Fisher® GX Control Valve and Actuator System

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Figure 1. Fisher GX Control Valve, Actuator, and FIELDVUE DVC2000 Digital Valve Controller

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Fisher GX control valve and actuator system.

Do not install, operate, or maintain a GX valve 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 Process Management sales office before proceeding.

Description

The GX is a compact, state-of-the-art control valve and actuator system, designed to control a wide range of process gases, vapors, and fluids.

The GX is rugged, reliable, and easy to select. It requires no actuator sizing -- the actuator selection is automatic once the valve body construction is selected.

The GX meets the requirements of both EN and ASME standards. It is available with a complete accessory package, including the FIELDVUE DVC2000 integrated digital valve controller.

Table 1. Fisher GX Valve Specifications

Specifications	EN	ASME
Valve Body Size	DN15, 20, 25, 40, 50, 80, 100, 150	NPS 1/2, 3/4, 1, 1-1/2, 2, 3, 4, 6
Pressure Rating	PN 10 / 16 / 25 / 40 per EN 1092-1	CL150 / 300 per ASME B16.34
End Connections	Flanged raised face per EN 1092-1	Flanged raised face per ASME B16.5
Valve Body/Bonnet Materials	1.0619 steel	ASME SA216 WCC steel
	1.4409 stainless steel	ASME SA351 CF3M stainless steel
	CW2M (sizes DN25 through DN100 only)	CW2M (NPS 1 through 4 only)
	ASME SA352 LCC	ASME SA352 LCC
	ASTM A990 CN3MCu/ASME SA351 CN7M (Cast Alloy 20) (sizes DN25 through DN100 only)	ASTM A990 CN3MCu/ASME SA351 CN7M (Cast Alloy 20) (NPS 1 through 4 only)
	CD3MN Duplex SST (sizes DN25 through DN100 only)	CD3MN Duplex SST (NPS 1 through 4 only)
	CF3 304L SST (sizes DN25 through DN100 only)	CF3 304L SST (NPS 1 through 4 only)
		M35-2 (NPS 1 through 4 only)
		N7M Alloy B2 (NPS 1 through 4 only)
Face-to-Face Dimensions	Consistent with EN 558-1 Series 1	Consistent with ANSI/ISA 75.08.01
Shutoff per IEC 60534-4 and ANSI/FCI 70-2	Metal seat - Class IV (standard)	
	Metal seat - Class V (optional)	
	PTFE seat - Class VI (optional)(1)	
Flow Direction	Flow-up (Cavitrol™ III trim, Flow down)	
Flow Control Characteristics	Equal Percentage and Linear	
Trim Style	**Port Diameters**	**Trim Style Description**
	4.8 mm	Micro-Flow trim (unbalanced)
	9.5, 14, 22 mm	Stem-Guided with Contoured Plug (unbalanced) or Port-Guided with Cavitrol III trim (unbalanced)
	36, 46 mm	Port-Guided Plug (unbalanced)
	70, 90, 136 mm	Balanced Trim with Contoured plug or Unbalanced Port-Guided Plug
Handwheel	Available as an option	
Travel Stop	Available as an option	

1. For 4.8 to 14 mm ports, Class VI shutoff is achieved without PTFE seat.

Educational Services

For information on available courses for the Fisher GX valve and actuator system, as well as a variety of other products, contact:

Emerson Process Management
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
http://www.emersonprocess.com/education

Valve Installation

⚠ WARNING

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

Personal injury or equipment damage caused by sudden release of pressure or bursting of pressure retaining parts might result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

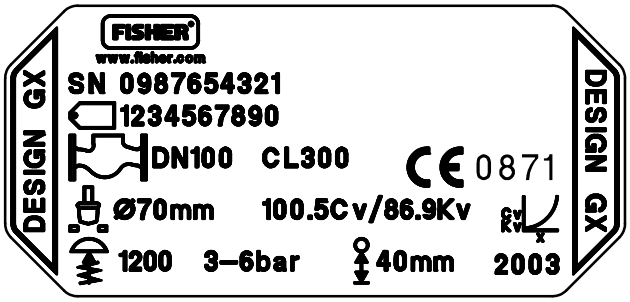
Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

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

CAUTION

This valve is intended for a specific range of pressures, temperatures and other application specifications. Applying different pressure and temperatures to the valve could result in parts damage, malfunction of the control valve or loss of control of the process. *Do not expose this product to service conditions or variables other than those for which the product was intended.* If you are not sure what these conditions are you should contact your Emerson Process Management sales office for more complete specifications. Provide the product serial number (shown on the nameplate, figure 2) and all other pertinent information.

Figure 2. Fisher GX Nameplate Examples (Key 35)



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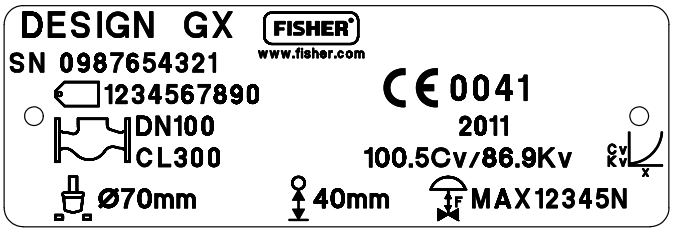
WITHOUT SPRING INFORMATION (USED PRIOR TO 2009)



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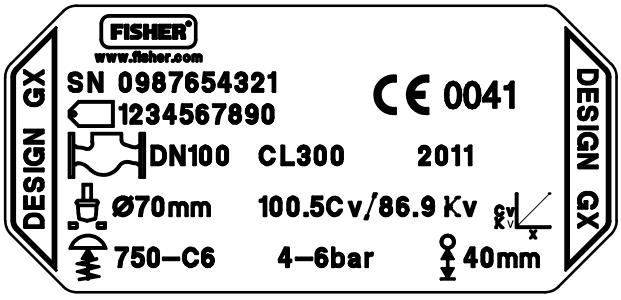
ELECTRIC ACTUATOR



GE41229-Sheet 1

WITH SPRING INFORMATION

⚠ WARNING

If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem whether it be from air pressure on the diaphragm or compression in the actuator springs. Likewise take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

If hoisting the valve take care to prevent people from being injured in case the hoist or rigging slips. Be sure to use adequately sized hoists and chains or slings to handle the valve.

1. Before installing the valve, inspect it to be certain that the valve body cavity is free of all foreign material. Clean out all pipelines to remove scale, welding slag and other foreign material.
2. The control valve assembly may be installed in any orientation unless limited by seismic criteria. However, the normal method is with the actuator vertical above the valve. Other positions may result in uneven trim wear, and improper operation. With some valves, the actuator may also need to be supported when it is not vertical. For more information, consult your Emerson Process Management sales office. Flow through the valve must be in the direction indicated by the arrow cast on the valve.
3. Use accepted piping practices when installing the valve in the pipeline. Use a suitable gasket between the valve and the pipeline flanges.
4. If continuous operation is required during inspection or maintenance, install isolating valves on either side of the control valve with a bypass valve to control the flow while the control valve is receiving maintenance.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing is tightened before shipment; however the packing might require some readjustment to meet specific service conditions.

Maintenance

⚠ 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 the process pressure. Relieve the process pressure from both sides of the valve.**
- **Depending on the actuator construction, it will be necessary to manage the pneumatic actuator loading pressure and any actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to ensure safe removal of the actuator from the valve.**
- **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, or when loosening the packing box pipe plug.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This ensures a good gasket seal because the used gasket may not seal properly.

Actuator Maintenance

For electric actuators, see the supplier's instruction manual.

The following sections provide procedures for actuator maintenance. Refer to figures 18, 19, 20, and 21.

The actuator soft parts may require periodic replacement. This includes the diaphragm (key 10), diaphragm O-ring (key 109), actuator rod bushing (key 19), and the actuator rod seal (key 20).

If the actuator stroking direction (air-to-open or air-to-close) is unknown, refer to the nameplate on top of the actuator casing and figure 2.

There are several optional actuator constructions, depending on supply pressure. Refer to the nameplate on the top of the actuator to determine the construction installed. Refer to figure 3 and table 2 for proper spring configuration.

Note

Older GX actuator nameplates do not contain spring configuration information. If you require replacement springs or wish to switch to an optional actuator construction, consult your Emerson Process Management sales office.

Note

When the GX actuator is equipped with the integrated FIELDVUE DVC2000 digital valve controller (figure 1), additional considerations may be required. Refer to the FIELDVUE DVC2000 Digital Valve Controller Mounting section of this manual for additional instruction.

Actuator Disassembly (For Air-to-Open Constructions - see figures 18 or 19)

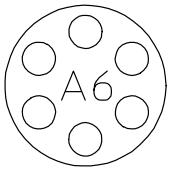
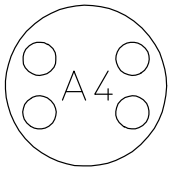
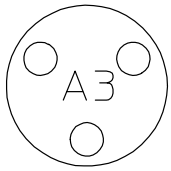
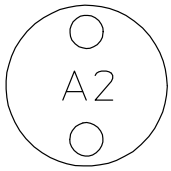
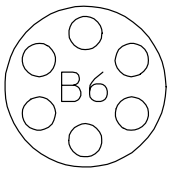
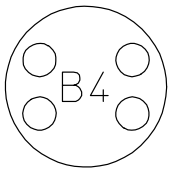
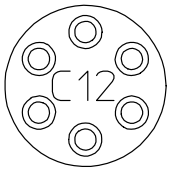
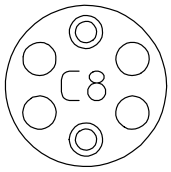
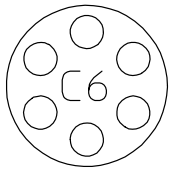
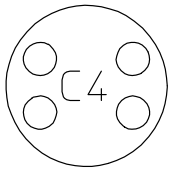
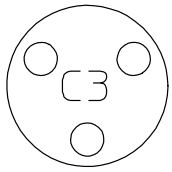
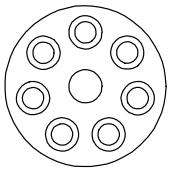
1. Connect a separate air supply to the lower diaphragm casing via the air supply connection on the yoke (as shown in figure 18 or 19) and apply sufficient air pressure to raise the valve plug/stem off the seat to mid-travel.
2. Remove the stem connector nut half (key 23), stem connector bolt half (key 24), and travel indicator (key 26).
3. Push the valve plug/stem (key 3) down until it contacts the seat.
4. Loosen the locknut (key 28) and thread the stem adjustor nut (key 27) down until it clears the top of the valve plug/stem (key 3).
5. Shut off the air pressure and disconnect the separate air supply to the lower diaphragm casing (as shown in figure 18 or 19).

⚠ WARNING

To avoid personal injury or property damage due to actuator springs (keys 12 and 82) being under compression, remove the long cap screws (key 16) last.

The upper actuator casing may remain fixed to the diaphragm and lower casing during disassembly, even if the casing cap screws have been loosened. If this happens, the actuator springs are still under compression. The upper casing could suddenly come loose and jump, due to the compressed energy of the springs. If the upper casing is stuck to the diaphragm and lower casing when you begin loosening the casing cap screws, pry the casings apart with a prying tool. Always ensure that the springs are dispersing energy and the upper casing is moving against the long bolts during disassembly.

Figure 3. Spring Configuration

ACTUATOR	TRAVEL	GX Actuator – Spring Quantity and Arrangement			
225	20				
		6 – GE37264X012	4 – GE37264X012	3 – GE37264X012	2 – GE37264X012
750	20				
		6 – GE00366X012	4 – GE00366X012		
750	40					
		6 – GE37344X012 & 6 – GE40917X012	6 – GE37344X012 & 2 – GE40917X012	6 – GE37344X012	4 – GE37344X012	3 – GE37344X012
1200	40 & 60					
		8 – GE13551X012 & 7 – GE13552X012				

Note: Concentric circles indicate nested springs.
Spring arrangements are shown looking down at lower casing from above.

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6. Remove the **short** actuator casing cap screws and hex nuts (keys 17 and 18) first. Once these have been removed from the actuator assembly, carefully remove the **long** actuator cap screws and hex nuts (keys 16 and 18), alternating between them to gradually release the spring energy (compression).
7. Remove the upper diaphragm casing (key 9) and the actuator springs (key 12 and/or 82).
8. Lift off the actuator stem/diaphragm assembly (includes keys 22, 11, 10, 14, 13, 109, and 15) and remove the cap screw (key 14), actuator spacer (key 13), actuator rod (key 22), and washer (key 15).
9. Replace the diaphragm (key 10), diaphragm O-ring (key 109), actuator rod bushing (key 19), and actuator rod seal (key 20), as needed.

Actuator Disassembly (For Air-to-Close Constructions - see figure 20 or 21)

1. Remove the stem connector nut half (key 23), stem connector bolt half (key 24), and travel indicator (key 26).

⚠ WARNING

To avoid personal injury or property damage due to actuator springs (key 12) being under compression, remove the long cap screws (key 16) last.

The upper actuator casing may remain fixed to the diaphragm and lower casing during disassembly, even if the casing cap screws have been loosened. If this happens, the actuator springs are still under compression. The upper casing could suddenly come loose and jump, due to the compressed energy of the springs. If the upper casing is stuck to the diaphragm and lower casing when you begin loosening the casing cap screws, pry the casings apart with a prying tool. Always ensure that the springs are dispersing energy and the upper casing is moving against the long bolts during disassembly.

2. Remove the **short** actuator casing cap screws and hex nuts (keys 17 and 18) first. Once these have been removed from the actuator assembly, carefully remove the **long** actuator cap screws and hex nuts (keys 16 and 18), alternating between them to gradually release the spring energy (compression).
3. Remove the upper diaphragm casing (key 9).
4. Lift off the actuator stem/diaphragm assembly (includes keys 22, 11, 10, 14, 13, 109, and 15) and remove the cap screw (key 14), actuator spacer (key 13), actuator rod (key 22), and washer (key 15).
5. Remove the actuator springs (key 12 and/or 82).
6. Replace the diaphragm (key 10), diaphragm O-ring (key 109), actuator rod bushing (key 19), and actuator rod seal (key 20), as needed.

Table 2. Actuator Spring Configuration Based on Minimum Supply Pressure(1)

ACTUATOR SIZE	TRAVEL	STEM MATERIAL	MINIMUM SUPPLY PRESSURE	SPRING CONFIGURATION	
	mm			Air-to-Open	Air-to-Close
225	20	S20910, N05500 S31603	4 bar (58 psi)	A6	A3
				A4(2)	A4(2)
			3 bar (44 psi)	A4	A3
			2 bar (29 psi)	A3	A2
225	20	S31803, N10675, N06022	4 bar (58 psi)	A6	A3
			3 bar (44 psi)	A4	A3
			2 bar (29 psi)	A3	A2
750	20	S20910, N05500 S31603	4 bar (58 psi)	B6	B4
				B6(2)	B6(2)
			3 bar (44 psi)	B6	B4
			2 bar (29 psi)	B4	B4
750	20	S31803, N10675, N06022	4 bar (58 psi)	B4	B4
			3 bar (44 psi)	B4	B4
			2 bar (29 psi)	B4	B4
750	40	S20910, N05500 S31603	4 bar (58 psi)	C12	C6
			3 bar (44 psi)	C8	C3
			2 bar (29 psi)	C4	C3
750	40	S31803, N10675, N06022	4 bar (58 psi)	C8	C6
			3 bar (44 psi)	C8	C3
			2 bar (29 psi)	C4	C3
1200	40 or 60	S20910, N05500 S31603	4 bar (58 psi)	D15	D15
			3 bar (44 psi)	D15	D15
			2 bar (29 psi)	N/A	N/A

1. Only applicable to actuators with spring information on the nameplate (see figure 2).
2. Only applicable to Cavitrol III constructions.

Table 3. Fisher GX Maximum Rated Travel

ACTUATOR SIZE	NUMBER OF CASING BOLTS	TRAVEL
		mm
225	6	20
750	10	20 or 40
1200	16	40 or 60

Table 4. Body Nut (Key 7) Torque Requirements

VALVE SIZE	TORQUE	
	N•m	lbf•ft
DN15, 20, 25 (NPS 1/2, 3/4, 1)	45.5	33.5
DN40 (NPS 1-1/2)	79.8	58.9
DN50 (NPS 2)	79.8	58.9
DN80 (NPS 3)	163	120
DN100 and DN150 (NPS 4 and 6)	282	208

Table 5. Yoke/Extension Bonnet Nut (Key 46) Torque Requirements (used on Extension Bonnet and Bellows Bonnet constructions)

VALVE SIZE	TORQUE	
	N•m	lbf•ft
DN15, 20, 25, 40, and 50 (NPS 1/2, 3/4, 1, 1-1/2, and 2)	79.8	58.9
DN80 and DN100 (NPS 3 and 4)	163	120

Actuator Assembly For Air-to-Open Constructions (or to Change Action to Air-to-Open - see figure 18 or 19)

1. Install the diaphragm (key 10) on the diaphragm plate (key 11). Insert the cap screw (key 14) through the actuator spacer (key 13) and place this assembly through the diaphragm/diaphragm plate assembly.
2. Place the diaphragm O-ring (key 109) and the washer (key 15) over the center hole of the diaphragm, so that the convex part of the washer is facing down toward the diaphragm and contains the O-ring. Ensure the convex part of the washer is guided in the diaphragm center hole as shown in figure 18 or 19.
3. Screw the actuator rod (key 22) onto the cap screw (key 14) and torque to 80 N•m (59.1 lbf•ft). Install the actuator stem/diaphragm assembly back into the actuator yoke (key 8).
4. Place the actuator springs (key 12 and/or 82) onto the spring locators in the diaphragm plate (key 11). See figure 3 and table 2 for proper spring quantity and arrangement.

- If the nameplate does not contain spring information, use the same quantity and arrangement as originally installed.

5. Install the upper diaphragm casing (key 9) so that the ribs on the top of the upper diaphragm casing are perpendicular with the yoke legs.

- **For size 225 and 750 actuators,** install the **2 long** cap screws (key 16) and hex nuts (key 18) 180 degrees apart from each other and in line with the actuator yoke legs.

- **For size 1200 actuators,** install the **4 long** cap screws (key 16) and hex nuts (key 18) 90 degrees from each other, with two of them in line with the actuator yoke legs.

6. Tighten the **long** cap screws (key 16) and hex nuts (key 18), alternating between them to gradually compress the springs, until the two casing halves and diaphragm touch.
7. Install the remaining **short** cap screws (key 17) and hex nuts (key 18) to the casing.
8. Tighten the actuator casing cap screws evenly using a cross-tightening procedure. Torque to 55 N•m (40 lbf•ft).

9. If you had previously removed the actuator assembly from the valve, place the actuator assembly back onto the valve body (key 1). Install the four body nuts (key 7), but tighten them only finger-tight.
10. Connect a separate air supply to the actuator air supply connection (as shown on the yoke in figure 18 or 19) and apply sufficient air pressure to raise the actuator rod (key 22) to the travel stop.

Note
If converting from air-to-close to air-to-open action, first move the vent cap (key 21) from the air supply connection on the yoke leg (see figure 20 or 21) to the top of the casing (see figure 18 or 19).

11. For standard bonnet constructions (figures 18, 19, 20, and 21), tighten the body nuts (key 7) evenly using a cross-tightening procedure. See table 4 for torque requirements.
    For extension and bellows bonnet constructions (figures 22 and 23), tighten the bonnet nuts (key 46) evenly using a cross-tightening procedure. See table 5 for torque requirements.
12. With the valve plug/stem (key 3) on the seat, thread the stem adjustor nut (key 27) up until it is the rated travel distance specified in table 3 from the actuator rod (key 22). Thread the locknut (key 28) up against the stem locknut and tighten per table 6.

Table 6. Stem Connector Torque Values

PART	STEM MATERIAL	TORQUE	
		N•m	Lbf•ft
M8 Stem Connector Cap Screws	All	35	26
M10 Stem Connector Jam Nut (Rie 4606 Coated)	S31603, S20910, N05500	48	35
	N06022, S31803, N10675	35	26
M14 Stem Connector Jam Nut	S31603, S20910, N05500	175	129
	N06022, S31803, N10675	138	102

13. Stroke the actuator rod until it contacts the stem adjuster nut (key 27) and install the stem connector halves and travel indicator (keys 23, 24, and 26) with the cap screws (key 25). Install the stem connector halves in the proper orientation so that when looking at the inside of the stem connector halves, the flats are down and the beveled surfaces are up.
14. Align the pointer of the travel indicator (key 26) with the appropriate mark on the travel scale.
15. Tighten the stem connector cap screws (key 25) to 35 N•m (26 lbf•ft).
16. Release the actuator pressure.

Note
For air-to-open action, the air supply tubing must be connected to the actuator yoke at the air supply connection, see figure 18 or 19. (If converting from air-to-close to air-to-open, the tubing will need to be re-routed to this location).

Actuator Assembly For Air-to-Close Constructions (or to Change Action to Air-to-Close - see figure 20 or 21)

1. Position the upper diaphragm casing (key 9) upside down on the bench so that it lays flat and not off balance.

Note
If converting from air-to-open to air-to-close action, first move the vent cap (key 21) from the top of the casing (see figure 18 or 19) and thread into the air supply connection on the yoke leg (see figure 20 or 21).

2. Install the diaphragm (key 10) on the diaphragm plate (key 11). Place the diaphragm O-ring (key 109) and the washer (key 15) over the center hole of the diaphragm, so that the convex part of the washer is facing down toward the diaphragm and contains the O-ring. Ensure the convex part of the washer is guided in the diaphragm center hole as shown in figure 20 or 21.
3. Insert the cap screw (key 14) through the washer and diaphragm, install the actuator spacer (key 13), and screw the actuator rod (key 22) onto the cap screw (key 14) finger-tight.
4. Radially align the spring locators in the diaphragm plate assembly (key 11) with the casing cap screw holes in the diaphragm (key 10). This will ensure that the springs do not cover the air path in the yoke.
5. Torque the cap screw (key 14) to the actuator rod (key 22) to 80 N•m (59.1 lbf•ft) and lay this assembly into the upper diaphragm casing (key 9).
6. Place the actuator springs (key 12 and/or 82) onto the spring locators in the diaphragm plate (key 11). See figure 3 and table 2 for proper spring quantity and arrangement.

- If the nameplate does not contain spring information, use the same quantity and arrangement as originally installed.

7. Remove and replace the actuator rod bushing (key 19) and actuator rod seal (key 20) in the actuator yoke (key 8), if necessary.
8. Set the actuator yoke (key 8) down onto the assembly that is resting in the upper diaphragm casing (key 9) so that the yoke legs are perpendicular with the ribs on the top of the upper diaphragm casing (key 9).

- **For size 225 and 750 actuators,** install the **2 long** cap screws (key 16) and hex nuts (key 18) 180 degrees apart from each other and in line with the actuator yoke legs.

- **For size 1200 actuators,** install the **4 long** cap screws (key 16) and hex nuts (key 18) 90 degrees from each other, with two of them in line with the actuator yoke legs.

9. Tighten the **long** cap screws (key 16) and hex nuts (key 18), alternating between them to gradually compress the springs, until the two casing halves and diaphragm touch.
10. Install the remaining **short** cap screws (key 17) and hex nuts (key 18) to the casing.
11. Tighten the actuator casing cap screws evenly using a cross-tightening procedure. Torque to 55 N•m (40 lbf•ft).
12. If you had previously removed the actuator assembly from the valve, place the actuator assembly back onto the valve body (key 1). **For standard bonnet constructions (figures 18, 19, 20, and 21),** install the body nuts (key 7) and tighten evenly using a cross-tightening procedure. See table 4 for torque requirements.
    For extension and bellows bonnet constructions (figures 22 and 23), install the bonnet nuts (key 46) and tighten evenly using a cross-tightening procedure. See table 5 for torque requirements.
13. With the valve plug/stem (key 3) in the closed position (on the seat), thread the stem adjustor nut (key 27) up until it is at the rated travel (see table 3) from the actuator rod (key 22). Thread the locknut (key 28) up against the stem locknut and tighten per table 6.
14. Stroke the actuator rod until it contacts the stem adjuster nut (key 27) and install the stem connector halves and travel indicator (keys 23, 24, and 26) with the cap screws (key 25). Install the stem connector halves in the proper orientation so that when looking at the inside of the stem connector halves, the flats are down and the beveled surfaces are up.
15. Align the pointer of the travel indicator (key 26) with the appropriate mark on the travel scale.
16. Tighten the stem connector cap screws (key 25) to 35 N•m (26 lbf•ft).

Note

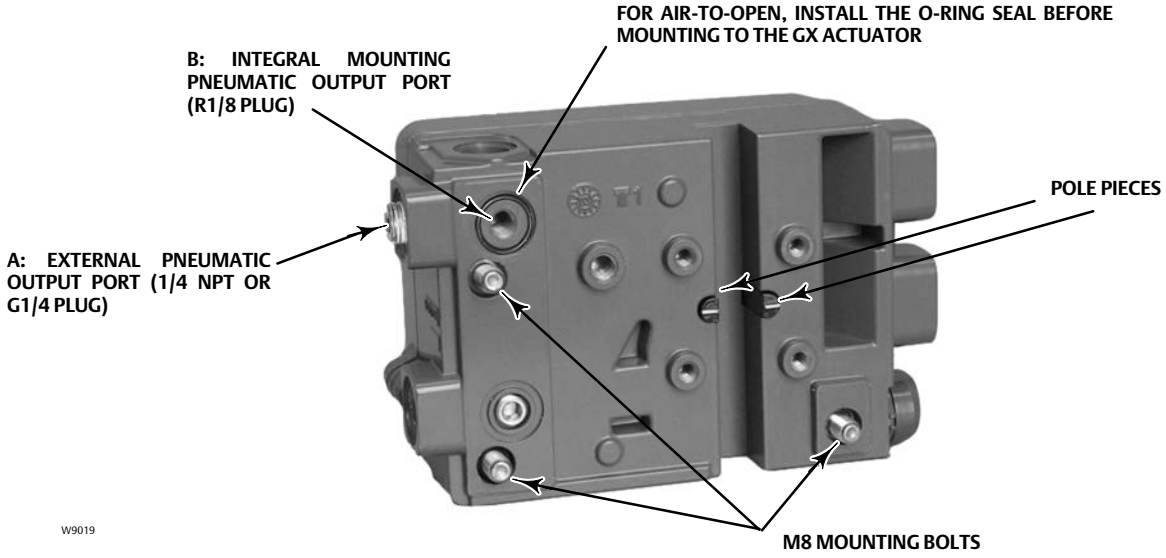
For air-to-close action, the air supply tubing must be connected to the actuator upper casing at the air supply connection, see figure 20 or 21. (If converting from air-to-open to air-to-close, the tubing will need to be re-routed to this location).

FIELDVUE DVC2000 Digital Valve Controller Mounting

This section provides instruction on mounting the FIELDVUE DVC2000 digital valve controller to the GX control valve. For further detail on the operation and maintenance of the DVC2000, refer to the DVC2000 instruction manual.

The FIELDVUE DVC2000 digital valve controller mounts directly to an interface pad on the GX actuator yoke leg, eliminating the need for mounting brackets (see figure 1). Internal passageways in the actuator route the pneumatic output to the actuator casing, which eliminates the need for external air supply tubing in the air-to-open (spring-to-close) constructions. (The GX will also accommodate other valve positioners, using the NAMUR mounting pads on the side of the yoke legs.)

Figure 4. DVC2000 Digital Valve Controller Mounting Details



The DVC2000 features linkage-less position feedback when mounted to the GX control valve. There are no touching parts between the controller and the valve stem, which simplifies controller installation. If maintenance is required, the DVC2000 can be easily removed from the valve.

In the air-to-open (spring-to-close) configuration, the air signal to the actuator casing is supplied through the air supply connection on the GX actuator yoke leg (see figure 18 or 19). In the air-to-close (spring-to-open) configuration, the air signal is supplied to the actuator through the air supply connection on the top of the actuator casing (see figure 20 or 21).

For an air-to-open construction, a DVC2000 will mount to the actuator (figure 18 or 19). The air signal is transmitted to the lower casing through the pneumatic passageway marked “air supply connection” in figure 18 or 19.

For an air-to-close construction, DN15 through DN100 (NPS 1/2 through 4) only: in the actuator design (figure 20 or 21), the pneumatic signal is connected directly to the air supply connection in the upper actuator casing. The yoke is symmetrical and the air passageways serve as a vent, whereby the DVC2000 can be easily moved from one side of the valve to the other without rotating the actuator.

DVC2000 Mounting Procedures

Steps A and B of the following instructions apply to the actuator construction shown in figures 18, 19, 20, and 21.

A. Mounting the DVC2000 to an air-to-open GX actuator (spring-to-close) (see figure 4 and figure 18 or 19):

1. Attach the magnetic feedback array (supplied with the DVC2000) to the valve stem connector using the alignment template (supplied with the mounting kit) for accurate alignment.
2. Remove the plug (R1/8) from the back of the DVC2000 housing (Port B in figure 4). This pneumatic output port on the DVC2000 lines up with the integral GX actuator air supply connection (see figure 18 or 19).
3. Install the plug (either G1/4 or 1/4 NPT, included in the mounting kit) to the external output pneumatic port (Port A in figure 4).
4. Remove the digital valve controller's cover.
5. Using a 6mm hex wrench, attach the digital valve controller to the GX actuator mounting pad on the side that has the open pneumatic port. Be sure to place the O-ring seal between the digital valve controller's pneumatic output and the actuator mounting pad (Port B, as shown in figure 4). Pneumatic tubing is not required because the air passages are internal to the actuator. Also, install the insulating gaskets around the mounting bolts.
6. Check for clearance between the magnet assembly and the DVC2000 feedback slot. The magnet assembly should be positioned such that the index mark in the feedback slot of the DVC2000 housing is between the valid range on the magnet assembly throughout the range of travel. (See figure 4).

B. For air-to-close GX actuator (spring-to-open) (see figure 4 and figure 20 or 21):

1. Attach the magnetic feedback array (supplied with the DVC2000) to the valve stem connector using the alignment template (supplied with the mounting kit) for accurate alignment.
2. In the air-to-close configuration it is required that an R1/8 plug be installed into the integral mount pneumatic port on the back of the DVC2000 housing (Port B of figure 4).
3. Remove the digital valve controller's cover.
4. Using a 6mm hex wrench, attach the digital valve controller to the GX actuator mounting pad.

Note
The O-ring seal and G1/4 or 1/4 NPT plugs (supplied in the mounting kit) are not used with this actuator construction.

5. Check for clearance between the magnet assembly and the DVC2000 feedback slot. The magnet assembly should be positioned such that the index mark on the pole pieces (back of the controller housing) is between the marks on the magnet assembly throughout the range of travel. (See figure 4.)
6. Install tubing between the external pneumatic output connection of the DVC2000 (Port A of figure 4) to the air supply connection (see figure 20 or 21) on top of the actuator casing.

When changing actuator action:

When field converting a GX actuator from air-to-open to air-to-close closed (or vice-versa), you will need to change the plugs for the pneumatic passages in the DVC2000 housing.

- To convert from air-to-close to air-to-open (spring-to-close), remove the R1/8 pneumatic plug on the back of the DVC2000 housing and install an O-ring (Port B of figure 4). Plug the external pneumatic output with a 1/4 NPT or G1/4 plug (depending on the housing version). (Port A of figure 4.)
- To convert from air-to-open to air-to-close (spring-to-open), remove the external pneumatic plug (1/4 NPT or G1/4 plug, depending on the housing version from Port A of figure 4). Install an R1/8 plug on the back of the DVC2000 housing (Port B of figure 4). Install tubing between the pneumatic output connection of the DVC2000 (Port A) to the air supply connection on top of the actuator casing (see figure 20 or 21).

Packing Maintenance

Key numbers refer to figures 15, 18, 19, 20, 21, 22, and 23.

Packing Adjustment

For ENVIRO-SEAL™ spring-loaded single PTFE V-ring packing (figure 15) or for ENVIRO-SEAL graphite ULF packing (figure 16), the Belleville spring pack (key 34) maintains a sealing force on the packing. If leakage is detected around the packing follower (key 29) check to be sure that the packing follower (key 29) is tight. Using a wrench, tighten the packing follower (key 29) in 1/4 turn intervals until the leakage is stopped. If leakage cannot be stopped in this manner, proceed to the Replacing Packing section in this manual.

Replacing Packing (Pneumatic Actuators)

This section provides instruction on replacing packing in standard bonnets, extension bonnets, and bellows extension bonnets.

Isolate the control valve from the line pressure, release pressure from both sides of the valve body and drain the process media from both sides of the valve. Shut off all pressure lines to the actuator and release all pressure from the actuator. Use lock-out procedures to ensure that the above measures stay in effect while you work on the equipment.

1. For air-to-open constructions:
   a. Connect a separate air supply to the lower diaphragm casing via the air supply connection on the yoke (as shown in figure 18 or 19) and apply sufficient air pressure to raise the valve plug/stem off the seat to mid travel.
   b. Remove the stem connector nut half (key 23), stem connector bolt half (key 24), and travel indicator (key 26).
   c. Push the valve plug stem (key 3) down until it contacts the seat.
   d. Loosen the locknut (key 28) and thread the stem adjustor nut (key 27) down until it clears the top of the valve plug stem (key 3).
   e. Shut off the air pressure and disconnect the separate air supply to the lower diaphragm casing (as shown in figure 18 or 19).
2. For air-to-close constructions, as shown in figure 20 or 21, remove the stem connector nut half (key 23), stem connector bolt half (key 24), and travel indicator (key 26).

⚠ WARNING

To avoid personal injury or property damage by uncontrolled movement of the actuator yoke (key 8), loosen the body/yoke nuts (figures 18, 19, 20, and 21, key 7) or bonnet/yoke nuts (figures 22 and 23, key 46) by following the instructions in the next step. Do not remove a stuck actuator yoke by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the actuator yoke.

Note

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

3. For standard bonnet constructions (figures 18, 19, 20, and 21), body nuts (key 7) attach the actuator yoke (key 8) to the valve body (key 1). Loosen these nuts approximately 3mm (1/8 inch).

For extension and bellows bonnet constructions, bonnet nuts (key 46) attach the actuator yoke (key 8) to the extension bonnet (key 39). Loosen these nuts approximately 3mm (1/8 inch).

4. Then loosen the valve-to-yoke gasketed joint by either rocking the actuator yoke or prying between the valve and actuator yoke. Work the prying tool around the actuator yoke until it loosens.

⚠ WARNING

If there is evidence of process fluid under pressure leaking from the joint, retighten the valve body/joint nuts and return to the Warning at the beginning of the Maintenance section to ensure proper steps have been taken to isolate the valve and relieve process pressure, thus avoiding property damage or personal injury.

5. If no fluid leaks from the joint, loosen the packing follower (key 29) two turns to relieve the packing compression load.
6. For standard bonnet constructions (figures 18, 19, 20, and 21), remove the body nuts (key 7) completely.
   For extension and bellows bonnet constructions (figures 22 and 23), remove the bonnet nuts (key 46) completely.

CAUTION

To avoid property damage, place the actuator yoke on a protective surface, as described in the following procedure.

7. Carefully lift off the actuator yoke and set it on a protective surface to prevent damage.
   For standard bonnet constructions, if the bonnet (key 4) together with the valve stem plug assembly has a tendency to lift with the actuator yoke, ensure it does not drop from the actuator.
   For extension and bellows constructions, ensure the bonnet (key 4) does not lift with the actuator yoke.
   For DN150 balanced constructions, if the bonnet, guide sleeve, or valve stem assembly have a tendency to lift with the actuator yoke, ensure they do not drop from the actuator.

CAUTION

For extension and bellows bonnet constructions, lifting the bonnet with the actuator yoke may cause possible damage to the valve plug and to the bellows.

8. Remove the stem adjustor nut (key 27) and locknut (key 28).
9. For standard bonnet constructions, remove the bonnet and the valve plug/stem assembly and set on a protective surface.
   For extension and bellows bonnet constructions, remove only the bonnet (key 4).
   For DN150 balanced constructions, remove the guide sleeve, bonnet, and valve plug stem assembly.

Table 7. Packing Follower Torque

Valve Size	Packing Style	Torque N•m (lbf•ft)	Packing Style	Torque N•m (lbf•ft)
DN15, 20, 25, 40, and 50	ENVIRO-SEAL PTFE	10 (7.4)	ENVIRO-SEAL ULF	35 (26)
DN80 and DN100	ENVIRO-SEAL PTFE	23 (17)	ENVIRO-SEAL ULF	50 (37)
DN150	ENVIRO-SEAL PTFE	36 (26)	ENVIRO-SEAL ULF	68 (50)

10. Remove the valve/yoke gasket (figures 18, 19, 20, and 21 key 5, figures 22 and 23 key 47) and cover the opening of the valve to protect the gasket surface and prevent foreign matter from getting into the valve cavity.
11. Remove the packing follower (key 29) from the bonnet (key 4).
12. Remove the Belleville spring pack (key 34) and packing spacer (key 30) from the bonnet (key 4). Carefully push out the remaining packing box parts from the bonnet (key 4) using a rounded rod or other tool which will not scratch the packing box wall. Clean the packing box and the metal packing box parts.

CAUTION

Inspect the valve stem, threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage the new packing.

13. Inspect the valve stem, threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.
14. Remove the covering protecting the valve cavity and install a new valve/yoke gasket (figures 18, 19, 20, and 21 key 5, figures 22 and 23 key 47) making sure that the gasket seating surfaces are clean and smooth.
    For DN150 balanced constructions, two gaskets are required; one between the valve body and guide sleeve, and the other between the guide sleeve and bonnet. Ensure the gasket seating surfaces are clean and smooth for both gaskets.
15. Carefully install the bonnet (key 4) onto the valve stem.
16. Install the new packing and the metal packing box parts according to figure 15 for ENVIRO-SEAL PTFE packing and according to figure 16 for ENVIRO-SEAL graphite ULF packing. Place a smooth-edged pipe over the valve stem and gently tap each soft packing part into the packing box. Apply anti-seize lubricant to the threads and install the packing follower (key 29).
17. Install the locknut (key 28) and stem adjustor nut (key 27).
    For standard bonnet constructions, install the valve plug/bonnet sub assembly into the valve body (key 1).
18. Mount the actuator onto the valve and install the body nuts (figures 18, 19, 20, 21 key 7, figures 22 and 23 key 46), but tighten them only finger-tight.
19. For air-to-open, connect a separate air supply to the lower diaphragm casing air supply connection (as shown in figure 18 or 19) and apply sufficient air pressure to raise the actuator rod (key 22) to the travel stop. Proceed to the next step.
    For air-to-close, proceed to the next step.
20. For standard bonnet constructions, tighten the body nuts (key 7) evenly using a cross-tightening procedure. See table 4 for torque requirements.
    For extension and bellows bonnet constructions, tighten the bonnet nuts (key 46) evenly using a cross-tightening procedure. See table 5 for torque requirements.
21. Thread the stem lock adjustor (key 27) up until it is the rated travel distance specified in table 3 from the actuator rod (key 22). Thread the locknut (key 28) up against the stem locknut and tighten to the torque specified in table 6.
22. Stroke the actuator rod until it contacts the stem adjuster nut (key 27) and install the stem connector halves and travel indicator (keys 23, 24, and 26) with the cap screws (key 25). Install the stem connector halves in the proper orientation so that when looking at the inside of the stem connector halves, the flats are down and the beveled surfaces are up.
23. Align the pointer of the travel indicator (key 26) with the appropriate mark on the travel scale.
24. Tighten the stem connector cap screws (key 25) to 35 N•m (26 lbf•ft).

Table 8. Seat Ring / Cage Torque Requirements

VALVE SIZE		TORQUE	
DN	NPS	N•m	lbf•ft
15, 20, 25	1/2, 3/4, 1	170	124
40	1-1/2	320	234
50	2	460	337
80	3	1020	747
100	4	1520	1113
150	6	3400	2500

Table 9. Stem Extension Torque Requirements

VALVE SIZE		TORQUE	
DN	NPS	N•m	Lbf•ft
15, 20, 25, 40, 50	1/2, 3/4, 1, 1-1/2, 2	40	30
80, 100	3, 4	120	89

Table 10. Bellows Nut Torque Requirements

VALVE SIZE		TORQUE	
DN	NPS	N•m	Lbf•ft
15, 20, 25, 40, 50	1/2, 3/4, 1, 1-1/2, 2	350	260
80, 100	3, 4	650	480

25. Tighten the packing follower (key 29) to the torque specified in table 7.

Alternately, the packing follower can be tightened by the following method:

a. Tighten the packing follower until the Belleville springs are compressed 100% (or completely flat), as detected by a rapid increase in nut torque.

b. For DN15 through DN100 (NPS 1/2 through 4), loosen the packing follower 60° of rotation.
For DN150 (NPS 6), loosen the packing follower 90° of rotation.

26. For air-to-open, release the actuator pressure.

27. For air-to-open, ensure the vent (key 21) is installed into the upper diaphragm casing (see figure 18 or 19).
For air-to-close, ensure the vent (key 21) is installed into the actuator yoke air supply connection (see figure 20 or 21).

Replacing Packing (Electric Actuators)

This section provides instruction on replacing packing in standard bonnets, extension bonnets, and bellows extension bonnets.

Isolate the control valve from the line pressure, release pressure from both sides of the valve body and drain the process media from both sides of the valve. Use lock-out procedures to ensure that the above measures stay in effect while you work on the equipment.

1. Stroke the actuator so the valve plug/stem (key 3) is at mid travel.
2. Remove the stem connector nut half (key 23), stem connector bolt half (key 24), and travel indicator (key 26).
3. Use precaution to ensure the actuator is locked in position and cannot stroke.
4. Mark the position of the locknut (key 28) on the stem for reassembly.
5. Push the valve plug/stem (key 3) down until it contacts the seat.
6. Loosen the locknut (key 28) and thread the stem adjustor nut (key 27) down until it clears the top of the valve plug stem (key 3).

⚠ WARNING

To avoid personal injury or property damage by uncontrolled movement of the actuator yoke (key 8), loosen the body/yoke nuts (figures 18, 19, 20, and 21, key 7) or bonnet/yoke nuts (figures 22 and 23, key 46) by following the instructions in the following step 7. below. Do not remove a stuck actuator yoke by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the actuator yoke.

Note

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

7. For standard bonnet constructions (figures 18, 19, 20, and 21), body nuts (key 7) attach the actuator yoke (key 8) to the valve body (key 1). Loosen these nuts approximately 3mm (1/8 inch).

For extension and bellows bonnet constructions, bonnet nuts (key 46) attach the actuator yoke (key 8) to the extension bonnet (key 39). Loosen these nuts approximately 3mm (1/8 inch).

8. Then loosen the valve-to-yoke gasketed joint by either rocking the actuator yoke or prying between the valve and actuator yoke. Work the prying tool around the actuator yoke until it loosens.

⚠ WARNING

If there is evidence of process fluid under pressure leaking from the joint, retighten the valve body/joint nuts and return to the Warning at the beginning of the Maintenance section to ensure proper steps have been taken to isolate the valve and relieve process pressure, thus avoiding property damage or personal injury.

9. If no fluid leaks from the joint, loosen the packing follower (key 29) two turns to relieve the packing compression load.
10. For standard bonnet constructions (figures 18, 19, 20, and 21), remove the body nuts (key 7) completely.
    For extension and bellows bonnet constructions (figures 22 and 23), remove the bonnet nuts (key 46) completely.

CAUTION

To avoid property damage, place the actuator yoke on a protective surface, as described in the following procedure.

11. Carefully lift off the actuator yoke and set it on a protective surface to prevent damage.
    For standard bonnet constructions, if the bonnet (key 4) together with the valve stem plug assembly has a tendency to lift with the actuator yoke, ensure it does not drop from the actuator.
    For extension and bellows constructions, ensure the bonnet (key 4) does not lift with the actuator yoke.

CAUTION

For extension and bellows bonnet constructions, lifting the bonnet with the actuator yoke may cause possible damage to the valve plug and to the bellows.

12. Remove the stem adjustor nut (key 27) and locknut (key 28).
13. For standard bonnet constructions, remove the bonnet and the valve plug/stem assembly and set on a protective surface.
    For extension and bellows bonnet constructions, remove only the bonnet (key 4).
14. Remove the valve/yoke gasket (figures 18, 19, 20, and 21 key 5, figures 22 and 23 key 47) and cover the opening of the valve to protect the gasket surface and prevent foreign matter from getting into the valve cavity.
15. Remove the packing follower (key 29) from the bonnet (key 4).

16. Remove the Belleville spring pack (key 34) and packing spacer (key 30) from the bonnet (key 4). Carefully push out the remaining packing box parts from the bonnet (key 4) using a rounded rod or other tool which will not scratch the packing box wall. Clean the packing box and the metal packing box parts.

Table 11. GX Electric Actuator Maximum Allowable Thrust

VALVE SIZE	STEM DIAMETER	TRAVEL	BONNET STYLE	STEM MATERIAL STRENGTH	MAXIMUM THRUST	
	mm	mm			N	lbf
DN25 to DN50 (NPS 1 to 2)	10	20	Plain	High(1)	17000	3820
				Low(2)	7600	1710
			Bellows/Extension	High(1)	11400	2560
				Low(2)	6700	1500
DN80 to DN100 (NPS 3 to 4)	14	20, 40	Plain	High(1)	20000	4500
				Low(2)	20000	4500
			Bellows/Extension	High(1)	20000	4500
				Low(2)	14500	3260

1. High strength stem materials consist of S200910, N05500, S31603.
2. Low strength materials consist of S31803, N10675, N06022.

CAUTION

Inspect the valve stem, threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage the new packing.

17. Inspect the valve stem, threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.
18. Remove the covering protecting the valve cavity and install a new valve/yoke gasket (figures 18, 19, 20, and 21 key 5, figures 22 and 23 key 47) making sure that the gasket seating surfaces are clean and smooth.
19. Carefully install the bonnet (key 4) onto the valve stem.
20. Install the new packing and the metal packing box parts according to figure 15 for ENVIRO-SEAL PTFE packing and according to figure 16 for ENVIRO-SEAL graphite ULF packing. Place a smooth-edged pipe over the valve stem and gently tap each soft packing part into the packing box. Apply anti-seize lubricant to the threads and install the packing follower (key 29).
21. Install the locknut (key 28) and stem adjustor nut (key 27). Ensure they are aligned with the mark made on the stem disassembly and tighten
    For standard bonnet constructions, install the valve plug/bonnet sub assembly into the valve body (key 1).
22. Mount the actuator onto the valve and install the body nuts (figures 18, 19, 20, 21 key 7, figures 22 and 23 key 46), but tighten them only finger-tight.
23. For standard bonnet constructions, tighten the body nuts (key 7) evenly using a cross-tightening procedure. See table 4 for torque requirements.
    For extension and bellows bonnet constructions, tighten the bonnet nuts (key 46) evenly using a cross-tightening procedure. See table 5 for torque requirements.
24. Push the valve plug/stem to the valve seat. Thread the stem adjustor nut (key 27) and locknut (key 28) to the previously marked position. Thread the locknut (key 28) up against the stem locknut and tighten to the torque specified in table 6.
25. Stroke the actuator rod until it contacts the stem adjuster nut (key 27) and install the stem connector halves and travel indicator (keys 23, 24, and 26) with the cap screws (key 25). Install the stem connector halves in the proper orientation so that when looking at the inside of the stem connector halves, the flats are down and the beveled surfaces are up.

26. Align the pointer of the travel indicator (key 26) with the appropriate mark on the travel scale.
27. Tighten the stem connector cap screws (key 25) to 35 N•m (26 lbf•ft).
28. Tighten the packing follower (key 29) to the torque specified in table 7.

Alternately, the packing follower can be tightened by the following method:

a. Tighten the packing follower until the Belleville springs are compressed 100% (or completely flat), as detected by a rapid increase in nut torque.

b. For DN15 through DN100 (NPS 1/2 through 4), loosen the packing follower 60° of rotation.

CAUTION

Ensure that the electric actuator maximum thrust output does not exceed the values in table 11. The up travel stop must be set in the electric actuator in order to prevent damage to the valve trim.

Valve Trim Maintenance

Key numbers in this section refer to figures 18, 19, 20, 21, 22, and 23.

Valve Trim Disassembly

1. Remove the actuator and bonnet assembly as described in the Replacing Packing section (steps 1 through 10).

- For standard bonnet constructions (figures 18, 19, 20, 21, and 25), proceed to the Seat Ring / Cage Removal section.
- For extension bonnet constructions (figure 22), proceed to step 3.
- For bellows bonnet constructions (figure 23), proceed to step 2.

2. For bellows bonnet constructions (figure 23), use a bellows nut tool made according to the dimensions in figure 26 and table 13 to remove the bellows nut (key 51) as follows:

a. Insert the bellows nut tool into the extension bonnet (key 39). Be certain the tool lugs are engaged in the corresponding recesses in the bellows nut.

b. Use a torque gun or driver having sufficient torque capabilities according to table 10. Connect the gun to a socket that snugly fits the hex head on the bellows nut tool.

c. Insert the socket onto the hex head of the bellows nut tool.

⚠ WARNING

Be careful to hold the torque gun, attached socket, and tool at right angles to the bellows nut when applying torque. Tilting the gun and socket while applying torque may cause the lugs on the bellows nut tool to suddenly disengage from the lugs on the bellows nut thus causing possible damage to the bellows nut and possible personal injury.

d. Remove the bellows nut (key 51).

3. For both extension and bellows bonnet constructions: Body nuts (key 7) attach the extension bonnet (key 39) to the valve body (key 1). Loosen these nuts approximately 3mm (1/8 inch). Then loosen the extension bonnet-to-body gasketed joint by either rocking the extension bonnet or prying between the body and extension bonnet. Work the prying tool around the extension bonnet until it loosens.
4. Remove the body nuts (key 7) completely and carefully lift the extension bonnet (key 39), and valve plug/stem extension assembly (key 3, 40 and 48) or plug/bellows/stem extension assembly (key 3, 49 and 48) from the top of the valve body.
5. Use a wrench to unscrew the plug/stem assembly (key 3) from the stem extension (key 40) or from bellows/stem assembly (key 49) as follows:

   a. Insert the wrench onto the stem extension hex flats (see figures 22 and 23).

CAUTION

In the following procedure, take precautions to ensure the valve plug and stem finish are not damaged.

   b. Clamp the plug/stem assembly (key 3) and holding it stable, unscrew the stem extension (key 40) or bellows/stem assembly (key 49). Take precautions to ensure the valve plug and stem finish are not damaged.

Note

There is a stem assembly locking insert (figures 22 and 23, key 48) in the valve plug/stem extension assembly. It is possible this insert may drop out during stem disassembly. If this is the case, ensure it is retained for reassembly of the valve stem to the stem extension.

6. Remove the plug/stem assembly (key 3) and bellows/stem assembly (key 49) from the extension bonnet. Remove the bellows gasket (key 50).
7. Proceed to the Seat Ring Removal section.

Seat Ring / Cage Removal

CAUTION

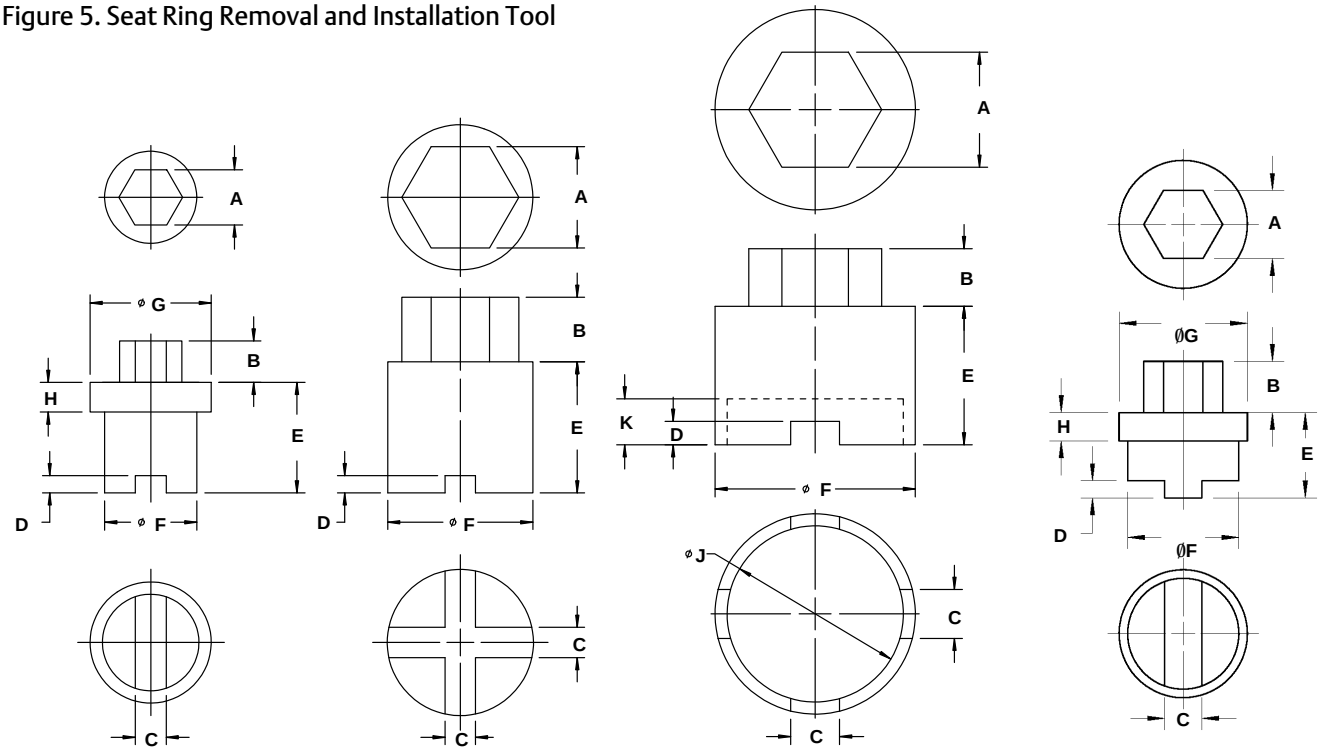
Use care to avoid damaging the gasket sealing surfaces.

The surface finish of the valve stem (key 3) is critical for making a good packing seal. The seating surfaces of the seat ring (key 2), cage (key 99), and the valve plug (key 3) are critical for tight shutoff and should therefore also be treated with care and properly protected.

1. Packing parts can be removed from the bonnet if desired. Replace these parts as described in the section on Packing Maintenance.
2. Use a seat ring tool made according to the dimensions in figure 5 and table 12 to remove the seat ring (key 2) as follows:

   a. Insert the tool into the valve body. Be certain the tool lugs are engaged in the corresponding recesses in the seat ring.

Figure 5. Seat Ring Removal and Installation Tool



DN15, 20, 25 (NPS 1/2, 3/4, 1) | **DN40, 50, 80, 100 (NPS 1-1/2, 2, 3, 4)** | **DN150 (NPS 6)** | **DN25 Cav III (NPS 1)**

GE02918-6 GG01215

Table 12. Seat Ring Removal and Installation Tool Dimensions

Valve Size		Part Number	A	B	C	D	E	FØ	GØ	H	JØ	K
DN	NPS		mm									
15, 20, 25	1/2, 3/4, 1	GE02918X012	24	15	15.2	9	54	40	45	10	---	---
25 (Cavitrol III)	1 (Cavitrol III)	Not Available	24	18	13	6	30	39	45	10	---	---
40(1)	1-1/2(1)	GE02918X022	36	20	2X 13.2	7.5	58	53	---	---	---	---
50(1)	2(1)	GE02918X032	46	28	2X 13.2	7.5	63	63	---	---	---	---
80	3	GE02918X042	60	36	2X 15.2	8.5	100	93	---	---	---	---
100	4	GE02918X052	70	44	2X 17.2	9.5	114	113	---	---	---	---
150	6	GE02918X062	100	50	2X 43	10.5	170.5	174	---	---	153	20

1. Also used for Cavitrol III cage removal.

b. Use a torque gun or driver having sufficient torque capabilities according to table 8. Connect the gun to a socket that snugly fits the hex head on the seat ring tool.

c. Insert the socket onto the hex head of the seat ring tool.

⚠ WARNING

Be careful to hold the torque gun, attached socket, and tool at right angles to the seat ring when applying torque. Tilting the gun and socket while applying torque may cause the lugs on the seat ring tool to suddenly disengage from the lugs on the seat ring thus causing possible damage to the seat ring and possible personal injury.

3. Remove the seat ring (key 2) from the valve body.
4. Inspect parts for wear or damage that would prevent proper operation of the valve body.
5. Replace trim parts as necessary.

Valve Trim Assembly

Assembly of Unbalanced Trim

Refer to figures 12, 18, 19, 20, 21, 22, 23, and 25.

1. Before installing the new seat ring / cage, thoroughly clean the threads in the valve body port. Apply suitable lubricant to the threads and to the 60° surface of the new seat ring (key 4). Screw the seat ring into the valve body. Using the seat ring tool, tighten the seat ring and torque according to the values in table 8. Remove all excess lubricant after tightening.
2. For standard bonnet constructions, perform the following. (Proceed to step 3 for extension and bellows bonnets.)
   a. Clean the body/yoke gasket seating surfaces and install a new body/yoke gasket (key 5).
   b. Remove any protective tape or covering from the valve plug/stem assembly.
   c. Insert the valve plug/stem assembly into the seat ring.

CAUTION

If the packing is to be reused and was not removed from the bonnet, perform the following step carefully to avoid damaging the packing with the stem threads.

   d. Install bonnet and actuator yoke onto the valve body by completing the assembly according to steps 15 to 27 of the section Replacing Packing, omitting step 16 if new packing is not being installed.
3. For extension and bellows bonnet constructions, perform the following.
   a. For bellows bonnet constructions, clean the extension bonnet/bellows gasket seating surfaces and install a new bellows gasket (key 50).
   b. Remove any protective tape or covering from the valve plug/stem assembly (key 3). Then insert the plug/stem assembly (key 3) through the extension bonnet bushing (key 41).
   c. Remove any protective tape or covering from the stem extension (key 40) or the bellows stem assembly (key 49). Screw the plug/stem assembly (key 3) into the stem extension or bellows/stem assembly. Note: Do not apply lubricant to the threads of the plug/stem assembly (key 3) or the bellows/stem assembly (key 49).

Note

Ensure the stem assembly locking insert (figures 22 and 23, key 48) has been first inserted in the bottom of the threaded hole in the stem extension.

CAUTION

In the following procedure, take precautions to ensure the valve plug and stem finish are not damaged.

d. Clamp the plug/stem assembly (key 3) and hold it stable. Using a box spanner tool tighten the plug/stem assembly (key 3) into the stem extension (key 40) or into the bellows/stem assembly (key 49) according to the stem extension torque requirements listed in table 9. Take precautions to ensure the valve plug and stem finish are not damaged.

e. For bellows bonnet constructions, apply suitable lubricant to the threads and to the bottom surface of the bellows nut (key 51). Screw the bellows nut into the extension bonnet. Using the bellows nut tool, a lathe or boring mill, tighten the bellows nut or torque according to the values in table 10. Remove all excess lubricant.

f. Clean the body/extension bonnet seating gasket surface and install the gasket (key 5).

g. Install the extension bonnet and plug/stem assembly onto the valve body. Install the body/yoke nuts (key 7) and tighten evenly using a cross-tightening procedure. See table 4 for torque requirements.

CAUTION

If the packing is to be reused and was not removed from the bonnet, perform the following step carefully to avoid damaging the packing with the stem threads.

h. Install the bonnet and actuator yoke onto the extension bonnet by completing the assembly according to steps 15 to 27 of the section Replacing Packing, omitting step 16 if new packing is not being installed.

Assembly of Balanced Trim

(Available in DN80, 100, and 150 [NPS 3, 4, and 6] only)

Refer to figure 10.

CAUTION

To protect the valve plug seal ring (key 37) and to ensure it seals properly, be careful not to scratch the surfaces of the ring groove in the valve plug or any of the surfaces of the replacement ring.

1. With the valve plug (key 3) removed according to the Disassembly portion of the Valve Trim Maintenance procedure, proceed as appropriate:

The seal ring (key 37) cannot be reused because it is a closed ring which must be pried and/or cut from the groove. Once the seal ring is removed, the elastomeric backup ring (key 38), which is also a closed ring, can be pried from the groove.

To install a new backup ring and seal ring onto the valve plug, apply a general purpose silicone-base lubricant to both rings (keys 38 and 37). Place the backup ring over the valve plug (key 3) and into the groove. Place the seal ring over the top edge of the valve plug (key 3) so that it enters the groove on one side of the valve plug. Slowly and gently

stretch the seal ring and work it over the top edge of the valve plug. The PTFE material in the seal ring must be permitted time to cold-flow during the stretching procedure, so avoid jerking sharply on this ring. Stretching the seal ring over the valve plug may make it seem unduly loose when in the groove, but it will contract to its original size after insertion into the bonnet.

2. Install the seat ring, valve plug/stem, bonnet and actuator yoke into the valve body by completing the assembly according to steps 1 to 3 of the section Assembly of Unbalanced Trim.

Repair Nameplate

If required by the end-user, an optional repair nameplate is available for recording changes made to the valve trim during maintenance (see figure 29). This nameplate can be ordered as a spare part, and is easily mounted to the actuator casing using a casing bolt. (Reference the Parts Ordering section of this manual.)

As shown in figure 29, the repair nameplate provides locations for maintenance personnel to record trim data, such as:

- Date of maintenance
- Trim material
- Port diameter
- Flow capacity (C_v / K_v)
- Flow characteristic
- Actuator Action ATO/ATC

Bellows Maintenance

This section provides instruction on the replacement of the bellows / stem assembly (see key 49 in figure 23).

1. Remove the actuator, bonnet assembly as described in the Replacing Packing section (steps 1 through 10).
2. Remove the plug/stem assemblies as described in the Valve Trim Disassembly section (steps 2 through 6).
3. To install the new bellows / stem assembly (key 49), perform the Valve Trim Assembly (step 3).

Figure 6. Fisher GX Handwheel Assembly

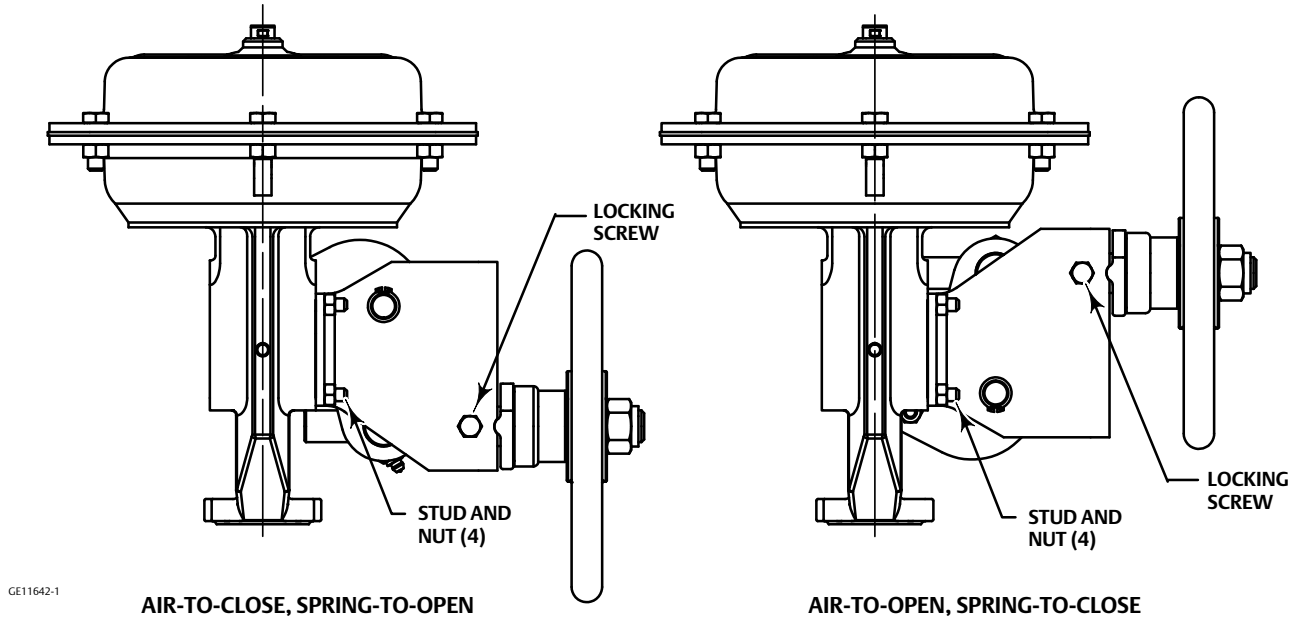
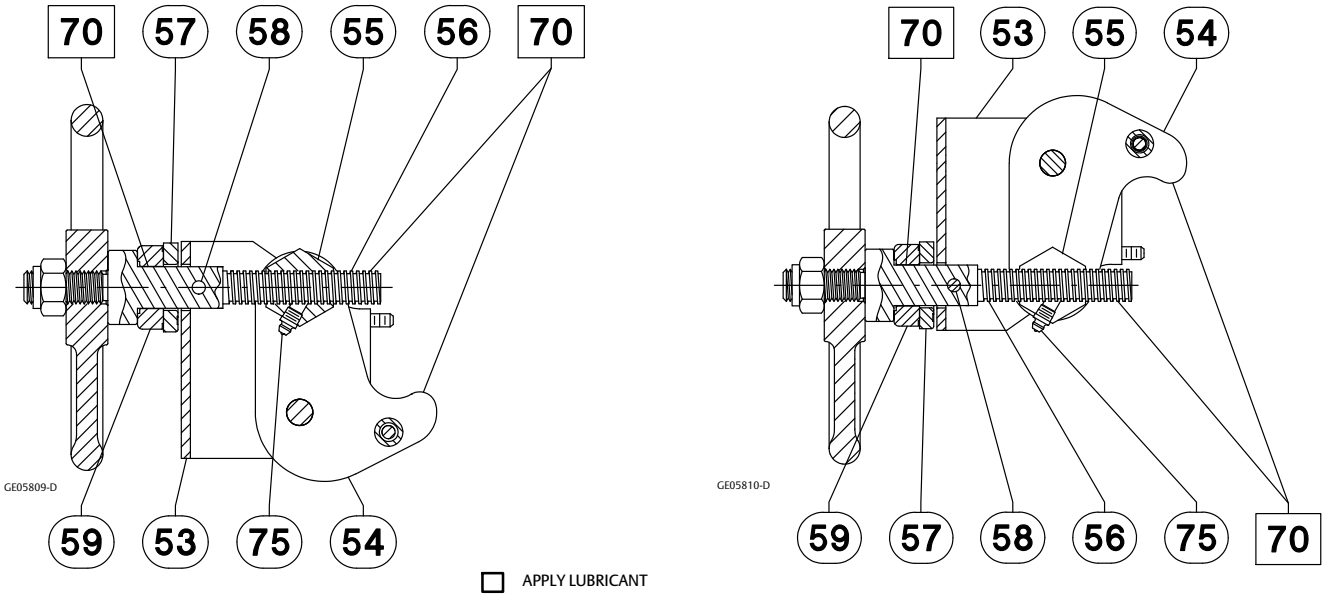


Figure 7. Fisher GX Handwheel Orientation and Grease Zerk Location



Handwheel Operation

CAUTION

This handwheel is designed only for use with size 225 and 750 actuators with 20 mm travel. To avoid equipment damage, do not assemble this handwheel on size 750 actuators with 40 mm travel or size 1200 actuators.

Principle of Operation

The GX handwheel is designed to compress the actuator springs and override the actuator fail action. Turning the handwheel drives the screw, nut, and levers. The levers push against the stem connector to transfer this motion. Reversing the direction of the handwheel will move the nut and levers in the opposite direction. Once the levers are no longer in contact with the stem connector, the locking screw should be used to secure the handwheel against undesired movement. To prevent damage due to overtravel, the handwheel should not be turned more than 2 full turns past the point at which the levers no longer contact the stem connector.

⚠ WARNING

To avoid personal injury or loss of process control due to equipment damage, ensure the levers are completely disengaged and the locking screw is tight while the valve is in normal pneumatic operation.

During normal pneumatic operation when the handwheel is not needed, a locking screw (see figure 6) is provided on the side of the handwheel housing to lock the handwheel levers out of the way.

⚠ WARNING

To avoid personal injury or equipment damage due to possible sudden shifting or falling of the valve assembly, do not lift the valve assembly by the handwheel.

GX Handwheel Installation (for use with 20mm travel only)

1. Note the orientation of the levers to the stem connector for either the air-to-close, spring-to-open configuration or for the air-to-open, spring-to-close configuration, as shown in figure 7.
2. Adjust the handwheel to allow positioning the levers above the stem connector before installation.
3. Install the handwheel to the GX mounting pad with four studs and nuts, as shown in figure 6. Torque to 24 N•m (18 lbf•ft).
4. Apply lithium grease to the grease zerk and to the tip of the levers (where they contact the stem connector), as shown in figure 7.

Travel Stop Operation

Principle of Operation

CAUTION

This travel stop is designed only for use with size 225 and 750 actuators with 20 mm travel. To avoid equipment damage, do not assemble this travel stop on size 750 actuators with 40 mm travel or size 1200 actuators.

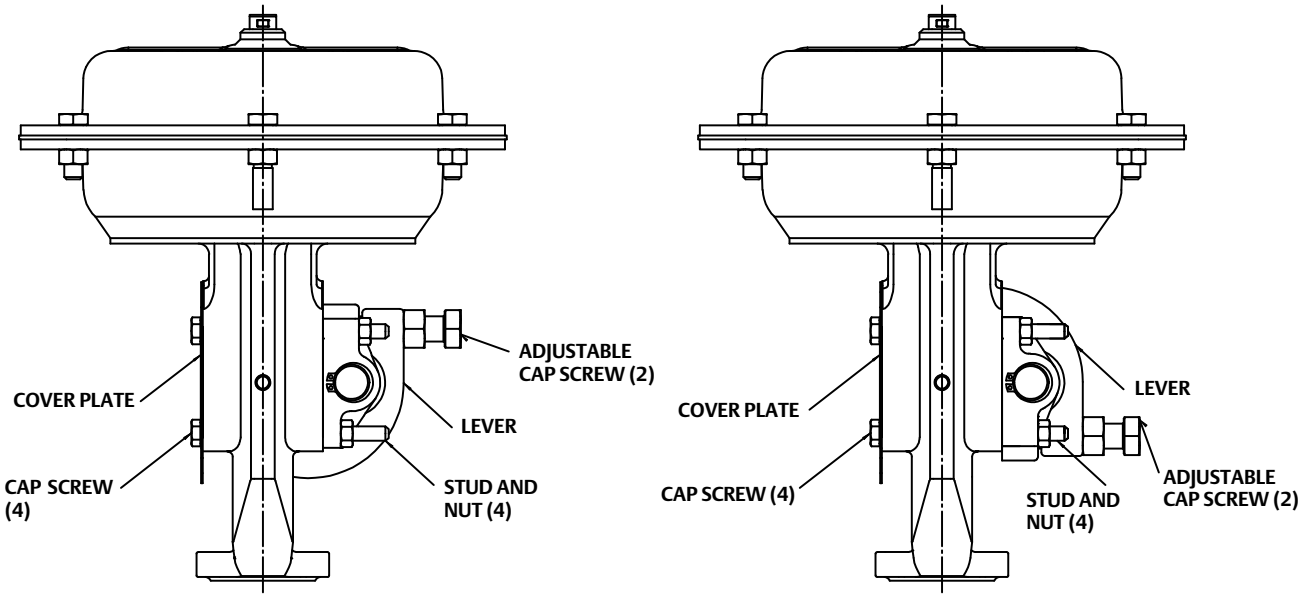
The GX travel stop is designed to mechanically limit and stop the valve at a preset position in an emergency or upon loss of instrument air. This assembly is mounted on the yoke with four studs. The lever pushes against the stem connector to stop the travel. Travel position can be adjusted by two adjustable cap screws on the lever, as shown in figure 8. A cover plate assembly is available to prevent pinch point damage caused by the lever, as shown in figure 8.

⚠ WARNING

To avoid personal injury or equipment damage due to possible sudden shifting or falling of the valve assembly, do not lift the valve assembly by the travel stop.

To avoid personal injury or loss of process control due to equipment damage, screw the adjustable cap screws to ensure the lever is completely disengaged while the valve is in normal pneumatic operation.

Figure 8. Fisher GX Travel Stop Assembly



GX Travel Stop Installation

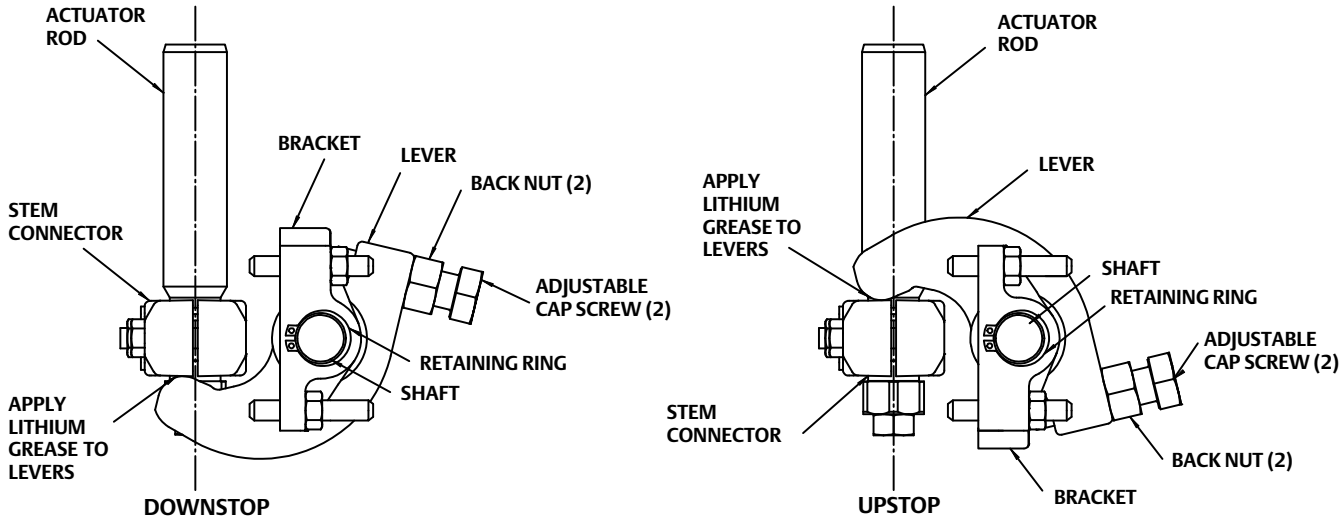
Downstop

1. Note the orientation of the lever to the stem connector for downstop positioning, as shown in figure 9. Adjust the travel stop to allow positioning the lever below the stem connector before installation.
2. Install the travel stop to the GX mounting pad with four studs and nuts, as shown in figure 8. Torque to 24.5 N•m (18 lbf•ft).
3. Apply lithium grease to the tip of the lever (where it contacts the stem connector) and to the two adjustable cap screws, as shown in figure 9.

Upstop

1. Note the orientation of the lever to the stem connector for upstop positioning, as shown in figure 9. Adjust the travel stop to allow positioning the lever above the stem connector before installation.
2. Install the travel stop to the GX mounting pad with four studs and nuts, as shown in figure 8. Torque to 24.5 N•m (18 lbf•ft).
3. Apply lithium grease to the tip of the lever (where it contacts the stem connector) and to the two adjustable cap screws, as shown in figure 9.

Figure 9. Fisher GX Travel Stop Orientation



Setting the Travel Stop Position

After sending the required position air signal to the actuator, screw the adjustable cap screws to assure the lever contacts with the stem connector tightly, then tighten the back nut. Check the actual stem position when giving the 100% air signal.

Standard Accuracy for the travel stop position is +/- 10% for 20 mm travel. For added precision, use the following procedure.

1. Send the desired position air signal to the actuator.
2. Set the travel stop, screw the adjustable cap screws to assure the lever contacts with the stem connector tightly, then tighten the back nut.
3. Send a 100% air signal.
4. Measure the difference between the actual stem position and the desired position.
5. Send the air signal for the desired position minus the differential position measured in step 4.
6. Reset the travel stop by adjusting the two cap screws and then tighten the back nut.

Figure 10. Fisher GX Balanced Trim
(Standard for DN80 and DN100 [NPS 3 and 4])

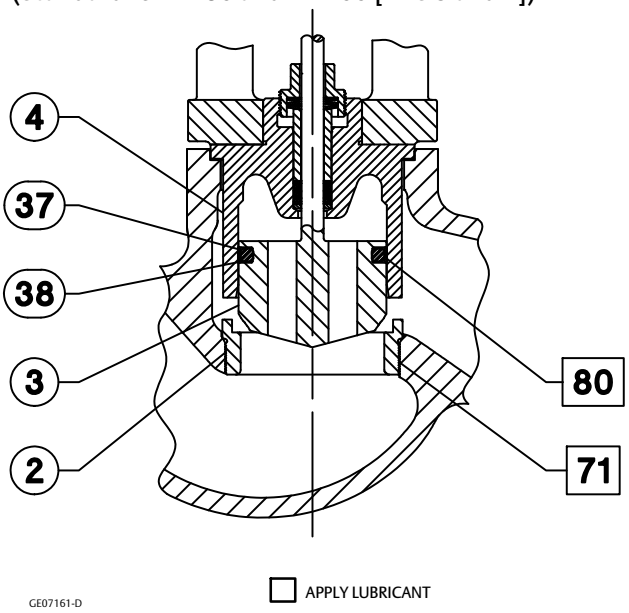


Figure 11. Fisher GX Balanced Trim
(DN150 [NPS 6])

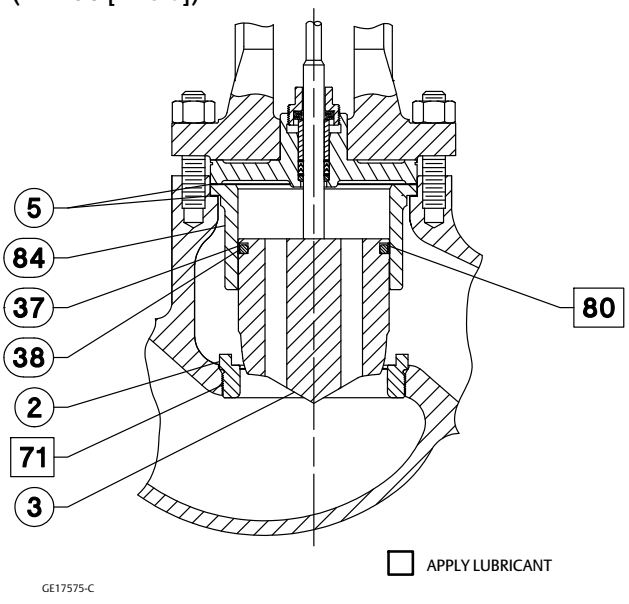


Figure 12. Fisher GX Unbalanced Port-Guided Trim
(DN40 to DN150 [NPS 1-1/2 to 6])

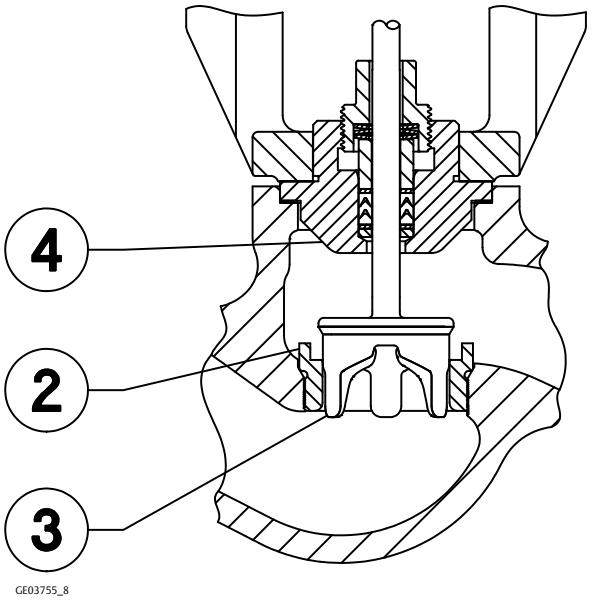


Figure 13. Fisher GX Whisper Trim™ III
(DN150 [NPS 6])

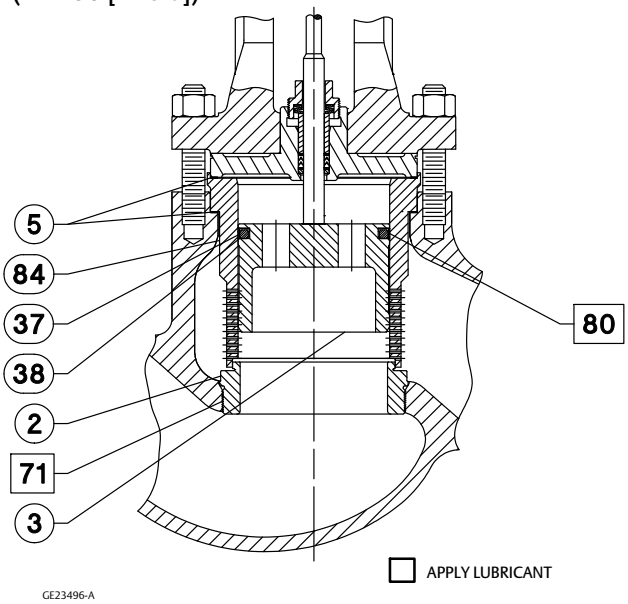


Figure 14. Fisher GX Control Valve with Typical Soft Seat Trim Construction
(Port Sizes of 36mm - 136mm)

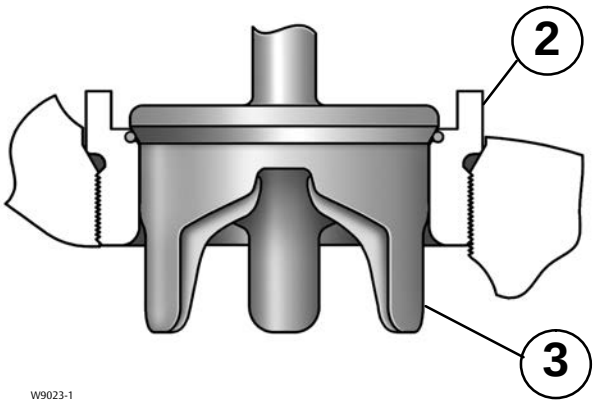


Figure 15. Fisher GX ENVIRO-SEAL PTFE Packing DN5 through DN150 (NPS 1/2 through 6)

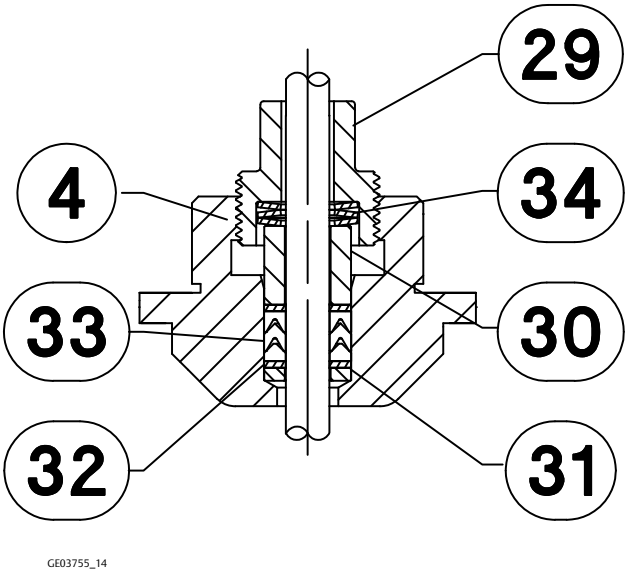


Figure 16. Fisher GX ENVIRO-SEAL Graphite ULF Packing DN15 through DN100 (NPS 1/2 through 4)

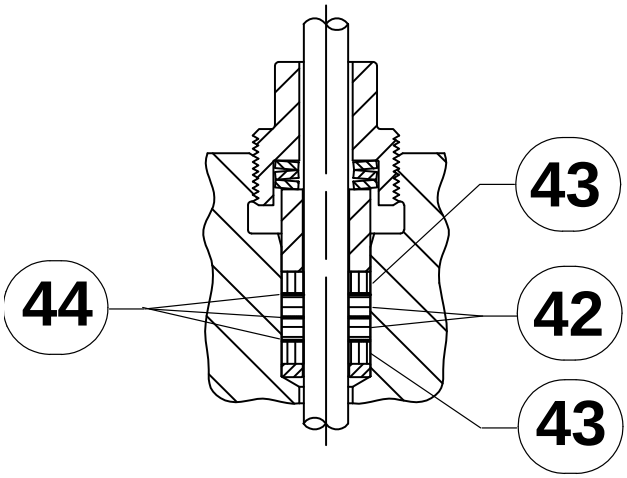


Figure 17. Fisher GX ENVIRO-SEAL Graphite ULF Packing DN150 Only (NPS 6 Only)

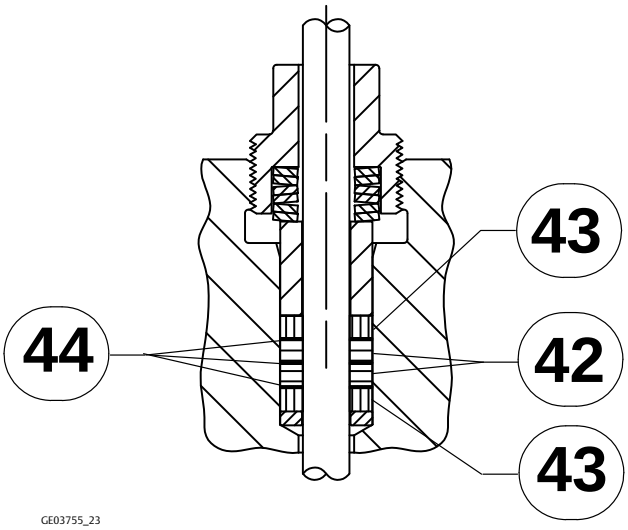


Figure 18. Fisher GX Control Valve and Actuator System Assembly, Air-to-Open (Spring-to-Close) (DN25 (NPS 1) with Unbalanced Contoured Plug)

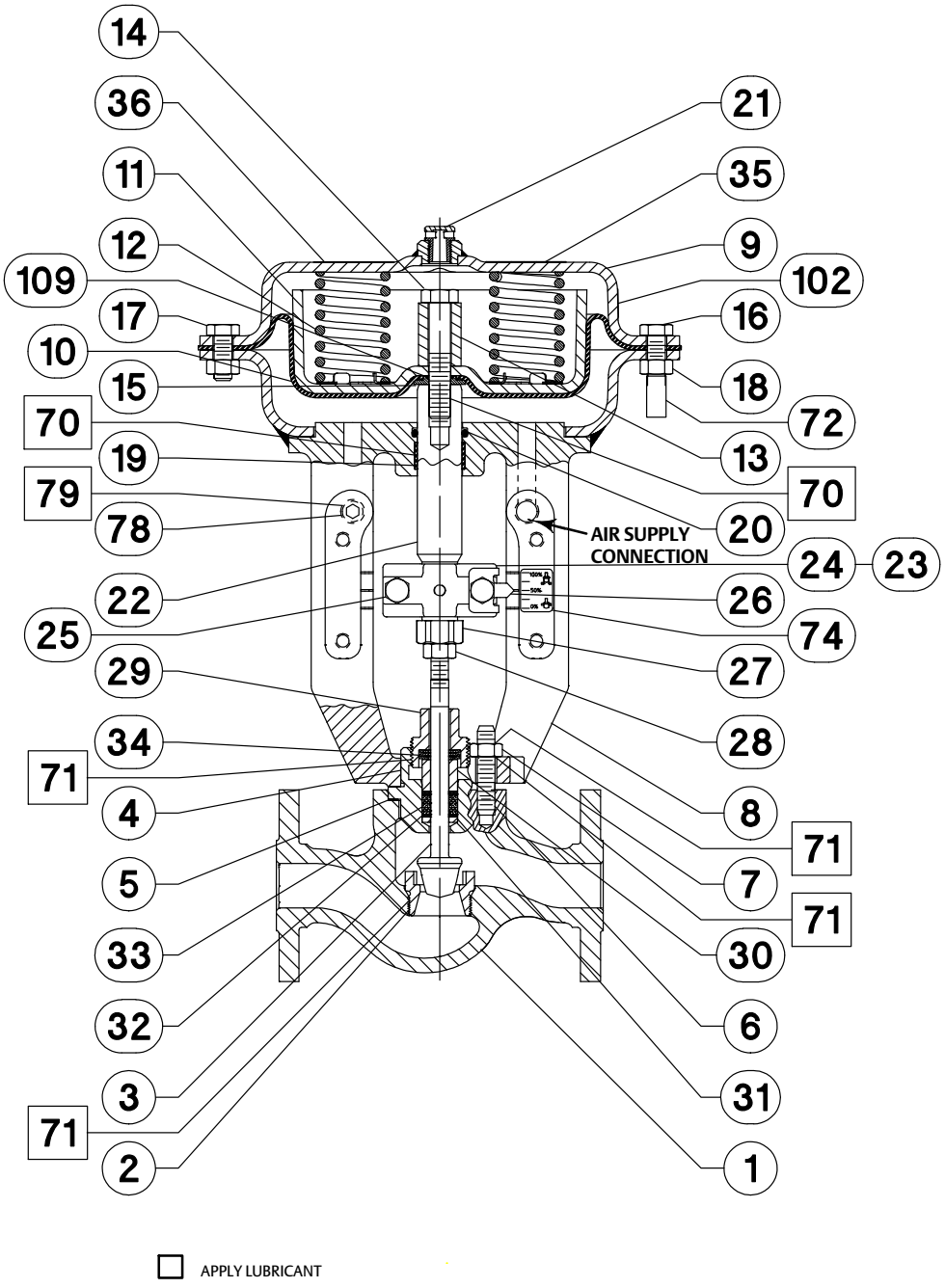


Figure 19. Fisher GX Control Valve and Actuator System Assembly, Air-to-Open (Spring-to-Close) (DN150 (NPS 6) with Unbalanced Contoured Plug)

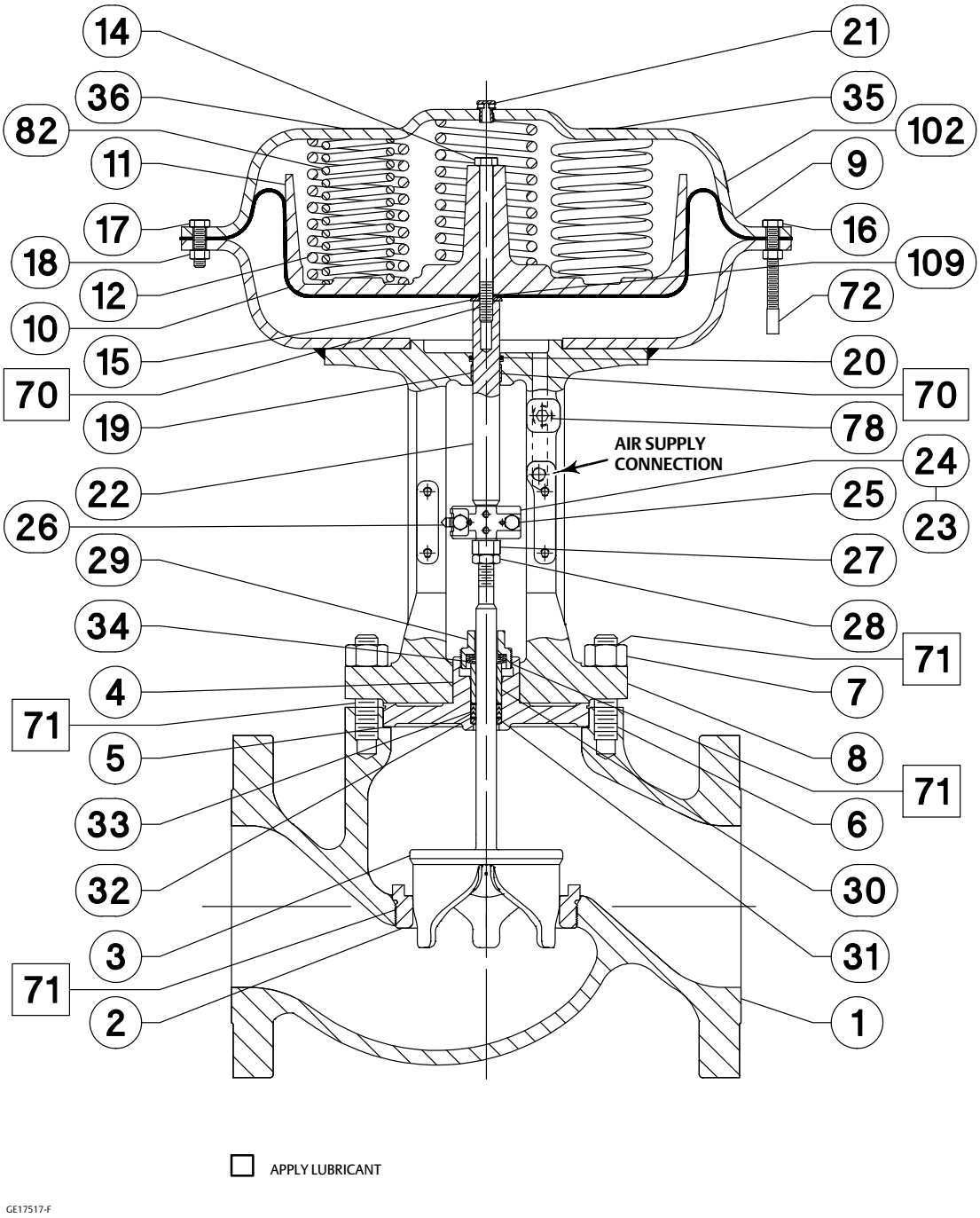


Figure 20. Fisher GX Control Valve and Actuator System Assembly, Air-to-Close (Spring-to-Open) (DN25 (NPS 1) with Unbalanced Contoured Plug)

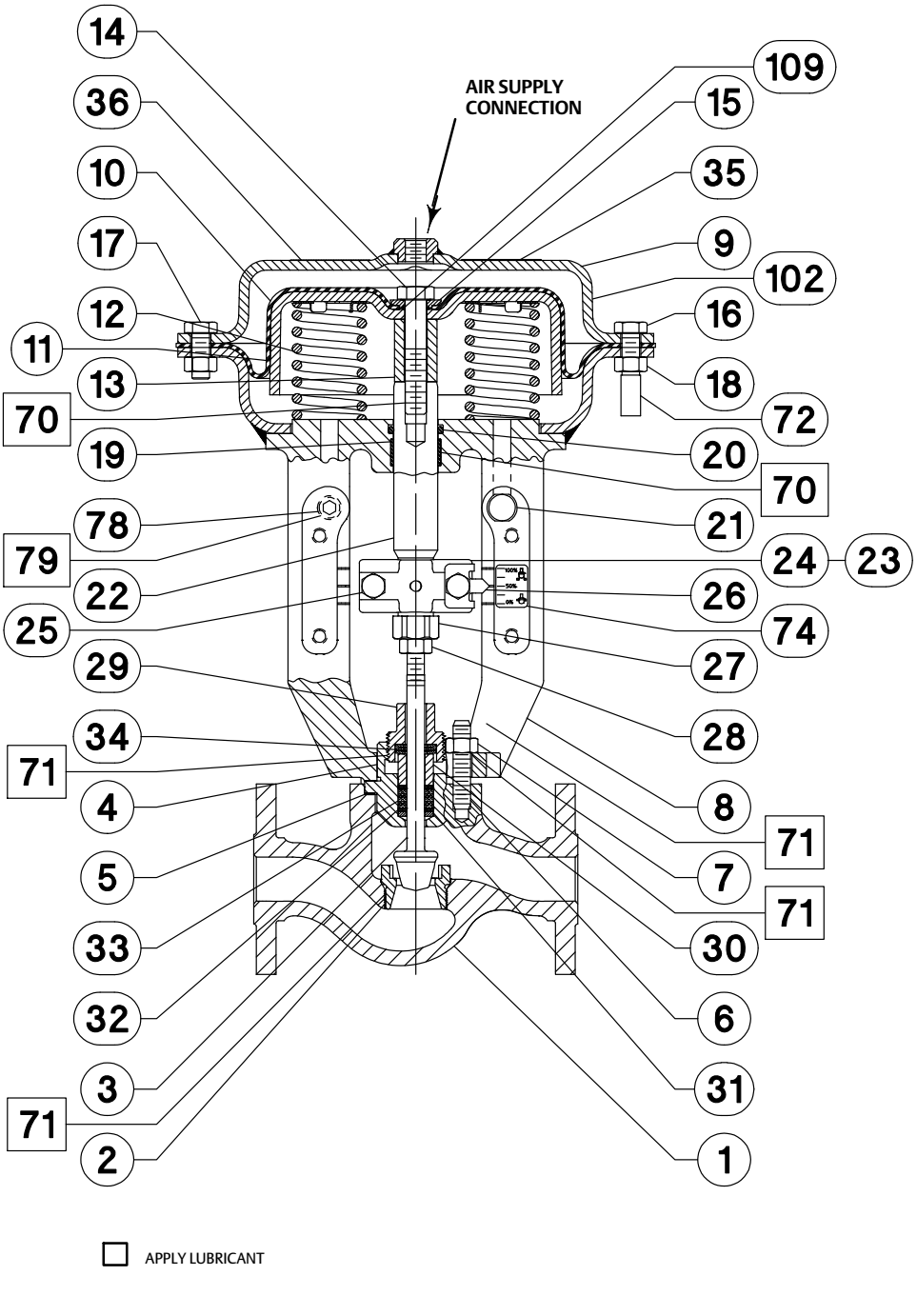


Figure 21. Fisher GX Control Valve and Actuator System Assembly, Air-to-Close (Spring-to-Open) (DN150 (NPS 6) with Unbalanced Contoured Plug)

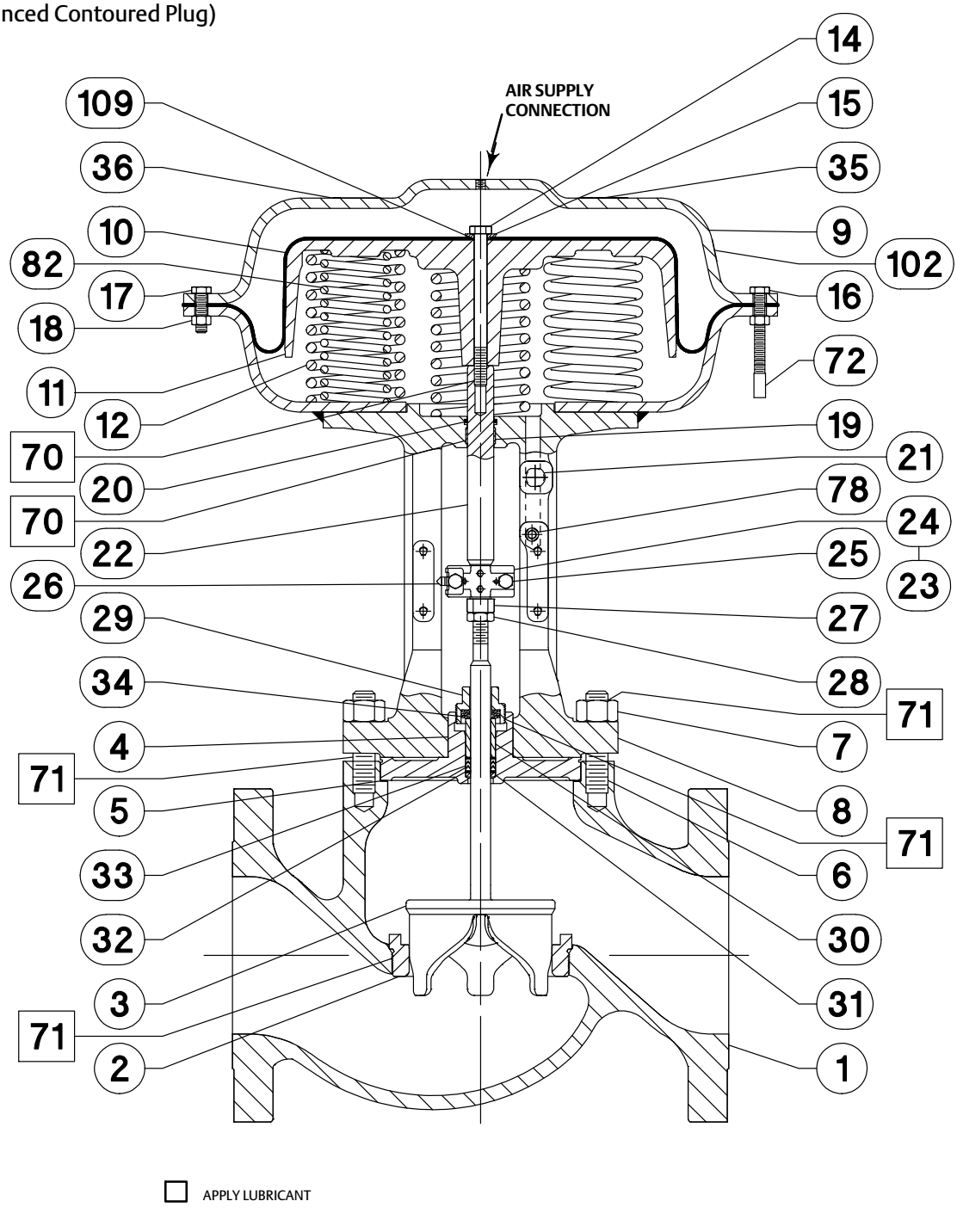


Figure 22. Extension Bonnet with ENVIRO-SEAL Graphite ULF Packing

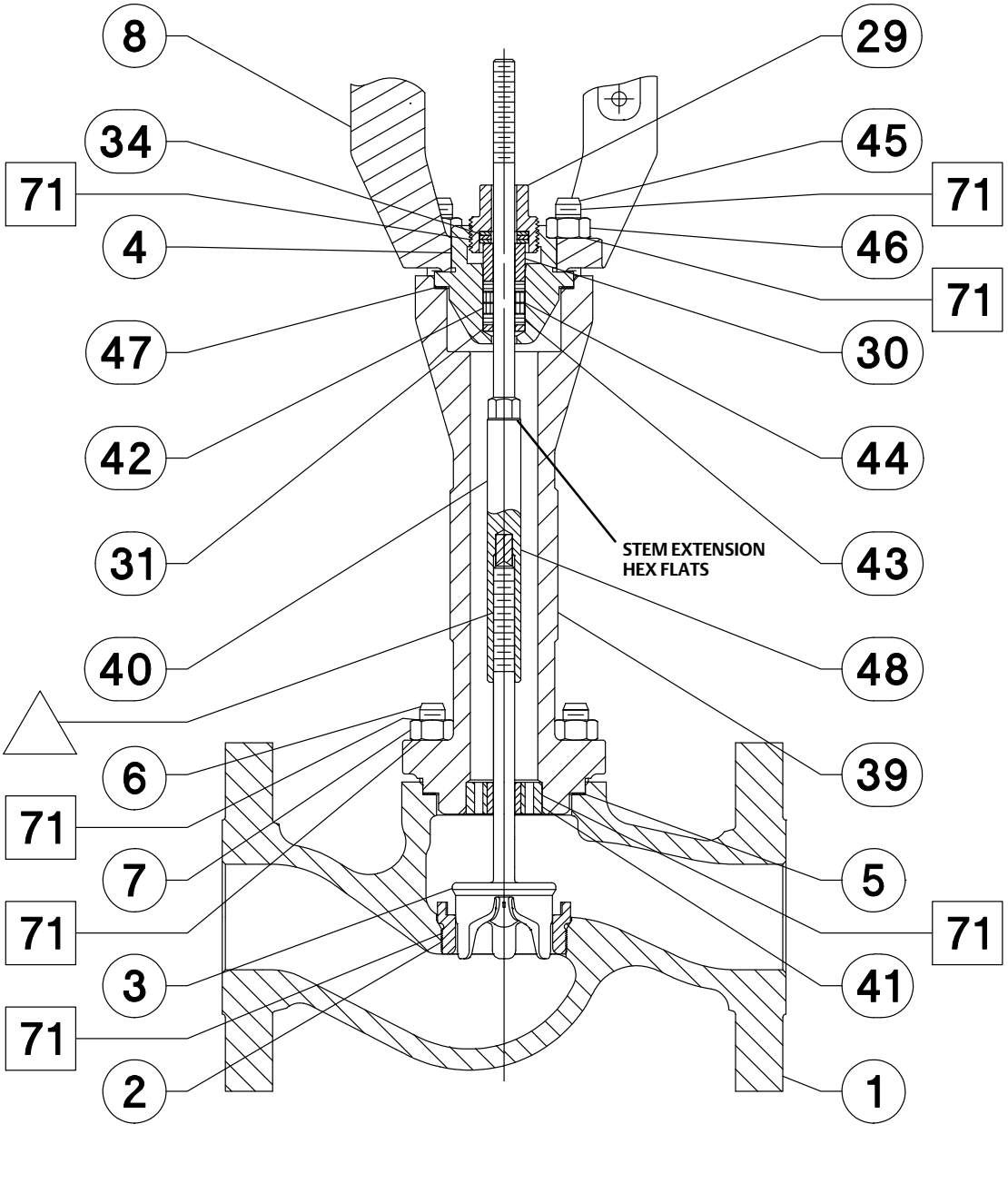


Figure 23. Bellows Extension Bonnet with ENVIRO-SEAL PTFE Packing

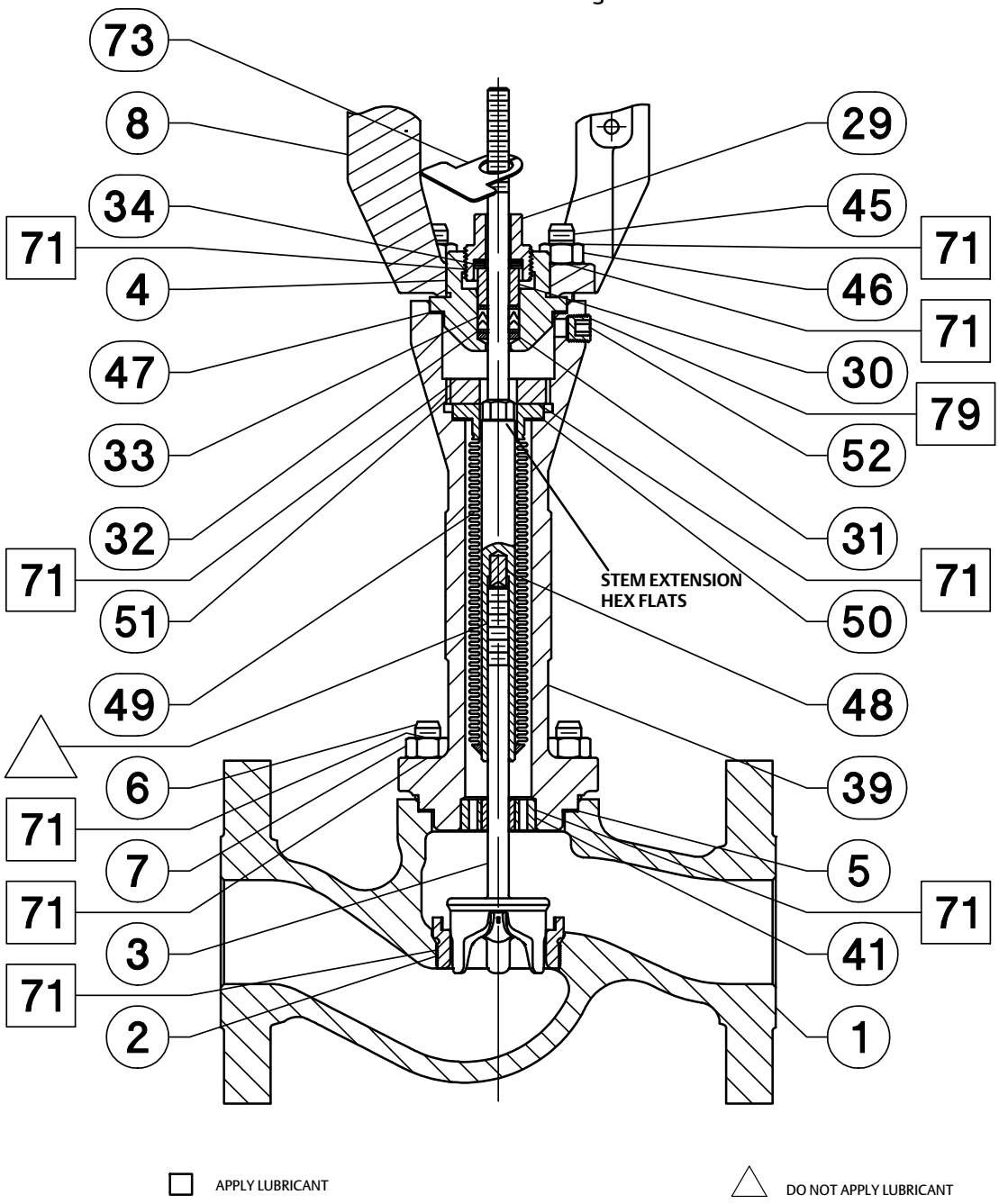


Figure 24. Cryogenic Extension Bonnet

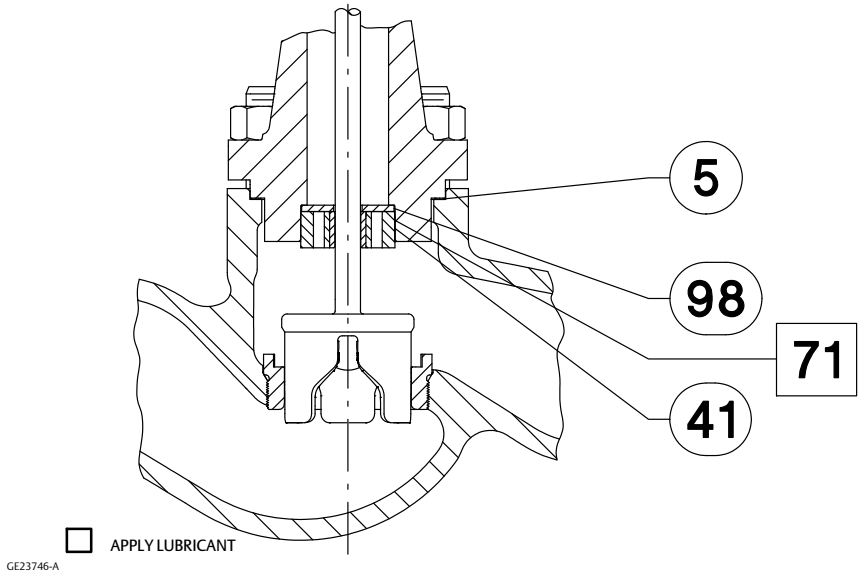


Figure 25. Fisher Cavitrol III Trim, DN25, DN40, and DN50 (NPS 1, NPS 1-1/2, and NPS 2)

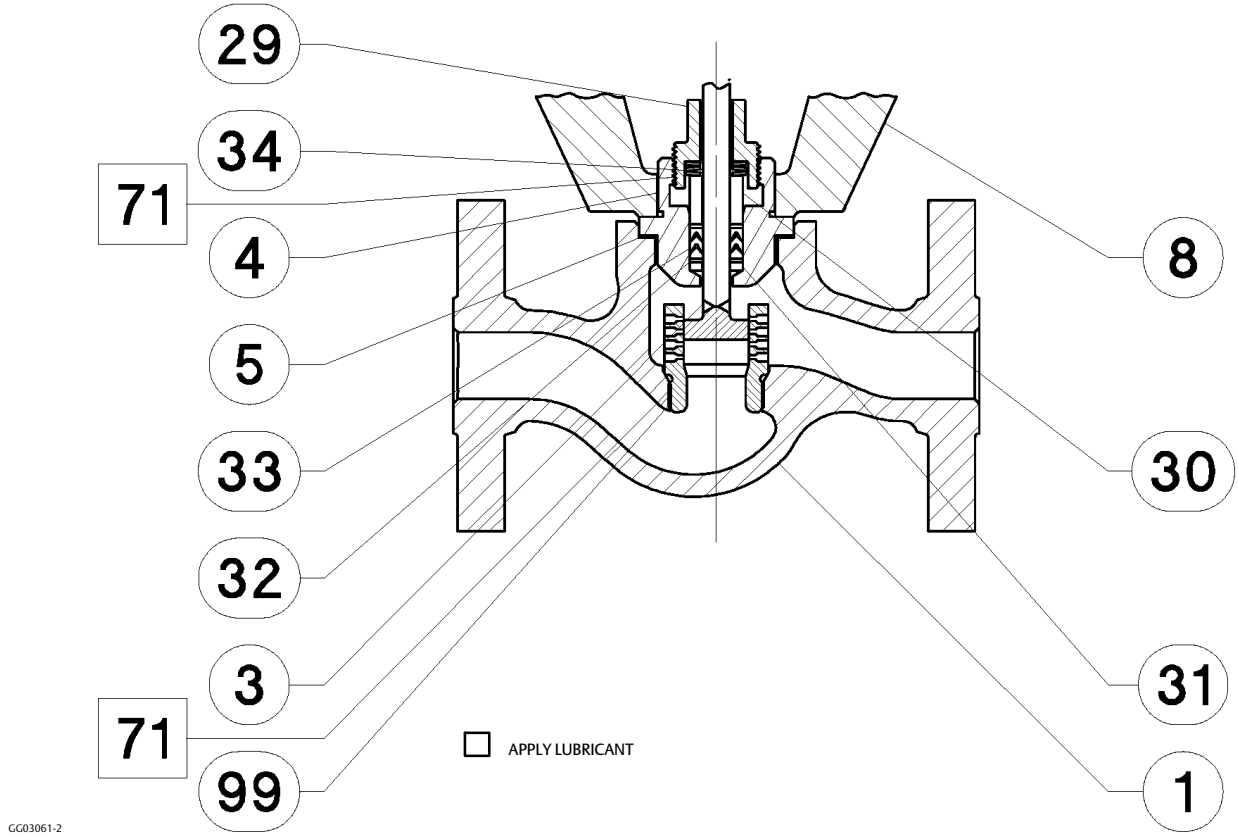
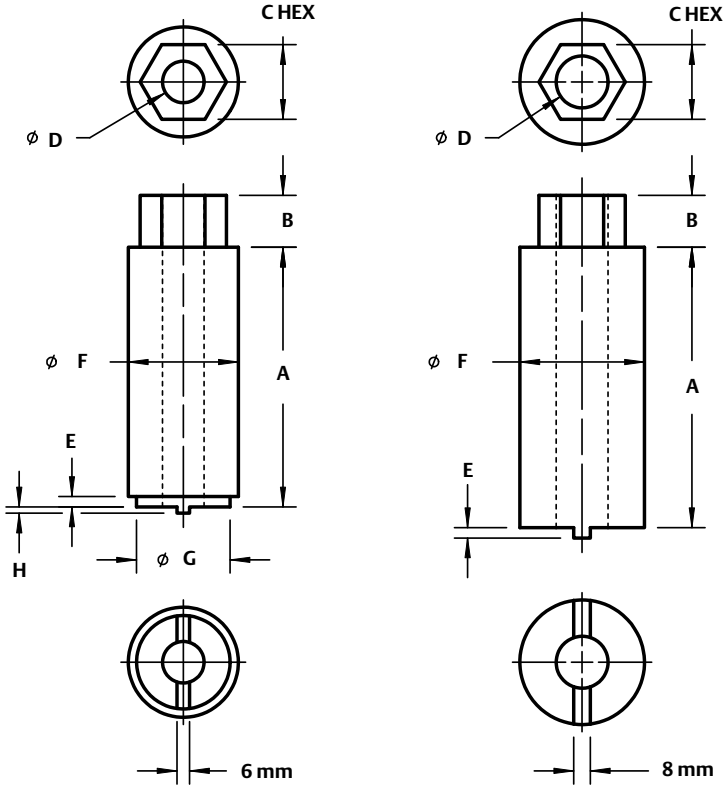


Figure 26. Bellows Nut Removal and Installation Tool



DN15, 20, 25, 40, and 50 (NPS 1/2, 3/4, 1, 1-1/2, and 2)

DN80 and 100 (NPS 3 and 4)

Table 13. Bellows Nut Removal and Installation Tool Dimensions

Valve Size		A	B	C	D	E	FØ	GØ	H
DN	NPS	mm							
15, 20, 25, 40, 50	1/2, 3/4, 1, 1-1/2, 2	125	25	36	20	5	53	45	3
80, 100	3, 4	135	25	1.42	25	5	60	---	---

Figure 27. Handwheel Assembly

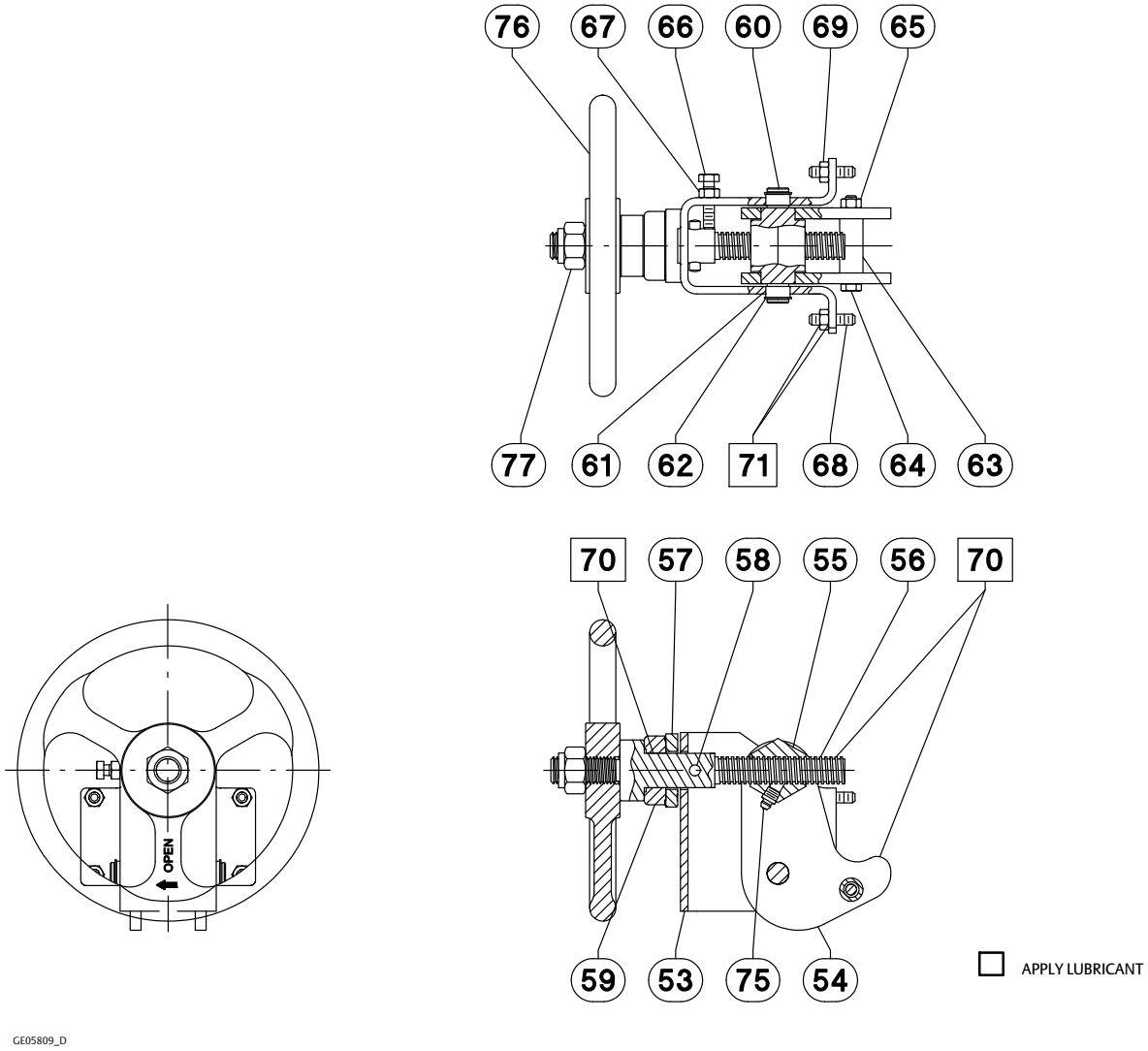


Figure 28. Fisher GX Electric Actuator Mounting

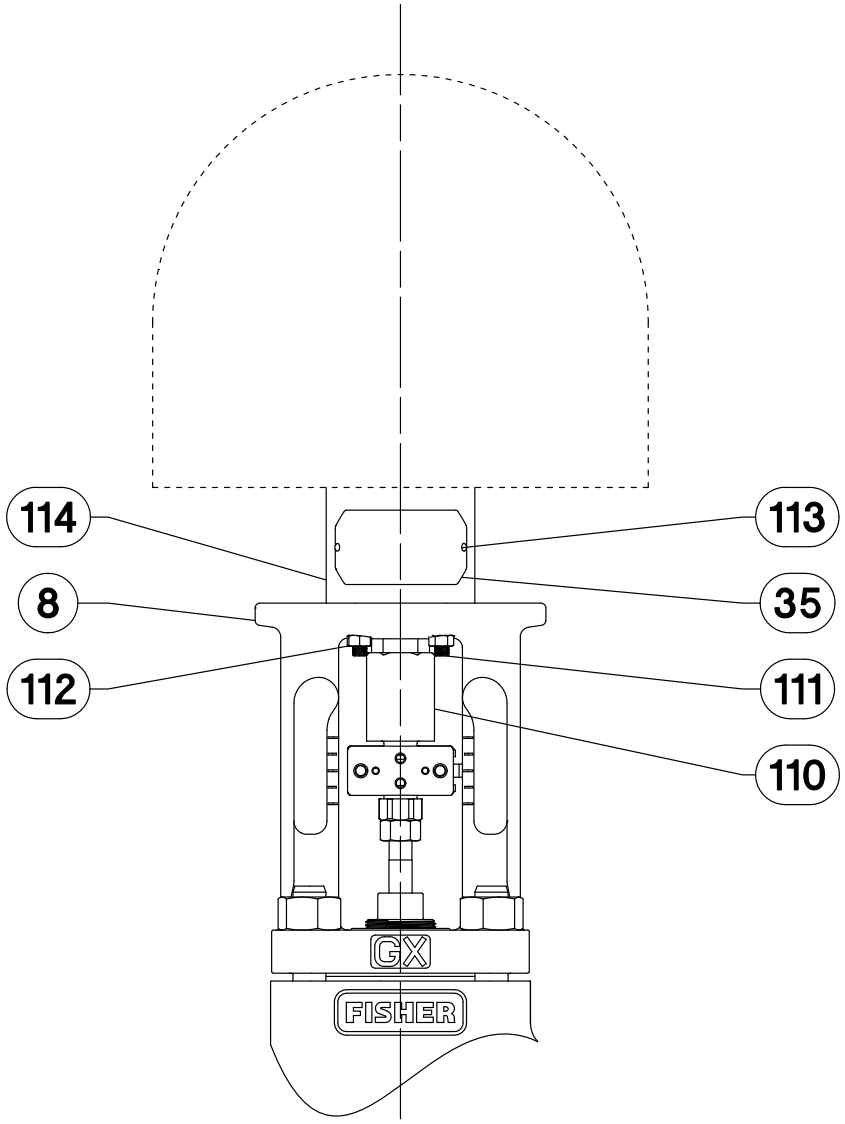
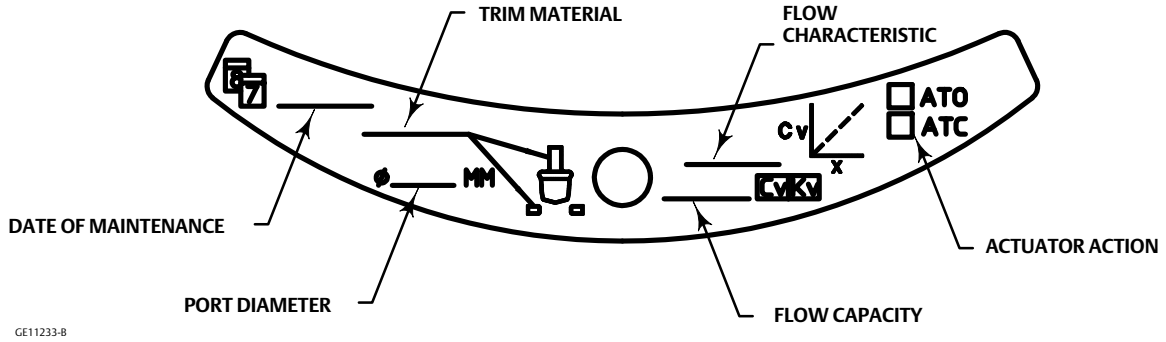


Figure 29. Repair Nameplate (Spaces Provided for Recording Trim Maintenance Data)



Parts Ordering

Each valve is assigned a serial number which can be found on the valve or on the nameplate (figure 2 and key 35, not shown). The nameplate will normally be fitted to the actuator. Refer to this serial number when contacting your Emerson Process Management sales office for technical assistance. When ordering replacement parts refer to this serial number and give the part description from the following parts list.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Process Management 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 Kits

	Valve Size Stem Diameter	DN15 to DN50 (NPS 1/2 to 2) 10 mm	DN80 and DN100 (NPS 3 and 4) 14 mm	DN150 (NPS 6) 19 mm
PACKING KITS	ENVIRO-SEAL PTFE packing (Contains keys 32 and 33)	RGXPACKX012	RGXPACKX022	RGXPACKX072
	ENVIRO-SEAL Graphite ULF packing (Contains keys 42, 43, and 44)	RGXPACKX052	RGXPACKX042	RGXPACKX082

	Actuator Size	225	750	1200
ACTUATOR KITS	Actuator (Contains keys 10, 15, 19, 109, and 20)	RGX225X0022	RGX750X0032	RGX1200X042

	Valve Size	DN80 (NPS 3)	DN100 (NPS 4)	DN150 (NPS 6)
BALANCED SEAL KITS(1)	Nitrile (Contains keys 37 and 38)	RGXSEALX012	RGXSEALX022	RGXSEALX072
	Ethylene Propylene (EPDM) (Contains keys 37 and 38)	RGXSEALX032	RGXSEALX042	RGXSEALX082
	FKM Fluorocarbon (Contains keys 37 and 38)	RGXSEALX052	RGXSEALX062	RGXSEALX092

1. A Gasket Kit is required when replacing the seals.

	Valve Size	DN15 to DN25 (NPS 1/2 to 1)	DN 40 (NPS 1-1/2)	DN 50 (NPS 2)	DN 80 (NPS 3)	DN 100 (NPS 4)	DN 150 (NPS 6)
GASKET KITS	Body / Bonnet Gasket Kit (Graphite Laminate) (Contains key 5)	GE00077X012	GE00078X012	GE00079X012	GE00080X012	GE00052X012	RGASKETXA62
	Body / Bonnet Gasket and Extension Bonnet Gasket Kit (Graphite Laminate) (Contains keys 5 and 47)	RGASKETXA12	RGASKETXA22	RGASKETXA32	RGASKETXA42	RGASKETXA52	---
	Body / Bonnet Gasket, Extension Bonnet Gasket, and Bellows Gasket (Graphite Laminate) (Contains keys 5, 47, and 50)	RGASKETXB12	RGASKETXB22	RGASKETXB32	RGASKETXB42	RGASKETXB52	---

	Description	DN15 to DN150 (NPS 1/2 to 6)
REPAIR NAMEPLATE	18-8 stainless steel nameplate. Will mount to all GX actuator sizes using casing bolt. See figure 29.	GE11233X012

Parts List

Note

Contact your Emerson Process Management sales office for part numbers.

Key	Description	
1	Valve Body	
2*	Seat Ring	
2*	Cavitrol III Cage	
3*	Valve Plug/Stem	
4	Bonnet	
5*	Body/Bonnet Gasket, graphite laminate	see gasket kits table
6	Body/Bonnet Bolting (4 req'd)	
7	Body/Bonnet Nut (4 req'd)	
8	Actuator Yoke	
9	Upper Diaphragm Casing	
10*	Diaphragm	see actuator kits table
11	Diaphragm Plate	
12	Actuator Springs	
13	Actuator Spacer	
14	Cap Screw	
15	Washer	see actuator kits table
16	Cap Screw, long	
	Size 225 Actuator (2 req'd)	
	Size 750 Actuator (2 req'd)	
	Size 1200 Actuator (4 req'd)	
17	Cap Screw, short	
	Size 225 Actuator (4 req'd)	
	Size 750 Actuator (8 req'd)	
	Size 1200 Actuator (12 req'd)	
18	Hex Nut	
	Size 225 Actuator (6 req'd)	
	Size 750 Actuator (10 req'd)	
	Size 1200 Actuator (16 req'd)	
19*	Actuator Rod Bushing	see actuator kits table
20*	Actuator Rod Seal	see actuator kits table
21	Vent Cap	
22	Actuator Rod	
23	Stem Connector Nut Half	
24	Stem Connector Bolt Half	
25	Cap Screw (2 req'd)	
26	Travel Indicator	
27	Stem Adjustor Nut	
28	Locknut	
29	Packing Follower	
30	Packing Spacer	
31*	Packing Box Ring	
32*	Anti-Extrusion Washer (2 req'd)	see packing kits table
33*	ENVIRO-SEAL PTFE Packing Set	see packing kits table
34	Belleville Spring (3 req'd)	

Key	Description	
35	Nameplate	
36	Warning Tag	
37*	Seal Ring	see balanced seal kits table
38*	Backup Ring	see balanced seal kits table
39	Extension Bonnet	
40*	Stem Extension	
41*	Extension Bonnet Lower Bushing	
42*	Graphite ULF Packing Ring (2 req'd)	see packing kits table
43*	Packing Ring (2 req'd)	see packing kits table
44*	Packing Washer (3 req'd)	see packing kits table
45	Yoke/Extension Bonnet Bolting (4 req'd)	
46	Yoke/Extension Bonnet Nut (4 req'd)	
47*	Extension Bonnet Gasket	see gasket kits table
48*	Insert (req'd for assembly of valve stem to extension stem)	
49*	Bellows/Stem Assembly	
50*	Bellows Gasket	see gasket kits table
51	Bellows Nut	
52	Pipe Plug	
53	Handjack Body	
54	Lever	
55	Operating Nut	
56	Drive Screw	
57	Pivot Washer	
58	Grooved Pin	
59	Bearing	
60	Pivot Pin	
61	Bushing	
62	Retainer Ring	
63	Spacer	
64	Cap Screw	
65	Hex Nut	
66	Lock Screw	
67	Hex Nut	
68	Stud	
69	Hex Nut	
70	Lubricant, Lithium Grease	
71	Lubricant, Anti-Seize	
72	Cap Plug	
73	Warning Tag	
74	Travel Indicator Scale	
75	Zerk Fitting	
76	Handwheel	
77	Locknut	
78	Pipe Plug	
79	Anti-seize sealant	
80	Lubricant, silicone sealant	
81	Pipe Plug	
82	Inner Actuator Spring	
84	Guide Sleeve	
84*	Whisper III Cage	
109*	O-ring	see actuator kits table
110	Rod Adaptor	
111	Stud	
112	Nut	
113	Drive Screw	
114	Electric Actuator Spacer	
115	Lead Seal and Wire (not shown)	

*Recommended spare parts
See Parts Kits

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