Type III drawing, mount the actuator as shown on that drawing.
5. Coat the remaining threads of the actuator mounting studs (key 101) and the contact faces of the nuts (key 102) with Nuclear Grade anti-seize lubricant (key 27). Place the washers (key 143) over the studs (key 101) and thread the nuts (key 102) onto the studs (key 101) and hand tighten. Torque the actuator mounting nuts (key 102) evenly in a criss-cross pattern to 292 N • m (215 ft • lbf). The torque for the 667NS with side-mounted handwheel is 315 N • m (426ft • lbf). For actuators with yoke spacers (key 209), connect the yoke spacer in the same way as connecting the actuator yoke.
6. Do not connect the actuator stem to the valve stem at this time. Whenever the actuator is installed on the valve, it is recommended that you perform the Bench Set Adjustment procedures below, to verify that the actuator is still adjusted correctly.

Loading Connection

1. Connect the loading pressure piping to the NPT internal connection in the top of the actuator yoke for size 45 and 70 or on the bottom of the diaphragm casing for size 80.
2. For size 70 actuators, insert a 1/4-inch bushing in the 1/2 NPT internal connection to decrease connection size, if necessary.
3. Keep the length of tubing or piping as short as possible to avoid transmission lag in the control signal. If an accessory (such as a volume booster or valve positioner) is used, be sure that the accessory is properly connected to the actuator. Refer to the accessory instruction manual if necessary.
4. Cycle the actuator several times to check that the valve stem travel is correct and that the travel occurs when the correct pressure range is applied to the diaphragm.
5. If valve stem travel is incorrect, refer to the Travel Adjustment procedure in the Adjustments section.
6. If the pressure range is incorrect, refer to the Bench Set procedure in the Adjustments section.

Adjustments

Travel Adjustment

⚠ WARNING

When moving the actuator stem with diaphragm loading pressure, use caution to keep hands and tools out of the actuator stem travel path. Personal injury and/or property damage is possible if something is caught between the actuator stem and other control valve assembly parts.

Make travel adjustments when the motion observed during actuator travel is different from the travel stamped on the actuator nameplate. If the Mounting the Actuator on the Valve procedure was followed correctly, this adjustment should not be necessary.

When adjusting travel of a reverse -acting (push-down-to-close) valve/actuator assembly, apply a low supply pressure to the actuator diaphragm casing. This moves the valve plug off the seat, reducing the chance of damaging the valve plug or seat during adjustments.

1. Back the stem locknuts away from the stem connector, and slightly loosen the stem connector cap screws.

CAUTION

Do not use wrenches or other tools directly on the valve stem. Damage to the stem surface and subsequent damage to the valve packing might result.

2. Tighten the locknuts together, use a wrench on these locknuts, and screw the valve stem either into the stem connector to lengthen travel or out of the stem connector to shorten travel.
3. Cycle the actuator to check travel. If travel is not equal to the specified travel, adjust and check travel until correct. Tighten the stem connector cap screws when correct travel is obtained.
4. Thread the stem locknuts against the stem connector.

Bench Set

Discussion of Bench Set

The bench set pressure range is used to adjust the initial compression of the actuator spring with the actuator assembly "on the bench." The correct initial compression ensures that the valve-actuator assembly will function properly when it is put in service and the proper actuator diaphragm operating pressure is applied.

The bench set range is established with the assumption that there is no packing friction. When attempting to adjust the spring in the field, it is very difficult to ensure that there is no friction being applied by "loose" packing.

Accurate adjustment to the bench set range can be made during the actuator mounting process (see the Mounting the Actuator on the Valve Procedure) by making the adjustment before the actuator is connected to the valve.

If you are attempting to adjust the bench set range after the actuator is connected to the valve and the packing tightened, you must take friction into account. Make the spring adjustment such that full actuator travel occurs at the bench set range (a) plus the friction force divided by the effective diaphragm area with increasing diaphragm pressure or (b) minus the friction force divided by the effective diaphragm area with decreasing diaphragm pressure.

For an assembled valve-actuator assembly, determine valve friction as described below:

1. Install a pressure gauge in the actuator loading pressure line that connects to the actuator diaphragm casing.

Note

Steps 2 and 4 require that you read and record the pressure shown on the pressure gauge.

2. Increase the actuator diaphragm pressure and read the diaphragm pressure as the actuator reaches its mid-travel position.
3. Increase the actuator diaphragm pressure until the actuator is at a travel position greater than its mid-travel position.
4. Decrease the actuator diaphragm pressure and read the diaphragm pressure as the actuator reaches its mid-travel position.

The difference between the two diaphragm pressure readings is the change in the diaphragm pressure required to overcome the friction forces in the two directions of travel.

5. Calculate the actual friction force:

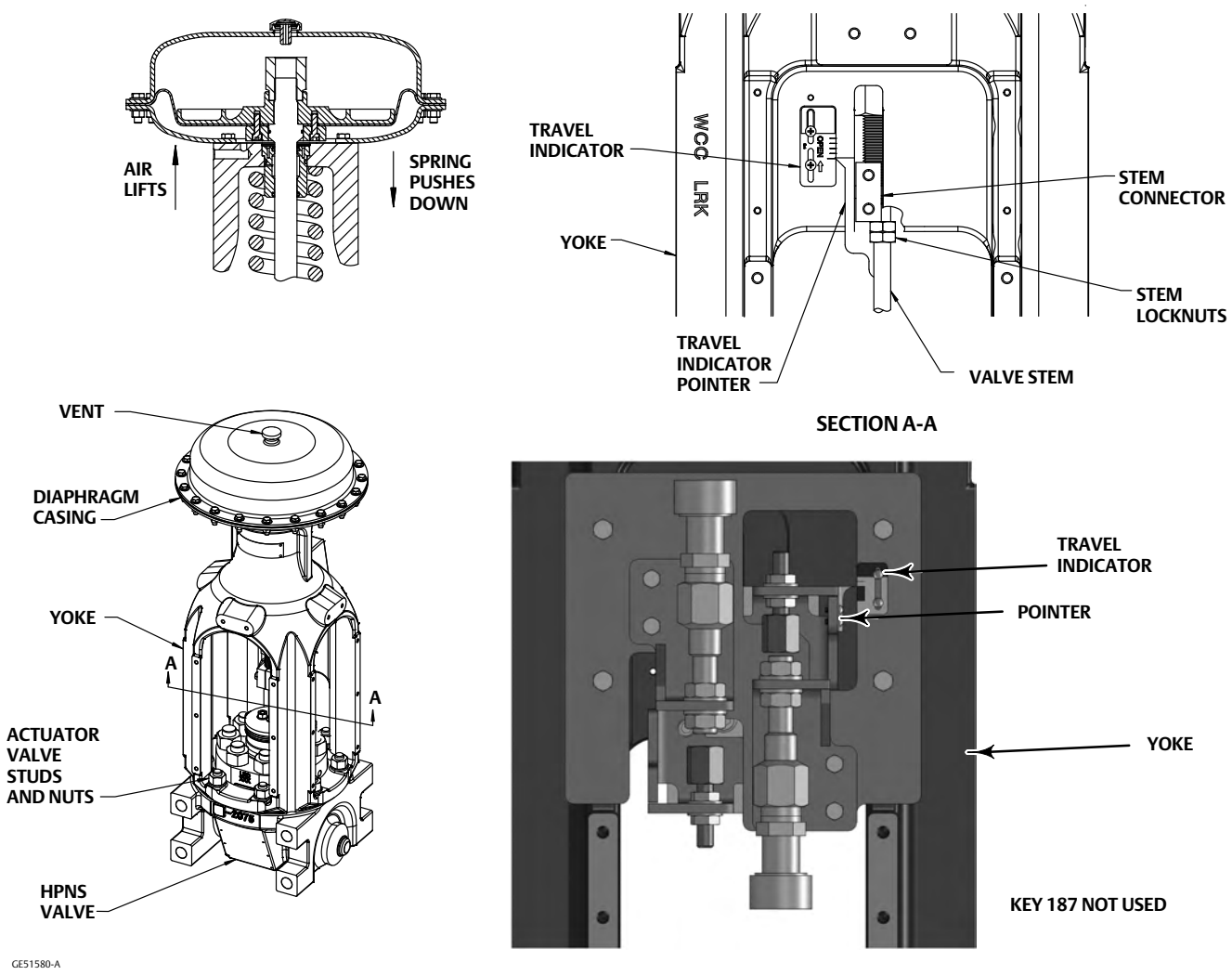
$$\begin{matrix}\textit{Friction}\\ \textit{Force,}\\ \textit{pounds}\end{matrix} = 1/2 \begin{pmatrix}\textit{Difference}\\ \textit{in pressure}\\ \textit{readings, psig}\end{pmatrix} \times \begin{pmatrix}\textit{Effective}\\ \textit{diaphragm area,}\\ \textit{inches}^2\end{pmatrix}$$

Refer to table 1 for the effective diaphragm area.

When determining valve friction, you can make diaphragm pressure readings at a travel position other than mid-travel if you desire. If you take readings at the zero or at the full travel position, take extra care to ensure that the readings are taken when the travel just begins or just stops at the position selected.

It is difficult to rotate the spring adjusting screw (key 127, figure 4, 7, or 8) when the full actuator loading pressure is applied to the actuator. Release the actuator loading pressure before adjusting. Then re-apply loading pressure to check the adjustment.

Figure 2. Schematic and Stem Connection Details for Fisher 667NS2



Bench Set Adjustment

Ensure that the actuator diaphragm is at the bottom of its travel and not connected to the valve.

Note

Some spring compression may be required to ensure that the actuator diaphragm is at the bottom of its travel and not connected to the valve.

⚠ WARNING

When moving the actuator stem with diaphragm loading pressure, use caution to keep hands and tools out of the actuator stem travel path. Personal injury and/or property damage is possible if something is caught between the actuator stem and other control valve assembly parts.

Also, provide a certified pressure gauge that will accurately read the diaphragm pressure from 0 through the upper bench set pressure marked on the nameplate. Apply loading pressure to the diaphragm.

Stroke the actuator a few times to ensure that the pressure gauge is working correctly, and that the actuator is functioning properly.

CAUTION

To prevent product damage, it is important to ensure that the actuator assembly is not binding or producing any friction on the actuator stem movement.

Key numbers are shown in figures 4 to 9.

1. If not already accomplished, push the valve stem down away from the actuator to the closed position.
2. Connect an unpressurized, regulated air hose to the port located on the side of the top of the yoke (key 109) for size 45 and 70, or on the bottom of the lower diaphragm casing for size 80.

Note

Rotate the handwheel clockwise until the travel indicator (key 164) on the lower sleeve (key 163) points to the neutral position on the handwheel travel scale (key 183).

3. Slowly increase the pressure on the bottom of the diaphragm (key 105) until the set pressure is 0.3 bar (5 psig) over the upper bench set pressure. The upper travel stop should be contacting the upper diaphragm plate (key 107).
4. Slowly decrease the pressure towards the upper bench set pressure while checking for the first movement of the actuator stem (key 125).

Note

Before turning the spring adjusting screw, assemble the stem connector around the actuator stem and put the long piece of the stem connector into the anti-rotating slot on the yoke. Mark the actuator stem as a visual reference to verify that stem rotation does not occur. Remove the stem connector before rechecking the bench set.

5. If movement occurs before or after the upper bench set pressure is reached, adjust the spring adjusting screw (key 127) - turn it clockwise to increase the pre-load in the spring (key 110) or turn it counterclockwise to decrease the preload in the spring until the actuator stem (key 125) movement is first detected at the upper bench set pressure.
6. Slowly decrease the pressure on the bottom of the diaphragm (key 105) until the lower bench set pressure is reached.
7. Mark a line on the actuator stem (key 125) and another on the leg of the actuator yoke or yoke/diaphragm casing assembly (key 109), making sure the lines are level.
8. Slowly increase the pressure on the bottom of the diaphragm (key 105) until the upper bench set pressure is reached.
9. Measure the distance between the two lines. This distance should be equal to the rated valve travel.
10. If the distance is correct, bench set is complete. Proceed to the Installing the Stem Connector Assembly subsection.
11. If this distance differs from the rated valve travel, verify that the correct spring and actuator stem are being used and verify that the upper bench set pressure is correct. Remember the free-length and load rate tolerances for the spring may produce a slightly different span than specified. Contact your Emerson sales office for assistance. After replacing the spring, repeat the steps above.
12. Bleed the pressure from the bottom of the diaphragm (key 105), and remove the air hose from the port in the top of the yoke (key 109) for size 45 and 70, or the bottom of the lower diaphragm casing for size 80.

Installing the Stem Connector Assembly

When installing the stem connector assembly (key 103), the actuator and valve stem threads should engage the threads of the stem connector by a distance equal to the diameter of the stem.

1. If necessary, push the valve stem down so that the valve plug is touching the seat ring on direct-acting valves.

Note

Replacement stem connectors are an assembly of two stem connector halves, cap screws, and a spacer between the connector halves. Remove the spacer and discard it, if present, before clamping the actuator and valve stems together.

2. If necessary, screw the valve stem locknuts down, away from the connector location.
3. Adjust the diaphragm pressure to the lower bench set pressure. This should be the same pressure used in the bench set steps, and it is marked on the nameplate.
4. Place the stem connector half (key 103B) with the threaded holes, approximately halfway between the actuator and valve stems. Refer to figures 4 to 9 to help locate the connector position.

⚠ WARNING

Incomplete engagement of either the valve stem or actuator stem in the stem connector can result in stripped threads, loss of process control, and/or improper operation. Be sure that the length of each stem clamped in the stem connector is equal to or greater than one diameter of that stem. Damage to threads on either stem or in the stem connector can cause the parts to be replaced prematurely.

5. Attach the other stem connector half (key 103A) with the anti-rotator in the groove on the yoke or yoke/diaphragm casing assembly and insert the hex cap screws (key 103C) and tighten them. If the actuator is to be used with a positioner, the positioner feedback bracket will be held in place on the stem connector bolt half (key 103A) by the

hex cap screws (key 103C). Secure the stem connector assembly with the hex cap screws (key 103C). Torque the cap screws (key 103C) to the value in table 5.

Table 5. Stem Connector Torque Specifications

Actuator Size	Stem Connector Torque	
	N • m	ft • lbf
45	41	30
70	41	30
80	102	75
80C with Hand Operation	102	75

6. Release pressure from the actuator casing. Screw the valve stem locknuts (key 115) up until the upper one contacts the bottom of the stem connector assembly (key 103). Do not overtighten the locknuts.
7. For the switch mounting for the NPS 1/2 HPNS valve with 70A actuator, follow the instructions in Installing the 1/4 Inch Travel Limit Switch Assembly section.
8. Coat Loctite® 242 (key 185) to the hex cap screws (key 147). Attach the proximity switch target mounting bracket (key 148) to the stem connector half (key 103B) using the hex cap screws (key 147) and washers (key 146). Center the bracket vertically on the stem connector and tighten the hex cap screws, torque to 91 N • m (67 ft • lbf) for size 45 and 70, and torque to 23 N • m (17 ft • lbf) for size 80. For actuator 1/4 inch travel, the proximity switch target mounting bracket (key 148) and hardware (keys 146, 147, and 187) are not used. Refer to Installing the 1/4 Inch Limit Switch Assembly section for switch assembly installation. Adjust the travel scale vertically to align the closed mark on the scale with the pointer on the bracket and tighten the mounting screws.

Note

For push-down-to-close valves, the valve plug seat is the limit for downward travel and the actuator up-stop is the limit for upward (away from the valve) movement.

⚠ WARNING

To avoid personal injury due to the sudden, uncontrolled movement of parts, do not loosen the cap screws when the stem connector has spring or loading pressure force applied to it.

1/4 Inch Travel Limit Switch Installation

Refer to Type III drawing, TopWorx™ GO SWITCH™ Mounting Instruction Manual, and figure 6 below for the installation of the TopWorx 1/4 inch travel limit switch bracket assembly.

1. Coat the threads of the two 1/2 inch socket bolts (key 224) with Loctite 242 (key185). Install the adapter plate (key 221) onto the stem connector assembly arm (key 103B). Torque to 92 N • m (68 ft • lbf).
2. Coat the threads of the eight 5/16 inch socket bolts (key 226) with Loctite 242 (key 185). Install the two target arms (key 223) on the adapter plate (key 221). Torque to 23 N • m (17 ft • lbf).
3. Coat the threads on the four 5/16 inch hex bolts (key 225) with Loctite (key 185). Install the mounting plate (key 220), to the Actuator Yoke (key 109). Ensure the Mounting Plate is oriented as per figure 6. Torque to 23 N • m (17 ft • lbf).
4. Coat the threads of the eight 1/4 inch hex head bolts (key 227) with Loctite 242 (key185). Install the two mounting bracket assemblies (key 222) on to the mounting plate (key 220). Torque to 11 N • m (8 ft • lbf).

5. Attach the travel scale (key 113) with machine screws (key 126). Tighten the screws.
6. Attach the pointer (key 208) with machine screws (key 126). Tighten the screws.
7. Attach the switches and the magnets as shown in figure 6 and as per the TopWorx GO SWITCH Mounting Instruction Manual.

Note

When positioning the magnet/switch, axial alignment is necessary. Ensure that the switch and magnet axes are not more than 0.1 inches eccentric.

8. While there is no air in the diaphragm, adjust the gap of the "CLOSED" (upper or right-hand) switch/magnet pair to a small gap approximately 0.1 inches. Tighten the magnet 47 N • m (35 ft • lbf). Adjust the switch so a gap of 0.075±0.015 inches is between the magnet and the switch. Tighten the switch to 47 N • m (35 ft • lbf). Use wire gages to verify the gap. Repeat the tightening of the switch if necessary to adjust the gap. Use of offset tools with the torque wrench may be helpful.

Note

Mount the magnets before mounting the switches, as adjusting one magnet can introduce movement of the other magnet attached to the target arm assembly, whereas the switches are fixed to the yoke. **Recommend under-estimating the gap before final torquing, as torquing may enlarge the gap.**

9. Cycle the valve open. Repeat step 8 for the "OPEN" (lower or left-hand) switch/magnet pair. Use wire gauges to verify the gap. Repeat the tightening of the switch if necessary to adjust the gap.
10. Calibrate switches per the TopWorx GO SWITCH Mounting Instruction Manual.

Deadband Measurement

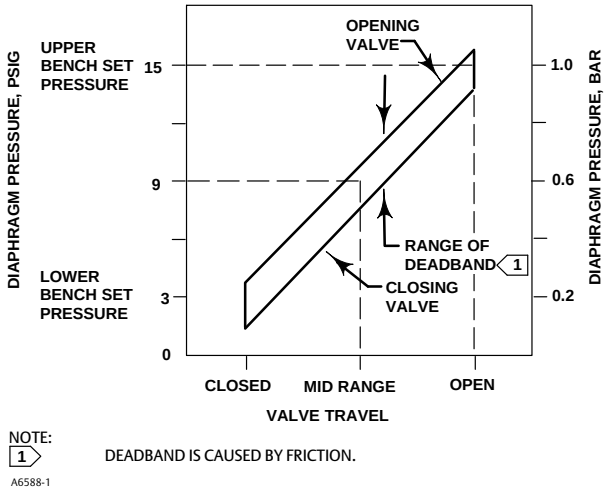
Deadband is caused by packing friction, unbalanced forces, and other factors in the control valve assembly. Deadband is the range a measured signal can vary without initiating a response from the actuator (see figure 3). Each actuator spring has a fixed spring rate (force). You have verified that the correct spring was installed in the actuator by completing the Bench Set Adjustment steps.

Deadband is one factor that affects the control valve assembly operation during automatic loop control. The control loop tolerance for deadband varies widely depending on the loop response. Some common symptoms of the deadband being too wide are no movement, a "jump" movement, or oscillating movements of the actuator during automatic loop control. The following steps are provided to determine the span of deadband. The percent of deadband is helpful in troubleshooting problems with the process control loop.

1. Start at a pressure near the lower bench set pressure, slowly increase pressure until the valve is approximately at mid-travel. Note this pressure reading.
2. Slowly decrease pressure until movement of the valve stem is detected and note this pressure.
3. The difference between these two pressures is deadband, in psi.
4. Calculate the percent of deadband by:

$$\text{Deadband} = \frac{\text{Deadband, psi}}{\text{Bench Set Span, psi}} = \text{nn \%}$$

Figure 3. Typical Valve Response to Deadband



Deadband Adjustments

1. Monitor actuator loading pressure carefully when making adjustments. Do not exceed the maximum pressure specifications of either the loading regulator or the actuator casings (refer to table 1 for maximum diaphragm casing pressure).
2. Each actuator spring has a fixed pressure span. Changing the spring compression shifts the span up or down to make valve travel coincide with the pressure range.
3. For sizes 45 and 70, turn the spring adjusting screw (key 127, figure 4) into the yoke to shift the span up or turn the spring adjusting screw out of the yoke to shift the span down. For size 80, rotate the spring adjusting screw (key 127) to shift the span.

For successful operation, the actuator stem and valve plug stem must move freely in response to the loading pressure change on the diaphragm.

Operation

In a reverse-acting diaphragm actuator, an increasing loading pressure causes the actuator stem to move upward, compressing the spring. When the diaphragm pressure is decreased, the spring moves the actuator stem downward. This is shown graphically in figure 2. In the event of failure of the loading pressure to the diaphragm of the actuator, the actuator stem moves to the extreme downward position. Push-down-to-close valves will close on failure of the diaphragm loading pressure.

The nameplate attached to the yoke of the actuator provides information about the specific construction and operating range. The spring and diaphragm have been selected to meet the requirements of the application, and in service, the actuator should create full travel of the valve plug when the diaphragm pressure (operate) range indicated on the nameplate is applied.

The nameplate specifies a bench set pressure range in addition to a diaphragm pressure (operate) range. The bench set range is that pressure range required to stroke the valve fully without any pressure in the body and no packing friction, as would be the case if the valve were set on the work bench. However, in service with the specified pressure drop applied across the valve, it should stroke over that diaphragm pressure (operate) range indicated on the nameplate.

When the control valve and actuator are installed, the actuator should be checked for correct travel, freedom from excessive friction, and correct action (air-to-open) to match the controlling instrument. For successful operation, the actuator stem and valve plug stem must move freely in response to the loading pressure change on the diaphragm.

Maintenance

Normally, only the elastomeric parts and the spring of the 667NS2 actuator require inspection or replacement. The maintenance instructions are divided into three subsections: Replacement of Elastomeric Parts, Disassembly, and Assembly. Perform only those steps applicable to the actuator size and required maintenance.

It is recommended that the diaphragm and all of the other elastomeric parts of the 667NS2 actuator be inspected every two outages. The absolute maximum replacement period for any of the elastomeric parts is six years.

All maintenance operations can be performed with the valve in the line.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the power actuator loading pressure and relieve any actuator spring precompression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline.* Process fluids may spray out under pressure when removing the packing hardware or packing rings.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

Replacement of Elastomeric Parts

The elastomeric parts in a size 45, 70, or 80 actuators include the diaphragm and O-rings. Because replacement of these parts necessitates complete disassembly, perform the steps outlined in the procedures for disassembly and assembly of size 45, 70, and 80 actuators.

Disassembly

Size 45 and 70 Actuators

Key number references are shown in figure 4 for size 45 and 70 actuators.

1. Bypass the control valve. Reduce the actuator loading pressure to atmospheric pressure, and remove the tubing or piping from the connection in the yoke (key 109).

⚠ WARNING

To avoid personal injury due to the sudden, uncontrolled movement of parts, do not loosen the stem connector cap screws on the stem connector (key 103) when spring force is applied.

2. To aid in assembly, record the position of the spring adjusting screw (key 127) on the actuator stem (key 125). Remove the cap screws (key 194) from the spring adjusting screw (key 127). Thread the spring adjusting screw off the actuator stem until all spring compression is relieved.
3. Remove the entire actuator from the valve body by removing the two cap screws from the stem connector assembly (key 103), separating the two halves of the stem connector and removing the eight yoke stud bolt nuts and washers (keys 102 and 143). For actuators with yoke spacers (key 209), remove the actuator and yoke spacer together as a unit.
4. Thread the spring adjusting screw off the actuator stem. Remove the spring seat (key 121) and spring (key 110).
5. Remove the diaphragm casing cap screws, nuts, and washers (key 119, 120, and 145), and lift off the upper diaphragm casing (key 104).
6. Take out the travel stop spacer nut (key 111), the diaphragm (key 105), the upper diaphragm plate (key 107), the lower diaphragm plate (key 108), and the actuator stem as an assembly. Use care when pulling the threads of the actuator stem through the seal bushing (key 116) to avoid damaging the O-rings (key 117).
7. Remove the travel stop spacer nut (key 111) off the stem and cap screws (key 195) off the bottom of the lower diaphragm plate (key 108) to separate the parts of this assembly. Remove and check the O-ring (key 193) on the stem (key 125) for excessive wear or damage.
8. Remove the snap ring (key 124), and lift out the seal bushing (key 116). Remove and check the O-rings (keys 117 and 118) for excessive wear or damage. The seal bushing has two 1/4-20 UNC tapped holes provided in its top surface to be used as an aid in removing it.
9. Remove the cap screws (key 114), and take off the lower diaphragm casing (key 122) and the gasket (key 123).

Size 80 Actuators

Key number references are shown in figure 7.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve, and drain the process media from both sides of the valve. Shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove the tubing or piping from the connection in the bottom of the lower diaphragm casing.

⚠ WARNING

To avoid personal injury due to the sudden, uncontrolled movement of parts, do not loosen the stem connector cap screws on the stem connector (key 103) when spring force is applied.

3. If the actuator has a handwheel, rotate the handwheel to relieve all spring compression.
4. Record the position of the spring adjusting screw (key 127) relative to the spring casing assembly (key 131) and unscrew the hex jam nut (key 135) and spring adjusting screw, relieving all compression from the spring (key 110).
5. Remove the two cap screws from the stem connector assembly (key 103), and separate the stem connector halves.
6. If removal of the actuator is necessary, unbolt the eight yoke stud bolt nuts and washers (keys 102 and 143), and remove the actuator from the valve body. Otherwise, leave the actuator mounted on the valve body.
7. Unscrew the cap screws, nuts, and washers (keys 119, 120, and 145), and lift the upper diaphragm casing and spring casing assembly (keys 104 and 131) over the spring. If necessary, remove the spring casing assembly (key 131) by unbolting the cap screws and washers (keys 114 and 144) and remove the travel stop (key 134) from the inside of the upper diaphragm casing (key 104).
8. Remove the guide bushing (key 133), the spring seat (key 121), and the bearing race and bearing (keys 129 and 130).
9. Lift off the spring (key 110).

10. Remove the actuator stem with the attached hex nuts (keys 132A and 132B), the upper diaphragm plate (key 107), the diaphragm (key 105), and the lower diaphragm plate (key 108) by carefully sliding the lower end of the actuator stem out of the seal bushing O-rings (key 117) and lifting the actuator stem with attached parts clear of the diaphragm casing. Lift using the 1/2-13 UNC tapped lifting hole on top of the actuator stem.
11. To aid in unfastening the actuator stem hex nuts (keys 132A and 132B) and to help prevent actuator stem damage, attach the stem connector assembly onto the actuator stem and grip the stem connector in a vise while unfastening the actuator stem hex nuts (keys 132A and 132B). Remove the hex nuts (keys 132A and 132B), and inspect the actuator stem and associated parts.
12. Remove the snap ring (key 124), and lift the seal bushing (key 116) and O-rings (keys 117 and 118) out of the actuator yoke/casing assembly (key 109). The seal bushing has two 1/4-20 UNC tapped holes provided in its top surface to be used as an aid in removing it.
13. Remove the O-rings (key 117 and 118).

Size 80 Actuators with Side-Mounted Handwheel

Key number references are shown in figures 8 and 9.

The side-mounted handwheel assembly is normally used as a manual operator. The handwheel is mounted in such position orientations that counterclockwise rotation always opens the valve. The assembly is a continuously connected type with an indicator to show neutral position. By rotating the handwheel away from neutral, the handwheel can be used to limit travel in either direction, but not both directions at the same time.

A grease fitting is provided on the gear case for periodic gear lubrication with Lubriplate Mag-1 (key 150).

Instructions are given below for complete disassembly and assembly in Assembly section. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

1. Complete steps 1 through 9 of the Disassembly portion of the Size 80 Actuator section.
2. Unscrew the cap screws and washers (keys 174 and 176), and lift the spacer/diaphragm casing assembly (key 167) and actuator stem (key 125) with the attached hex nuts (keys 132 and 198), the cap screws (key 197), the upper diaphragm plate (key 107), the diaphragm (key 105), the lower diaphragm plate (key 108), travel stop nut (key 168), and set screw (key 170) by carefully sliding the lower end of the actuator stem out of the lower sleeve (key 163).
3. Loosen the set screws (key 170). Remove the stem travel stop nut (key 168) over the actuator stem (key 125).
4. Remove the actuator stem (key 125) with the attached hex nuts (keys 132 and 198), the cap screws (key 197), the diaphragm plate (key 107), the diaphragm (key 105), and the lower diaphragm plate (key 108) by carefully sliding the lower end of the actuator stem out of the seal bushing O-rings (key 117) and lifting the actuator stem with attached parts clear of the diaphragm casing. Lift using the 1/2-13 UNC tapped lifting hole.
5. Remove the cap screws (key 197) from the hex nut (key 198). To aid in unfastening the actuator stem hex nuts (keys 132 and 198) and to help prevent actuator stem damage, attach the stem connector assembly onto the actuator stem and grip the stem connector in a vise while unfastening the actuator stem hex nuts. Remove the hex nuts and attached parts, and inspect the actuator stem and associated parts.
6. Remove the snap ring (key 124), and lift the seal bushing (key 116) and O-rings (keys 117 and 118) out of the spacer. The seal bushing has two 1/4-20 UNC tapped holes provided in its top surface to be used as an aid in removing it.
7. Remove the O-rings (key 117 and 118).
8. Unscrew the two machine screws (key 171), and remove the travel stop indicator (key 164) off the lower sleeve (key163).
9. Turn the handwheel (key 159) to raise the lower sleeve (key 163) until it is free of the worm gear. Lift out the lower sleeve.
10. Remove the cap screws (key 196) and set screws (key 173) from the retainer thrust plate (key 165).

11. Remove the set snap ring (key 172). Take the retainer thrust plate (key 165) out of the gear case (key 151).
12. Take out the parts in the following order: the gear retainer, the thrust bearing, the worm gear, and the second thrust bearing (keys 162, 160, 161, and 160).
13. Unscrew the set screw (key 170), then, unscrew the handwheel cap (key 156) off the worm shaft (key 154).
14. Remove the handwheel (key 159) off the worm shaft (key 154). Do not lose the ball and the spring (keys 158 and 157).
15. Loosen the two set screws (key 170), and unscrew the front and back worm retainer (keys 155 and 152). The ball bearing (key 153) will come out with the retainers.
16. Remove the worm shaft (key 154).
17. Unscrew the cap screws and washers (keys 169 and 175), and lift the gear case (key 151) and key (key 166) off the yoke (key 109).
18. Remove the key (key 166) from the bottom of the gear case (key 151).

Assembly

Size 45 and 70 Actuators

Key number references are shown in figures 4 and 5 for size 45 and 70 actuators.

1. Place the spring (key 110) into the yoke (key 109). Coat the sealing surface of the yoke with NyoGel 718B (key 149), as appropriate to the installation, and place the gasket on top of the yoke. Coat the top surface of the gasket (key 123) with NyoGel 718B (key 149).
2. Apply Loctite 242 (key 185) to the lower diaphragm casing hex cap screws (key 114). Attach the lower diaphragm casing (key 122) to the yoke with the cap screws (key 114). Tighten the cap screws to 41 N•m (30 ft • lbf) of torque for the size 45 actuators, and 102 N•m (75 ft • lbf) of torque for the size 70 actuators. Insert and evenly tighten the cap screws using a crisscross pattern.
3. Install two O-rings (key 117) into the grooves in the inner diameter of the seal bushing (key 116). Install one O-ring (key 118) into the groove in the outer diameter of the seal bushing (key 116).
4. Lubricate the O-rings, and fill the seal bushing with NyoGel 718B (key 149) as appropriate to the installation, and reinstall the bushing in the top of the yoke. Secure with the snap ring (key 124).
5. Coat O-ring (key 193) with NyoGel 718B (key 149) and install it to the groove of the stem. Apply Loctite 242 (key 185) to the travel stop spacer nut (key 111). Stack and assemble the diaphragm (key 105) and upper diaphragm plate (key 107) with the stem by tightening the travel stop spacer nut to 183 N • m (135 ft • lbf). Apply Loctite 242 (key 185) to the cap screws (key 195) and bolt the lower diaphragm plate (key 108) to the upper diaphragm plate. Torque the cap screws to 23 N • m (17 ft • lbf), then place this assembly in the actuator. Take care when pushing the actuator stem through the seal bushing so that the threads do not damage the O-rings. Orient the flat side of the actuator stem so that it faces towards an open window of the yoke (recommendation is facing to the opening to the right of the word “FISHER” on the yoke). See figure 4.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 45 and 70 actuators.

CAUTION

Overtightening the diaphragm casing cap screws and nuts (keys 119 and 120) can damage the diaphragm. Do not exceed a torque of 27 N•m (20 ft•lbf) when performing the following tightening procedure.

Note

Do not use lubricant on these cap screws and nuts. Fasteners must be clean and dry.

6. Install the upper diaphragm casing (key 104), and secure with the cap screws, washers, and nuts (keys 119, 145, and 120) in the following manner. The first four hex nuts tightened should be diametrically opposed and 90 degrees apart. Tighten these four hex nuts to 13 N•m (10 ft • lbf).
7. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 13 N•m (10 ft • lbf).
8. Repeat this procedure by tightening four hex nuts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 ft • lbf).
9. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 27 N•m (20 ft • lbf).
10. After the last hex nut is tightened to 27 N•m (20 ft • lbf), all the hex nuts should be tightened again to 27 N•m (20 ft • lbf) in a circular pattern around the bolt circle.
11. Once completed, no more tightening is recommended.
12. Lift the spring (key 110) and spring seat (key 121) into position. Apply Nuclear Grade anti-sieze lubricant (key 27) to the threads of the actuator stem (key 125) and to the surface of the spring adjusting screw (key 127) that contacts the spring seat. These locations are indicated on the assembly drawing in figure 4. Thread the spring adjusting screw on the actuator stem so that it matches the position recorded during disassembly. Continue to rotate the spring adjusting screw until a set of threaded holes line up with the flat on the actuator stem. Apply Loctite 242 (key 185) to the cap screws (key 194) and thread them into the spring adjusting screw. Tighten the cap screws to 23 N•m (17 ft • lbf) after adjustment of the bench set.
13. Thread the stem hex nuts (key 115) onto the valve plug stem.
14. Mount the actuator on the valve body, and make up the stem connection by following the procedures in the Mounting the Actuator on the Valve section.

Note

For actuators with yoke spacers (key 209), when lifting the yoke spacer and actuator (figure 5) together, follow the previous instructions for lifting a valve/actuator assembly.

Size 80 Actuators

Key number references are shown in figure 7.

1. Install qty-2 O-rings (key 117) into the grooves in the inner diameter of the seal bushing (key 116). Install qty-1 O-ring (key 118) into the groove in the outer diameter of the seal bushing (key 116). Lubricate the O-rings and fill the seal bushing with NyoGel 718B (key 149), as appropriate to the installation. Place the seal bushing and O-rings into the yoke/casing assembly (key 109), and install the snap ring (key 124).
2. To aid in assembling the actuator stem (key 125) and associated parts (keys 108, 105, 107, 132A, and 132B), attach the stem connector assembly (key 103) onto the actuator stem, and grip the stem connector in a vise.
3. Coat the threads of the middle of the actuator stem (key 125) and the seating side of the hex jam nuts (keys 132A and 132B) with Nuclear Grade anti-seize lubricant (key 27). Slide the lower diaphragm plate (key 108), the diaphragm (key 105), and the upper diaphragm plate (key 107) onto the actuator stem. Slide the first hex nut (key 132A) onto the stem, tighten the hex nut to 650 N•m (480 ft • lbf), slide the second hex nut (key 132B) onto the stem, and tighten it to 407 N•m (300 ft • lbf). Remove the subassembly from the vise, and remove the stem connector assembly (key 103) from this subassembly.
4. Slide the shorter end of the actuator stem through the seal bushing and the O-rings (key 117), and align the diaphragm cap screw holes with the lower diaphragm casing flange cap screw holes.

5. Lubricate the guide bushing (key 133) with NyoGel 718B (key 149), as appropriate to the installation. Lubricate the bearing race and bearing (keys 129 and 130) with NyoGel 718B (key 149).
6. Position the spring (key 110), the spring seat (key 121), the lubricated bearing race (key 129) and bearing (key 130), and the lubricated guide bushing (key 133) on top of the diaphragm plate as shown in figure 7.
7. If the spring casing assembly (key 131) has been removed from the upper diaphragm casing, replace it and tighten the cap screws, with Loctite 242 (key 185) applied to the threads and washers (keys 114 and 144), to 102 N•m (75 ft • lbf) torque. If the travel stops (key 134) have been removed from the upper diaphragm casing (key 104), apply Loctite 242 (key 185) to the travel stop threads. Tighten them to the inside of the upper diaphragm casing to 102 N•m (75 ft • lbf). Lower the diaphragm casing and spring case assembly onto the diaphragm.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 80 actuators.

CAUTION

Overtightening the diaphragm casing cap screws and nuts can damage the diaphragm. Do not exceed the final torque values for the appropriate diaphragm material. These final torque values can be found in table 6.

Note

Do not use lubricant on these cap screws and nuts. Fasteners must be clean and dry.

Table 6. Size 80 Casing Cap Screw Torque Values

DIAPHRAGM MATERIAL	INITIAL TORQUE	FINAL TORQUE
	N•m (ft•lbf)	N•m (ft•lbf)
EPDM / Meta-Aramid	25.5 (19)	51 (38)
Nitrile, Silicone, FKM/Meta-Aramid	25.5 (19)	51 (38)

8. Insert the diaphragm casing cap screws, washers, and nuts (keys 119, 145, and 120) and tighten in the following manner. The first four hex nuts tightened should be diametrically opposed and 90 degrees apart. Tighten these four hex nuts to the initial torque value found in table 6 for the diaphragm material being used.
9. Tighten the remaining hex nuts in a clockwise, crisscross pattern to the initial torque value found in table 6 for the diaphragm material being used.
10. Repeat this procedure by tightening four hex nuts, diametrically opposed and 90 degrees apart, to the final torque value that is specified in table 6 for the diaphragm material being used.
11. Tighten the remaining hex nuts in a clockwise, crisscross pattern to the final torque value that is specified in table 6 for the diaphragm material being used.
12. After the last hex nut is tightened, complete another tightening sequence. Tighten in a circular pattern around the bolt circle to the final torque value that is specified in table 6 for the diaphragm material being used.
13. Once completed, no more tightening is recommended.
14. Lubricate the spring adjusting screw (key 127) and the seating face of the jam nut (key 135) with Nuclear Grade anti-seize lubricant (key 27). Thread the spring adjusting screw (key 127) into the hex jam nut (key 135) and spring casing assembly (key 131) so that the spring adjusting screw matches the position recorded in step 4 of the

disassembly procedures for size 80 actuators. Also, make sure that the spring adjusting screw properly engages the spring seat. Then, using a striking wrench and a dead blow hammer, seat the jam nut with several strong hits until the jam nut does not turn with repeated impacts.

15. Screw the two hex nuts (key 115) onto the valve plug stem. Mount the actuator on the valve body, and make the stem connection by following the procedures in the Mounting the Actuator on the Valve section.

Size 80 Actuators with Side-Mounted Handwheel

Key number references are shown in figures 8 and 9.

1. Press fit key (key 166) into slot on the bottom of the gear case (key 151). If the key is too tight to fit, file or grind the key slightly for a better fit.
2. Place the gear case (key 151) on the top of the yoke (key 109) with the worm shaft opening on the right, when facing the Fisher Logo on the yoke (key 109).
3. Coat the gear case hex cap screws (key 169) with Nuclear Grade anti-seize lubricant (key 27). Thread the hex cap screws (key 169) into the gear case (key 151) from the bottom side of yoke flange with one washer (key 175) per hex cap screw until hand tight. Torque the gear case hex cap screws (key 169) to 292 N • m (215 ft • lbf) using a criss-cross tightening pattern.
4. Pack the two ball bearings (key 153) with Lubriplate Mag-1 (key 150). Coat the worm shaft (key 154) threads with Lubriplate Mag-1 (key 150), and slide the shaft into the gear case (key 151).
5. Insert the ball bearing (key 153) in the Nuclear Grade anti-seize lubricant (key 27) coated front worm retainer (key 155), and thread the retainer and ball bearing into the gear case. The bearing should not be loose. Make sure to align the set screw slot in the retainer with the set screw hole in the gear case (key 151). Insert the Loctite 242 (key 185) applied set screw (key 170), and tighten.
6. Insert the ball bearing (key 153) in the back worm retainer (key 152). Thread the Nuclear Grade anti-seize lubricant (key 27) coated back worm retainer (key 152) and ball bearing (key 153) into the gear case (key 151), so that the end of the shaft fits snugly in the back worm retainer (key 152). Align the set screw slot in the worm retainer (key 152) with the set screw hole in the gear case (key 151). Apply Loctite 242 (key 185) to the set screw (key 170). Insert the set screw (key 170), and tighten.
7. Put the spring (key 157) and ball (key 158) in the handwheel (key 159). Slide the handwheel (key 159) onto the worm shaft (key 154). Make sure the ball (key 158) does not fall out of the hole in the front worm retainer (key 155). Thread the handwheel cap (key 156) onto the worm shaft, insert the Loctite 242 (key 185) applied set screw (key 170), and tighten.
8. Lubricate the two thrust bearings (key 160) with Lubriplate Mag-1 (key 150). Install one thrust bearing (key 160); then install the worm gear (key 161), followed by the second thrust bearing (key 160). Make sure the raised bearing surface of the thrust bearings (key 160) is towards the worm gear.
9. Install the gear retainer (key 162) and retainer thrust plate (key 165) into the gear case (key 151). Make sure the retainer thrust plate (key 165) has the side with two patterns of threaded holes facing up. Use an appropriate tool and carefully install the retaining ring (key 172) into the groove of the gear case (key 151).
10. Thread the Loctite 242 (key 185) applied set screw (key 173) into the retainer thrust plate (key 165) and adjust the set screws to eliminate free play in the thrust bearings. Then torque them to approximately 14 N • m (10 ft • lbf) using a criss-cross tightening pattern. Thread the Loctite 242 (key 185) applied button head cap screws (key 196) into the retainer thrust plate (key 165), then torque them to approximately 14 N • m (10 ft • lbf).
11. The lower sleeve (key 163) has two screw holes in one end. Coat the lower sleeve threads with Lubriplate Mag-1 (key 150), slide the end of the lower sleeve without the holes, into the gear case and worm gear (key 161) from the bottom of the gear case. Turn the handwheel (key 159), and feed the lower sleeve through the worm gear. Ensure that the key (key 166) in the gear case engages the slot in the lower sleeve (key 163). Continue turning the handwheel until the lower sleeve protrudes from the retaining flange. Fasten the travel stop indicator (key 164) to the lower sleeve with two machine screws (key 171).
12. Lubricate the O-rings (key 117, 118), and fill the seal bushing with NyoGel 718B (key 149). Install two O-rings (key 117) into the grooves in the inner diameter of the seal bushing (key 116). Install one O-ring (key 118) into the

groove in the outer diameter of the seal bushing (key 116). Place the seal bushing and O-rings into the spacer/diaphragm casing assembly (key 167) with the small diameter facing down, and install the snap ring (key 124) above the seal bushing (key 116).

13. To aid in assembly, attach the stem connector assembly (key 103) onto the actuator stem and grip the stem connector in a vise. Coat the threads of the middle of the actuator stem (key 125) and seating side of the lower hex jam nut (key 198) and upper hex jam nut (key 132) with Nuclear Grade anti-seize lubricant (key 27). Slide the lower diaphragm plate (key 108), the diaphragm (key 105), and the upper diaphragm plate (key 107) onto the actuator stem. Slide the first hex nut (key 198) onto the stem, tighten the hex nut to 650 N • m (480 ft • lbf), slide the second hex nut (key 198) onto the stem, and tighten it to 407 N • m (300 ft • lbf). Thread the Loctite 242-applied cap screws (key 197) into the lower hex jam nut (key 198), then tighten. Remove the subassembly from the vise, and remove the stem connector assembly (key 103) from this subassembly.
14. Slide the threaded end of the actuator stem through the seal bushing (key 116) and the O-rings (key 117). Coat the stem travel stop nut (key 168) with Nuclear Grade anti-seize lubricant (key 27). Slide it onto the actuator stem and align its bolt hole with actuator stem set screw slot. Lubricate the set screw (key 170) with Loctite 242 (key 185). Insert the set screw (key 170), and tighten.
15. Slide the threaded end of the actuator stem into the inner of the lower sleeve (key 163) until the stem travel stop nut (key 168) contacts the lower sleeve (key 163) and rest the spacer/diaphragm casing assembly (key 167) on the top flange of the gear case with the square boss on the spacer 180 degrees from the Fisher Logo of the yoke (key 109). Rotate the assembly to align the bolt holes in the spacer with the bolt holes in the top flange. Coat the threads of cap screws (key 174) with Nuclear Grade anti-seize lubricant (key 27). Insert the cap screws and washers (keys 174 and 176) and tighten to 176 N • m (130 ft • lbf) torque using a criss-cross tightening pattern.
16. Rotate the assembly to align the bolt holes in the diaphragm (key 105) with the bolt holes in the lower diaphragm casing.
17. Complete steps 5 through 15 of the Size 80 Actuator in the Assembly section.
18. Attach the two travel scales (key 113 and 183) to the yoke (key 109) using the pan head machine screws (key 126) per scale. Leave the screws finger-tight; they will be tightened after adjustment of the travel scale.
19. Mount the two spacer cover bands (key 177) using hex cap screws (key 178); torque to 23 N • m (17 ft • lbf).
20. Install the fitting with the cap (key 184) into the gear case.

Troubleshooting

Table 7. 667NS2 Troubleshooting

Problem	Possible Solution
Actuator Stroke is less than full rated travel	Ensure all parts are intact and assembled as specified.
	Check for debris or damaged parts that may be jamming actuator.
	Ensure stem connector is assembled as specified.
	Verify bench set for proper actuator spring load. See Discussion of Bench Set in this instruction manual.
	Inspect valve, see valve instruction manual.
Air leakage	Verify diaphragm casing bolts are torqued as specified with the proper tightening procedure.
	Disassemble and inspect sealing surfaces and diaphragm on the actuator diaphragm case and yoke, especially the diaphragm for scratches or nicks. Replace damaged parts as needed.
Valve does not move	Disassemble and inspect the diaphragm casing and check for debris or damaged parts that may be jamming the actuator. Replaced damaged and broken parts as needed.
	Ensure stem connector is assembled as specified.
	Inspect valve, see valve instruction manual.
	Verify bench set for proper actuator spring load. See Discussion of Bench Set in this instruction manual.
	Inspect all air connections for leakage.
Other	Contact Emerson if more assistance is needed.

Figure 4. Fisher Size 45 or 70 667NS2 Actuator

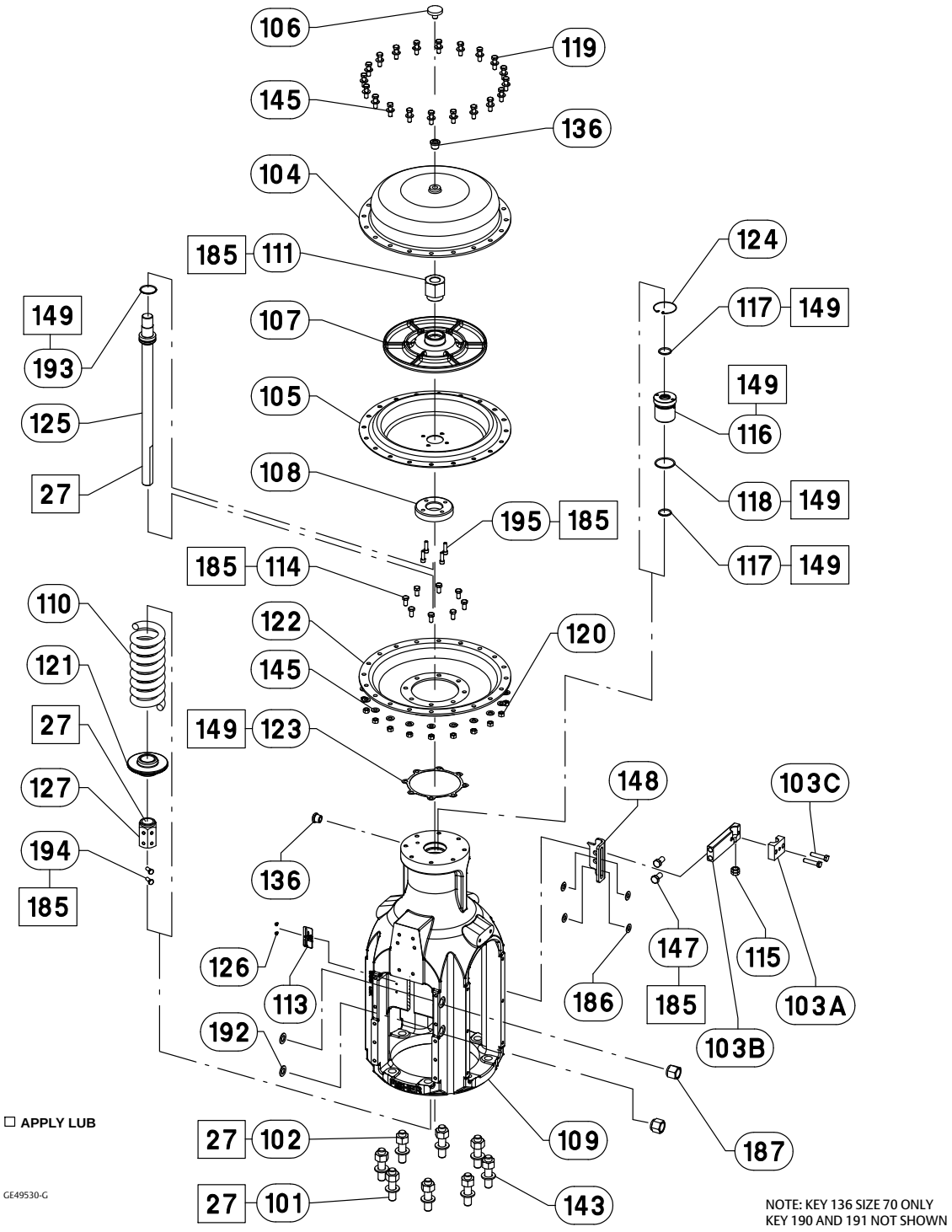


Figure 5. Fisher 667NS2 Size 70 Actuator with Yoke Spacer

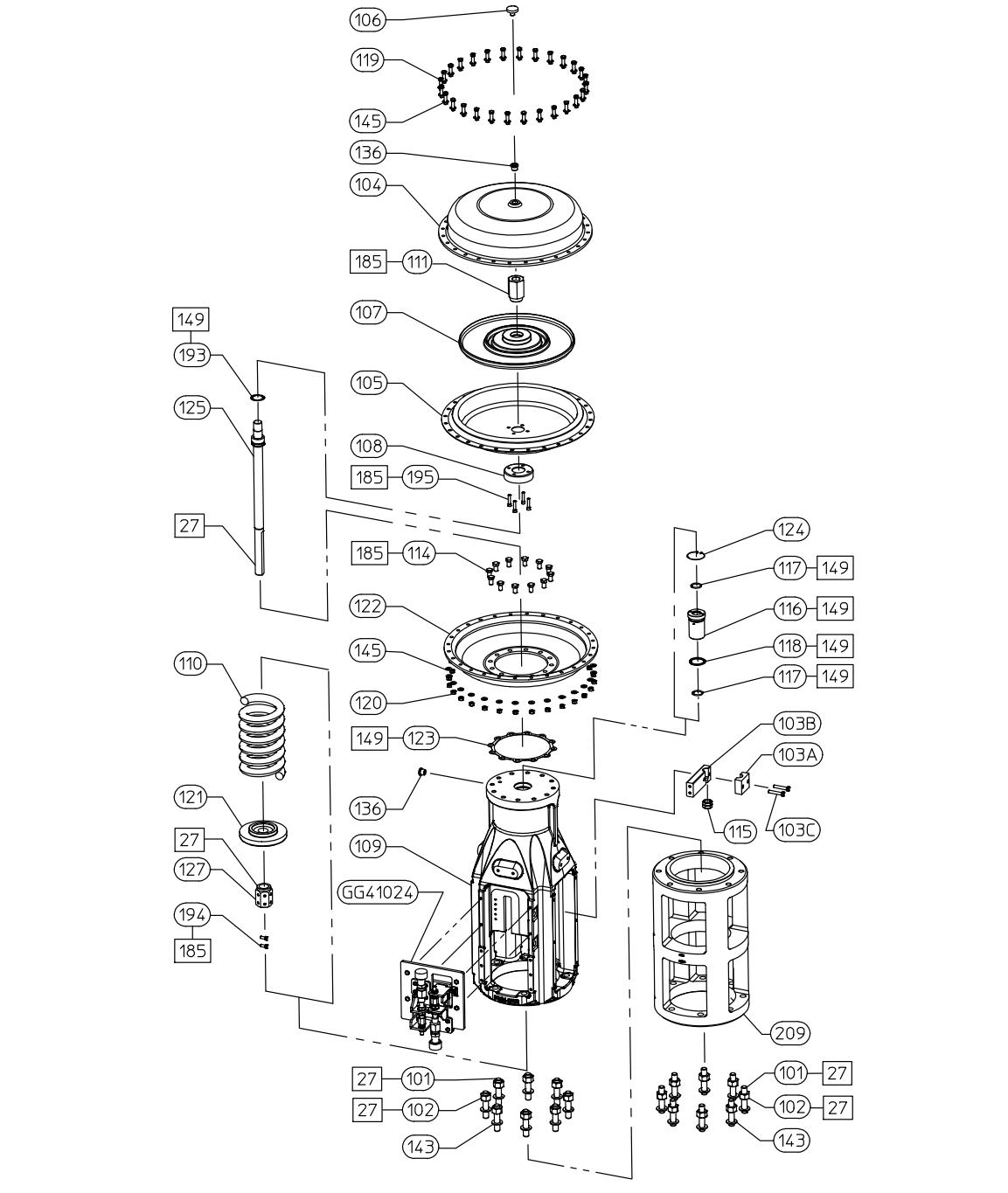


Figure 6. Limit Switch Mounting Assembly for Fisher 667NS2 Size 70A Actuator, ¼ Travel

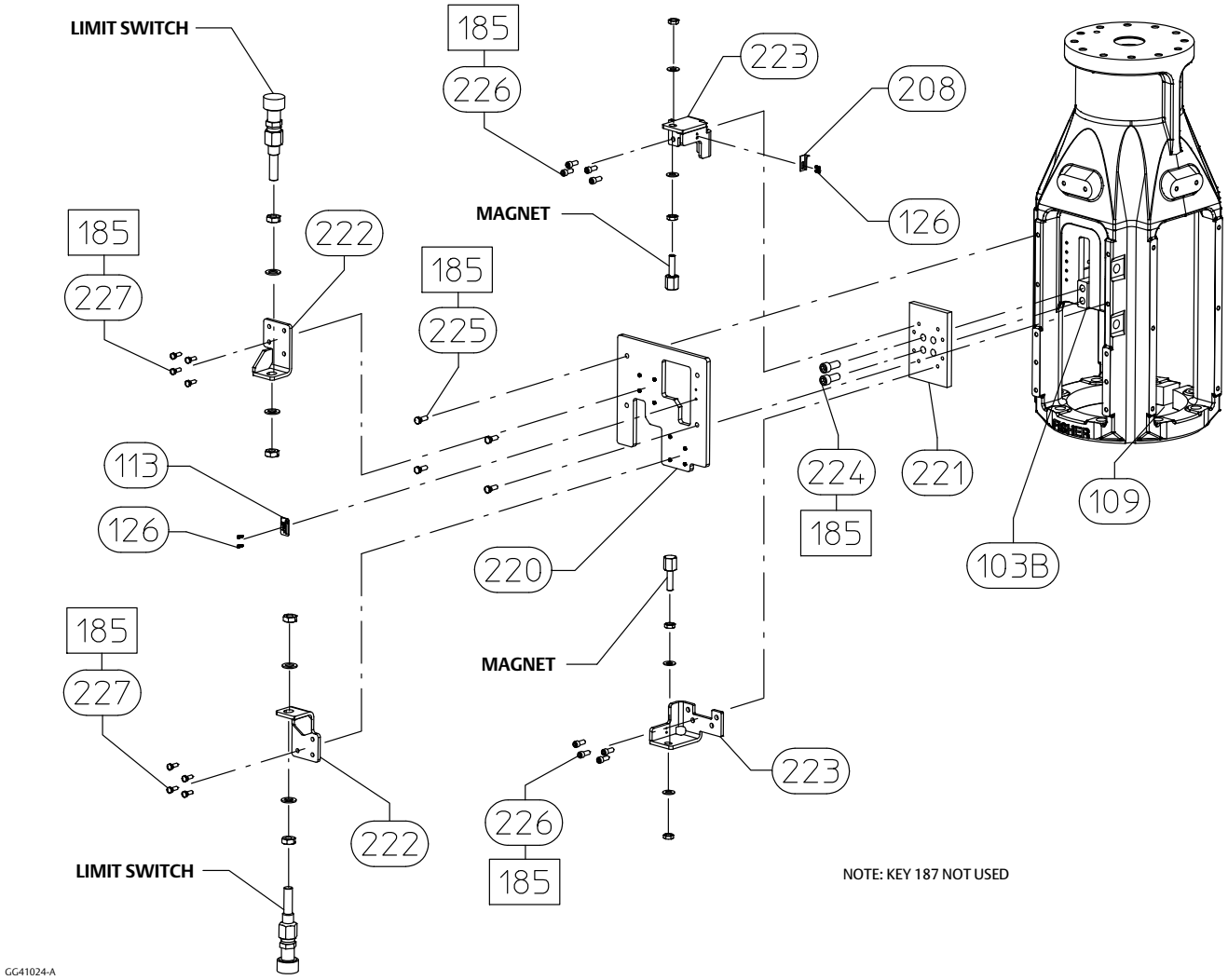


Figure 7. Fisher Size 80 667NS2 Actuator

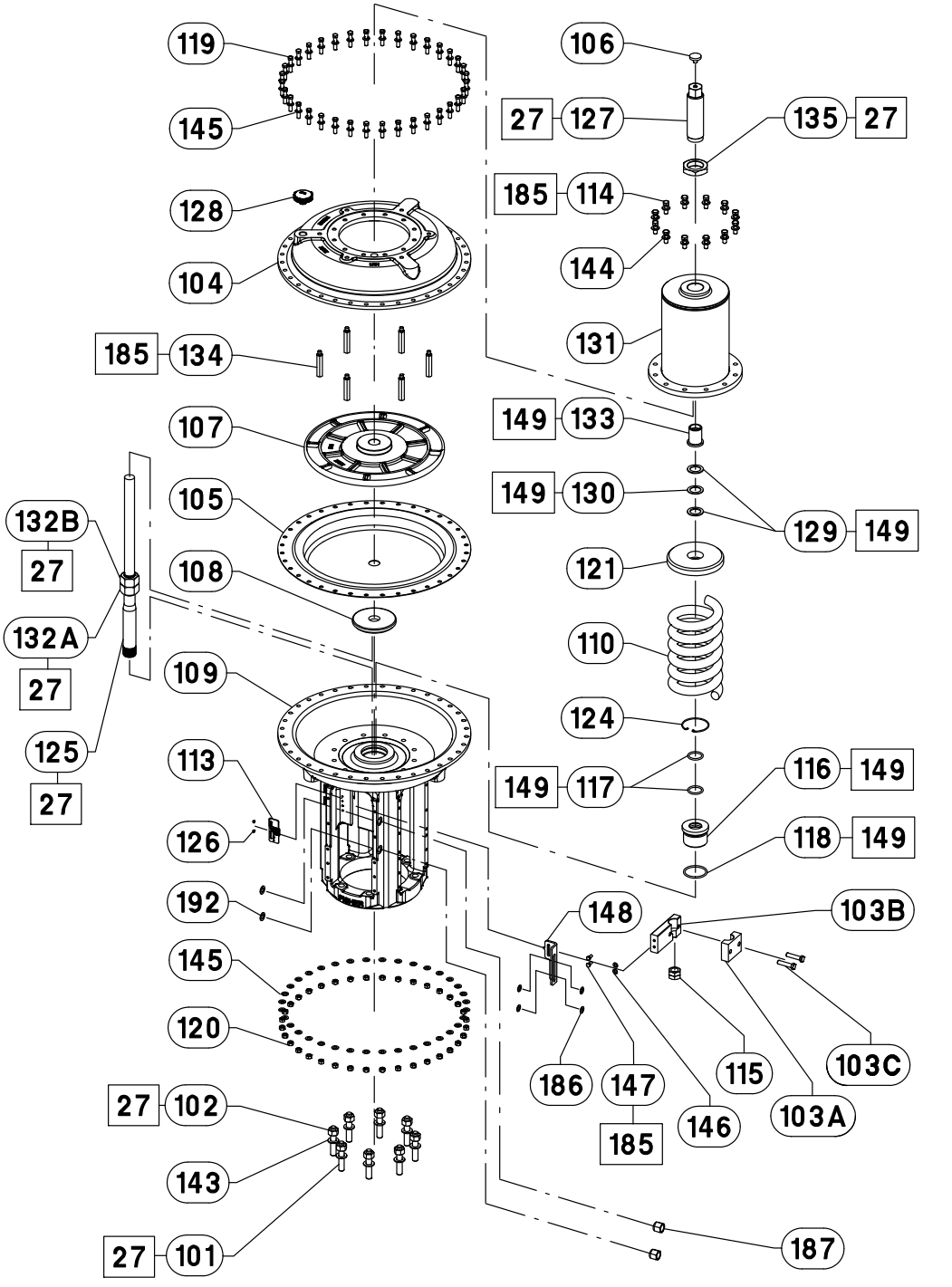
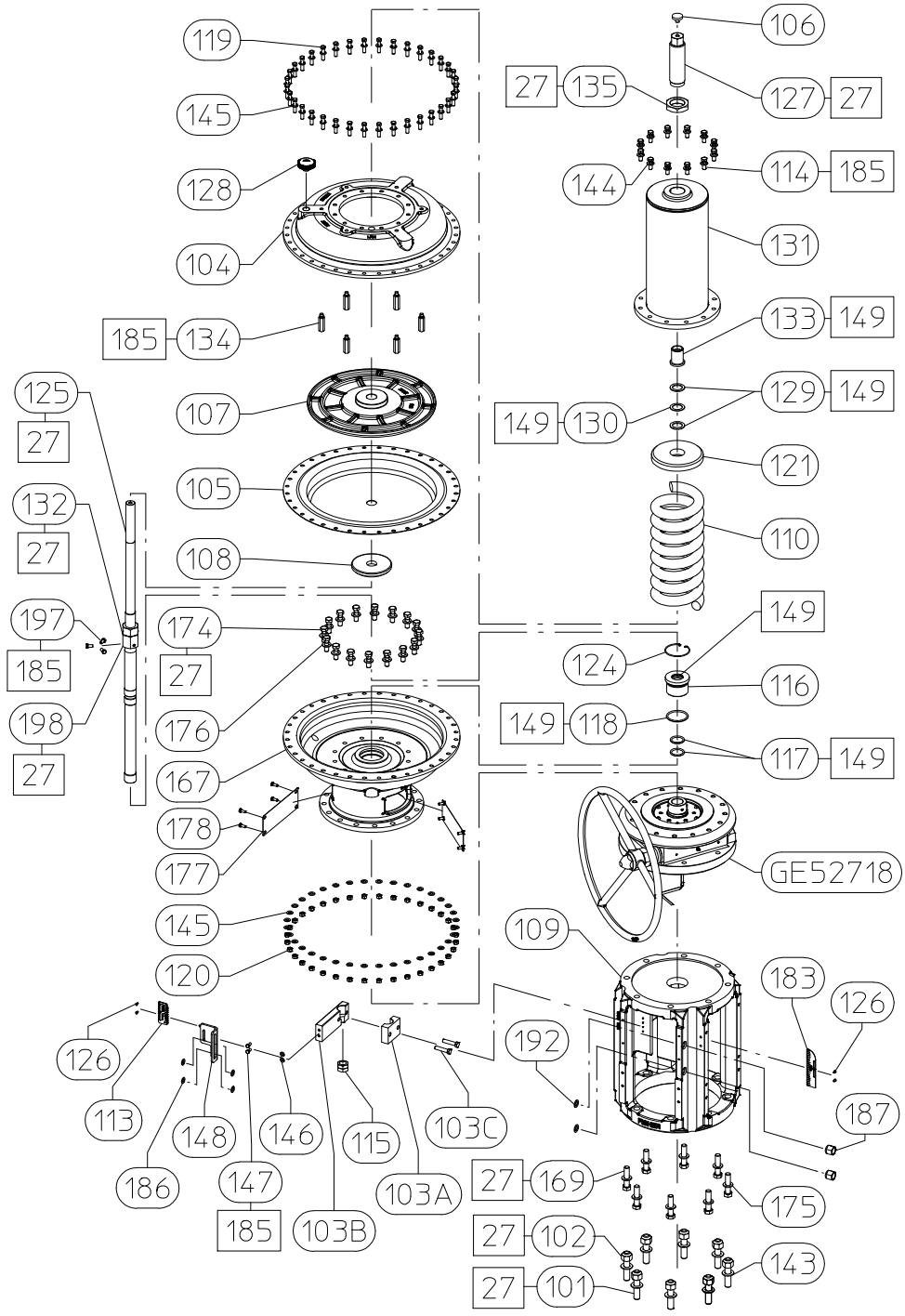


Figure 8. Fisher Size 80 667NS2 Actuator with Side-Mounted Handwheel



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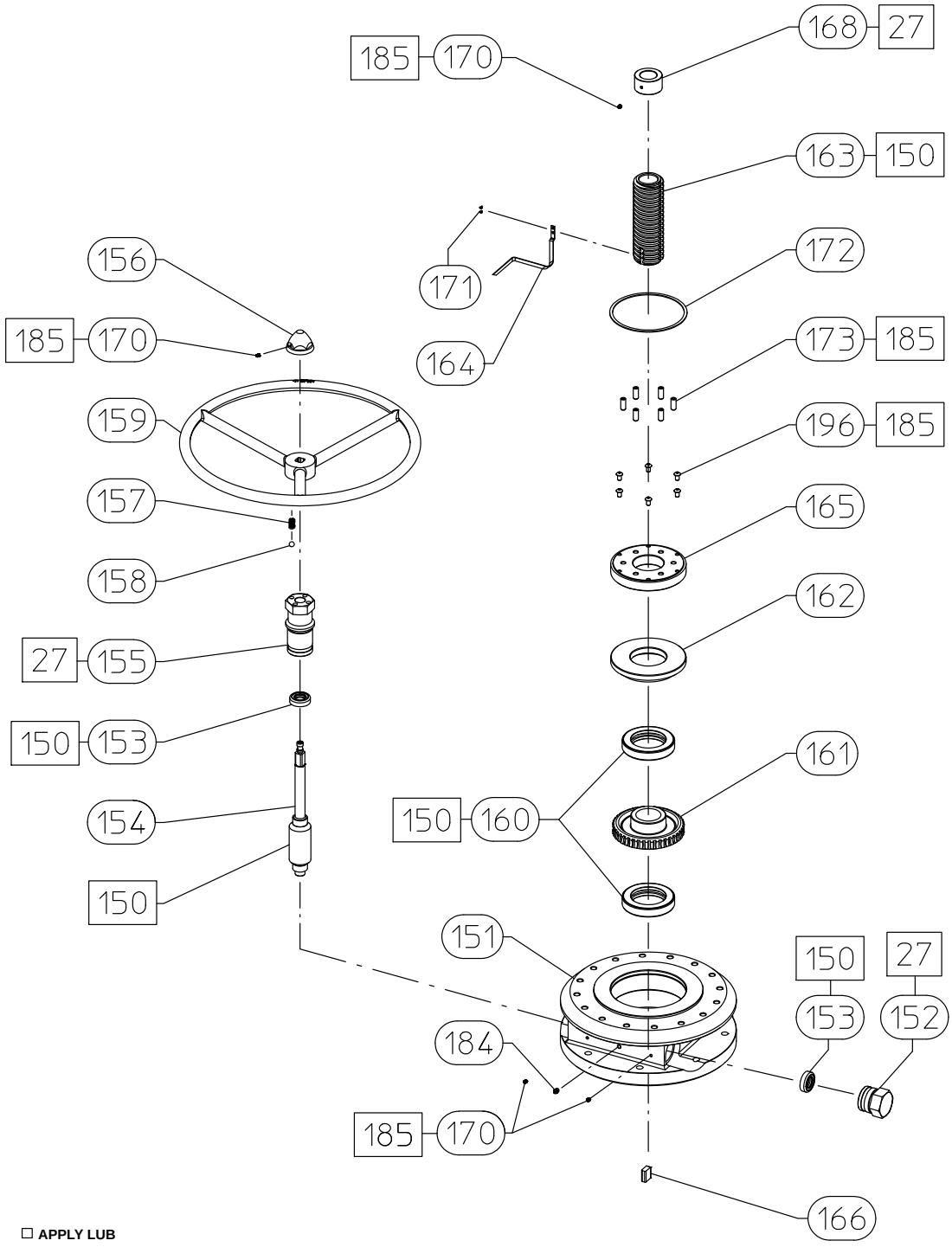
GE52757-F

NOTE: KEY 190 AND 191 ARE NOT SHOWN

Figure 9. Fisher Size 80 667NS2 Actuator Side-Mounted Handwheel



Parts Ordering

Each actuator has a serial number stamped on the nameplate. Always refer to this serial number when corresponding with your Emerson sales office regarding replacement parts or technical information.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Key	Description	Part Number
27	Nuclear Grade Anti-Seize Lubricant	
101	Stud, Mounting	see following table
102	Nut, Mounting	see following table
103A	Stem Connector Bolt Half	see following table
103B	Stem Connector Nut Half	see following table
103C	Hex Cap Screw, Stem Connector	see following table
104	Upper Diaphragm Casing	see following table
105*	Diaphragm	see following table
106	Vent Assy., Small	see following table
107	Upper Diaphragm Head	see following table
108	Lower Diaphragm Head	see following table
109	Yoke or Yoke/Diaphragm Assembly	see following table
110	Spring	see following table
111	Travel Stop Spacer	see following table
113	Travel Scale	see following table
114	Hex Cap Screws, Casing	see following table
115	Hex Nut, Valve Stem	see following table
116*	Seal Bushing	see following table
117*	O-ring, Inside	see following table
118*	O-ring, Outside	see following table
119	Hex Cap Screw, Diaphragm Casing	see following table
120	Hex Nuts, Diaphragm Casing	see following table
121	Spring Seat	see following table
122	Lower Diaphragm Casing	see following table
123*	Gasket, Diaphragm Casing	see following table
124	Snap Ring	see following table
125	Actuator Stem	see following table
126	Machine Screw, Travel Scale	see following table
127	Spring Adjusting Screw	see following table
128	Vent Assy., Large	see following table
129*	Thrust Bearing Race	see following table
130*	Thrust Bearing	see following table
131	Spring Casing Assembly	see following table
132A	Hex Jam Nut, Diaphragm Head	see following table
132B	Hex Jam Nut, Diaphragm Head	see following table
133*	Bushing	see following table
134	Travel Stop	see following table
135	Hex Nut, Spring Adjusting Screw	see following table
136	Pipe Bushing	see following table
143	Washer, Mounting Stud	see following table
144	Washer, Casing	see following table
145	Washer, Diaphragm Casing	see following table
146	Washer, Pointer	see following table
147	Shoulder Screw, Pointer	see following table
148	Travel Pointer, Bracket	see following table
149	NyoGel 718B (not furnished)	
150	Lubriplate Mag-1 (not furnished)	
151	Gear Case	GG20006X012
152	Back Worm Retainer	GG27182X012
153*	Bearing, Ball	1H735999012
154	Shaft, Worm	GE48885X012
155	Worm Retainer, Front	GE48880X012
156	Handwheel Cap	0W012819042
157	Spring, Compensator	0D005916012
158	Ball	1A342732992
159	Handwheel	GE48767X012
160*	Bearing, Thrust	1H735499012
161	Gear, Worm	2H735512052
162	Retainer, Bearing & Gear	1H735024392
163	Sleeve, Lower	GG08513X012
164	Travel stop indicator	GG08624X012
165	Retainer Thrust Plate	GG20281X012
166	Key	GG14273X012
167	Spacer/Diaphragm Case Assembly	GG15464X012
168	Travel Stop Nut	1H734224092
169	Screw, Cap, Hex HD	1A5671X0042
170	Screw, Set, Hex Socket	1A710328992
171	Screw, Mach, Flat HD	1H736528982
172	Ring, Retaining	GG20282X012
173	Screw, Set, Hex Socket	1H734628992
174	Screw, Cap, Hex HD	1A3512X0042
175	Washer	1A375738982
176	Washer	1A3517X0012
177	Cover Band	GG09486X012
178	Screw, Cap, Hex HD	1A381635222
183	Travel Scale	1H745638992
184	Fitting	1A700999012
185	Loctite 242 (not furnished)	
186	Washer, Plain	see following table
187	Adapter, Switch	see following table
190	Yoke Cover	see following table
191	Screw, Yoke Cover	see following table
192	Washer, Plain	see following table
193*	O-ring, Actuator Stem	see following table
194	Screw, Cap, Hex HD	see following table
195	Screw, Cap, Hex Socket	see following table
196	Screw, Cap, Hex Socket	13B8412X052
197	Screw, Cap, Hex HD	1A3684X0082
198	Hex Nut, Lower	GG26567X012
208	Travel Pointer	see following table
209	Yoke Spacer	GG34513X012
220	Plate, Mounting	GE80639X022
221	Plate, Adapter	GE80640X022
222	Bracket Assy, Mounting	GE80641X022
223	Arm, Target	GE80644X022
224	Screw, Hex Socket Cap	1A7711X0172
225	Screw, Hex HD	1C5958X0192
226	Screw, Hex Socket Cap	1F1448X0092
227	Screw, Hex HD	1A3917X0232

*Recommended spare parts

Table 8. Fisher 667NS2 Spare Parts*

Part Description / Key No.	Replacement Part Number	Qty	Classification	Spare Part Code(1)	Spare Part Requirement Rationale(3)	Shelf Life	Shelf Life Rationale(2)
Diaphragm (Key 105)	Refer to following table	1	Non-Safety Related	O/n	Recommendation to purchase this spare part is based on shelf life restrictions. The diaphragm is a key component within the actuator construction, required to ensure optimal performance over time. Degradation of the diaphragm could lead to inconsistencies with valve operation. Emerson recommends replacing this component every 6 years.	N/A	See FGS8A31 for information regarding elastomer shelf life.
Casing Gasket (Key 123)	Refer to following table	1	Non-Safety Related	O/n	If the lower diaphragm casing must be removed from the yoke and this seal is broken, this gasket should be replaced.	N/A	Does not exhibit a tendency to degrade over time.
O-ring (Key 117)	Refer to following table	2	Non-Safety Related	O/n	If the seal bushing must be removed, this O-ring should be replaced.	N/A	See FGS8A31 for information regarding elastomer shelf life.
O-ring (Key 118)	Refer to following table	1	Non-Safety Related	O/n	If the seal bushing must be removed, this O-ring should be replaced.	N/A	See FGS8A31 for information regarding elastomer shelf life.
O-ring (Key 193)	Refer to following table	1	Non-Safety Related	O/n	If the lower dia;phragm plate must be removed, this O-ring should be replaced.	N/A	See FGS8A31 for information regarding elastomer shelf life.
Seal Bushing (Key 116), Bushing (Key 133)	Refer to following table	1	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson recommends replacing this component every 12 years.	N/A	Does not exhibit a tendency to degrade over time.
Thrust Bearing Race (Key 129) Thrust Bearing (Key 130) Bearing, Ball (Key 153) Bearing, Thrust (Key 160)	Refer to following table	1	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson replacing this component every 12 years.	N/A	Does not exhibit a tendency to degrade over time.

1. ME/n = construction/installation spares. P/n = preoperational spares. S/n = start-up spares. O/n = operational spares.
2. Dependent on good storage practices and conditions.
3. Maintenance schedule is dependent on service conditions.

Table 9. Keys 101 and 143 Yoke Mounting Studs and Washers

ACTUATOR SIZE	QUANTITY(1)	STUD SIZE, INCH	KEY 101 MOUNTING STUD PART NUMBER	MATERIAL	KEY 143 WASHER PART NUMBER
45A	8	3/4-10 x 3.5	1B958831012	SA 193 B7	1A375738982
70A		3/4-10 x 3.75	1K552131012		
70B					
80A		3/4-10 x 4.25	1P590231012		
80B					
80C					
80C with Hand Operation		7/8-9 x 4.75	1P9261X0282		1A5198X0032

1. If a yoke spacer is being used, an additional 8 studs and 8 washers will be needed to mount it to the valve body.

*Recommended spare parts

Table 10. Key 102 Yoke Mounting Nuts

ACTUATOR SIZE	QUANTITY(1)	STUD SIZE, INCH	PART NUMBER	MATERIAL
45A	8	3/4-10	1A352024072	SA 194 2H
70A				
70B				
80A				
80B				
80C				
80C with Hand Operation		7/8-9	1C1727X1122	

1. If a yoke spacer is being used, an additional 8 nuts will be needed to mount it to the valve body.

Table 11. Key 103 Stem Connector Assembly

ACTUATOR SIZE	VALVE STEM SIZE, INCH	ASSY. PART NUMBER
45A	1/2	GG05587X012
70A	3/4	GG05493X012
70B		GG05876X012
80A	1	GG05855X012
80B		GG05846X012
80C		GG08622X012

Table 12. Keys 104 and 134 Upper Diaphragm Casing and Travel Stops

ACTUATOR SIZE	BACK-SEATED VALVE?	KEY 104 UPPER DIAPHRAGM CASING PART NUMBER	VALVE TRAVEL, INCH	KEY 134 TRAVEL STOP PART NUMBER
45	Yes	3E844628992	N/A	N/A
	No	GE84328X0A2		
70	Yes	GE32000X012		
	No			
80	Yes	GE44888X012	1-1/8	16A1503X022
			1-1/2	16A1504X022
			1-3/4	16A1504X022
			2	16A1505X022
	No		1-1/2	16A1503X022
			1-3/4	14B6410X022
			2	16A1504X022
			3	16A1507X012

Table 13. Key 105* Diaphragm

ACTUATOR SIZE	PART NUMBER
45	GE57681X012
70	GE57318X012
80	GE45044X022

Table 14. Key 106 Vent Assembly

ACTUATOR SIZE	PART NUMBER
45	17A5515X012
70	
80	

Table 15. Key 107 Upper Diaphragm Plate

ACTUATOR SIZE	PART NUMBER
45	GE57685X012
70	GE57286X012
80	GE44940X012

*Recommended spare parts

Table 16. Key 108 Lower Diaphragm Plate and Key 195 Hex Socket Cap Screw

ACTUATOR SIZE	KEY 108 LOWER DIAPHRAGM PLATE PART NUMBER	KEY 195 CAP SCREW PART NUMBER
45	GE57684X012	1V1542X0012
70	GE57287X012	10A3869X012
80	16A0858X012	N/A

Table 17. Key 109 Yoke or Yoke/Diaphragm Casing Assembly

ACTUATOR SIZE	PART NUMBER
45A	GG05116X022
70A	GG05114X012
70B	GG05127X022
80A(1)	GE55300X012
80B(1)	GE57117X012
80C(1)	GG48795X012
80C with Hand Operation	GG08627X012

1. Size 80A, 80B, and 80C are yoke/casing weldments.

Table 18. Key 110 Spring

ACTUATOR SIZE	CASING LENGTH	PART NUMBER(1)
45	N/A	1E8258X0042
		1E8267X0012
		1E8270X0012
		1E8271X0012
70		1N1285X0042
		1N1287X0022
		1N7193X0042
80	Standard	1H7470X0072
		1H7473X0052
	Long	1U5314X0072

1. The spring part number is dependent on several factors and will be selected during valve/actuator sizing.

Table 19. Key 111 Travel Stop Spacer Nut

ACTUATOR SIZE	BACK-SEATED VALVE?	VALVE TRAVEL Inch	PART NUMBER
45	Yes	3/4	GE56238X012
	No		GE56133X012
70	Yes	1/4	GE59812X012
		3/4	GE56141X012
		2	GE61293X012
	No	3/4	GG66182X012
		1-1/2	GE56141X012
		2	GE56133X012

Table 20. Key 114 and Key 144 Hex Cap Screws and Washers

ACTUATOR SIZE	SCREW SIZE Inch	QTY. REQUIRED	KEY 114 SCREW PART NUMBER	KEY 144 WASHER PART NUMBER
45	3/8-16 x 0.75	8	1A3684X0082	N/A
70	1/2-13 x 0.88	12	1N1293X0092	N/A
80	1/2-13 x 1.5	12	1A4533X0162	1A5189X0042

Table 21. Key 113 and 126 Travel Scale and Machine Screw

ACTUATOR SIZE	VALVE TRAVEL	KEY 113 TRAVEL SCALE PART NUMBER	KEY 126 MACHINE SCREW PART NUMBER
	Inch		
45A	0.75	1E808138992	59081160X12
70A	0.25	1L998338992	1A3451X0012
	0.75	1H745738992	1A3431X0012
	1.5	1H745938992	
	2	1H746038992	
70B	2	1H746038992	
80A	1.125	1H745838992	
	1.5	1H745938992	
80B	2	1H746038992	
80C	1.125	1H745638992	1A3408K0012
	1.75	GE53453X012	
	3	1H746138992	

Table 22. Keys 116*, 117*, 118*, and 124 Seal Bushing Components

ACTUATOR SIZE	KEY 116 SEAL BUSHING PART NUMBER	KEY 117 INSIDE O-RING PART NUMBER	KEY 118 OUTSIDE O-RING PART NUMBER	KEY 124 SNAP RING PART NUMBER
45	17A2645X012	1N2854X0022	1E8458X0082	1E845638992
70	17A2646X012	1N1633X0042	1E8458X0082	1E845638992
80	26A0856X032	16A1178X072	1D4392X0112	1H744037022

Table 23. Keys 119, 120, and 145 Diaphragm Casing Connecting Hex Cap Screws, Nuts, and Washers

ACTUATOR SIZE	SCREW SIZE	NUT AND SCREW QTY. REQUIRED	KEY 119 HEX CAP SCREW PART NUMBER	KEY 120 HEX NUT PART NUMBER	WASHER QTY. REQUIRED	KEY 145 WASHER PART NUMBER
	Inch					
45	3/8-24 x 1.25	20	1A3683X0042	1A3465X0092	40	1H7231X0032
70	3/8-24 x 1.50	28	1A3464X0032	1A3465X0092	56	1H7231X0032
80	7/16-20 x 2.0	36	1A9155X0082	1A3403X0062	72	17B4654X032

Table 24. Key 121 Spring Seat

ACTUATOR SIZE	PART NUMBER
45	1R180023122
70	1N757722012
80	28A2263X012

Table 25. Key 122 Lower Diaphragm Casing(1,2)

ACTUATOR SIZE	PART NUMBER
45	3E845325062
70	2N131025062

1. Size 80A, 80B, and 80C are yoke/casing weldments, see table 17.
2. Size 80C w/ Hand Operation has spacer/casing weldments.

Table 26. Key 123* Diaphragm Casing Gasket

ACTUATOR SIZE	PART NUMBER
45	15A9185X022
70	15A9184X042

*Recommended spare parts

Table 27. Key 125 Actuator Stem and Key 193 O-ring

ACTUATOR SIZE	CASING LENGTH	KEY 125 ACTUATOR STEM PART NUMBER	KEY 193 O-RING PART NUMBER
45A	N/A	GE57682X012	1H9938X0092
70A		GE57285X012	
70B			
80A	Standard	GE45644X012	N/A
80B	Long	GE45645X012	
80C	Standard	GH05589X022	
	Long	GG48672X012	
80C with Hand Operation	Long	GE48577X012	

Table 28. Key 127 Spring Adjusting Screw and Key 194 Hex Head Cap Screw

ACTUATOR SIZE	KEY 127 SPRING ADJUSTING SCREW PART NUMBER	KEY 194 HEX HEAD CAP SCREW PART NUMBER
45	GE57683X012	1A381635222
70	GE57299X012	1A381635222
80	GE45643X012	N/A

Table 29. Key 128 Large Vent Assembly

ACTUATOR SIZE	PART NUMBER
80A	10B8716X012
80B	
80C	
80C with Hand Operation	1D5295000A2

Table 30. Keys 129*, 130*, and 133* Spring Adjustor Bushing Components

ACTUATOR SIZE	KEY 129 THRUST BEARING RACE PART NUMBER	KEY 130 THRUST BEARING PART NUMBER	KEY 133 BUSHING PART NUMBER
80	16A0875X012	16A0874X012	18A0170X022

Table 31. Key 131 Spring Casing

ACTUATOR SIZE	CASING LENGTH	PART NUMBER
80	Standard	GG07176X012
	Long	GE45647X012

Table 32. Keys 132A and 132B Diaphragm Head Locknuts

ACTUATOR SIZE	PART NUMBER
80	1C1122X0042

Table 33. Key 135 Hex Nut, Spring Adjusting Screw

ACTUATOR SIZE	PART NUMBER
80	GE56063X012

Table 34. Key 136 Pipe Bushing

ACTUATOR SIZE	PART NUMBER
70	1C3790X0012

Table 35. Key 115 Hex Nut, Valve Stem

ACTUATOR SIZE	PART NUMBER
45	1A353735252
70	1A351135252
80	1C6352X0042

*Recommended spare parts

Table 36. Keys 146, 147, 148, 208, 186, 187, and 192 (Pointer Washer, Pointer Hex Cap Screw, Travel Pointer, Magnet Washer, Adaptor Switch, and Switch Washer)

ACTUATOR SIZE	KEY 146 POINTER WASHER PART NUMBER	KEY 147 POINTER HEX CAP SCREW PART NUMBER	KEY 148/ KEY 208 TRAVEL POINTER PART NUMBER	KEY 186 MAGNET WASHER PART NUMBER	KEY 187 ADAPTOR SWITCH PART NUMBER	KEY 192 SWITCH WASHER PART NUMBER
45A	N/A	1A5823X0032	GG05591X022	17B4654X012	GE56473X012	GE54163X012
70A w/ Bellows Flange		1A3451X0012	GE80897X012		N/A	
70A		1A5823X0032	GG05494X012		GE56473X012	
70A w/ Connector Arm			GE47216X022			
70B			GG05884X012			
70B w/ Connector Arm			GG05880X012			
80A	1B8659X0042	GE56486X012	GG05858X012			
80B			GG05872X012			
80C			GG08625X012			
80C w/ Connector Arm			GG49076X012			

Table 37. Keys 190 and 191 Yoke Cover and Screws

ACTUATOR SIZE	KEY 190 COVER PART NUMBER	SCREW SIZE, INCH	SCREW QTY, REQUIRED	KEY 191 SCREW PART NUMBER
45A	GG08469X012	5/16 - 18 X 0.5	4	1C2752X0042
70A w/ Bellows Flange	N/A	N/A	N/A	N/A
70A	GG08471X012	5/16 - 18 X 0.5	4	1C2752X0042
70B	GG08472X012			
80A	GG08471X012			
80B	GG08472X012			
80C	GG08597X012	10-24 x 0.38	4	1A3408K0012
80C w/ Connector Arm	GG49081X012			

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