

# Fisher™ CL600 Control-Disk™ Rotary Valve

## Contents

Introduction .....	1
Scope of Manual .....	1
Description .....	1
Specifications .....	2
Educational Services .....	2
Installation .....	4
Maintenance .....	9
Packing Maintenance .....	10
Replacing the Seal Ring Assembly .....	13
Replacing the Disk, Shafts, or Bearings .....	15
Actuator Mounting .....	20
Parts Ordering .....	21
Parts Kits .....	21
Parts List .....	21

Figure 1. Fisher CL600 Control-Disk Valve with 2052 Actuator and DVC6200 Digital Valve Controller



X0955-1

## Introduction

### Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Fisher CL600 Control-Disk valve, NPS 3 through NPS 24 (figure 1). Refer to separate instruction manuals for information covering the power actuator and accessories.

Do not install, operate, or maintain a CL600 Control-Disk 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 sales office](#) or Local Business Partner before proceeding.

### Description

The Fisher CL600 Control-Disk valve maintains tight shutoff, and can be specified for a wide range of pressure and temperature conditions.

The CL600 Control-Disk valve is available in a lugged body design. A splined shaft can combine with a variety of spring-and-diaphragm or pneumatic piston actuators. A keyed shaft option is available for larger sizes and can combine with a variety of pneumatic piston actuators. These combinations help make the CL600 Control-Disk valve a reliable rotary control valve for control applications in the process industries.

Table 1. Fisher CL600 Control-Disk Valve Specifications

Specifications	ASME
Valve Body Size	NPS 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24
Pressure Rating	CL600 per ASME B16.34
Valve Body Materials	WCC or CF8M (std)
	LCC, CD3MN, M35-2, and CW2M
Disk Materials	CF8M (std), CD3MN, M35-2, and CW2M
Disk Edge Coating	Chrome Plate (std)
	Chrome Coat
	Chromium Carbide Coating
End Connections	Mates with RF Flanges per ASME B16.5 Optional construction mates with RTJ Flanges per ASME B16.5
Valve Body Style	Lugged (Single Flange) or Lugged with drilled through flange holes
Shaft Connection Style	NPS 3-24: Splined (std) NPS 14-24: Keyed
Face-to-Face Dimensions	Meets MSS SP68, API 609, ASME B16.10, EN 558 standards; Double Flanged upon request
Shutoff	Soft Seal: Class VI
	Metal Seal: Class IV, reverse direction only
	Phoenix III Seal: Class VI; reverse direction preferred, forward direction optional
	High Pressure Seal: Class VI, reverse direction only
Flow Direction	Standard (reverse flow) is with the flow into the shaft side of the disk
Flow Characteristic	Linear
Disk Rotation	Clockwise (CW) to close

## Educational Services

For information on available courses for Fisher CL600 Control-Disk valves, as well as a variety of other products, contact:

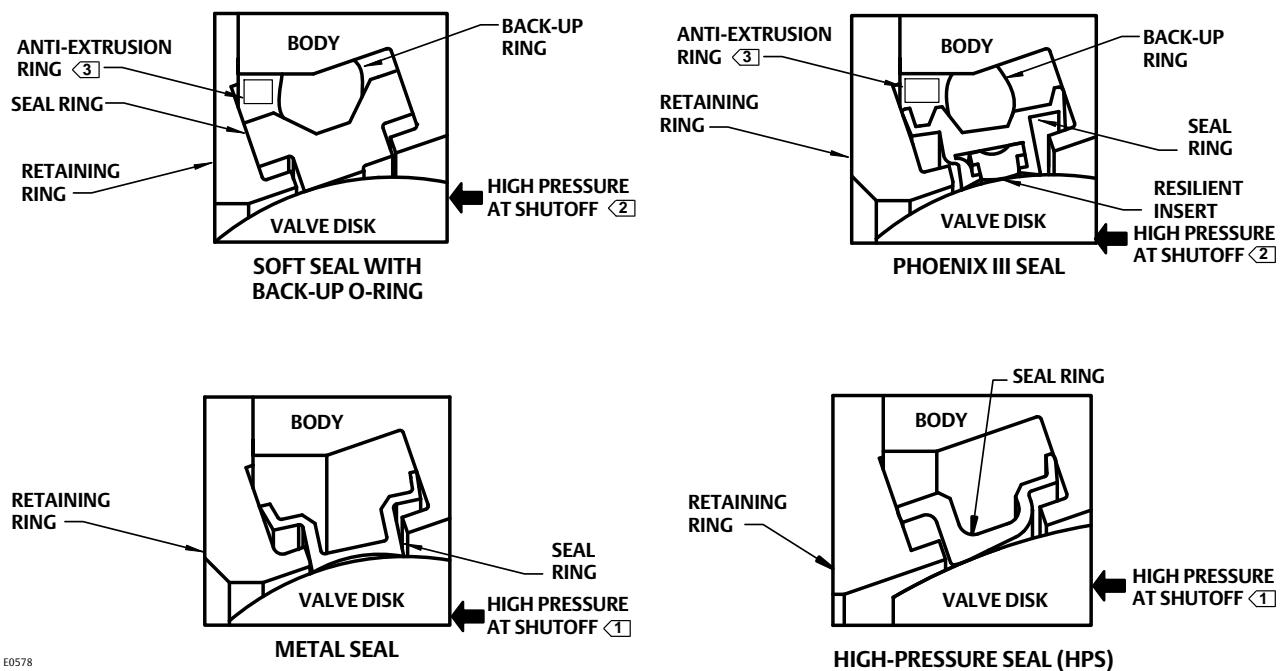
Emerson Automation Solutions  
 Educational Services - Registration  
 Phone: 1-641-754-3771 or 1-800-338-8158  
 E-mail: education@emerson.com  
 emerson.com/fishervalvetraining

Table 2. Valve Size, Shaft Diameter, and Approximate Weight

VALVE SIZE	SHAFT DIAMETER AT PACKING		SHAFT DIAMETER AT ACTUATOR <sup>(1)</sup>		APPROXIMATE WEIGHT	
	NPS	mm	Inches	mm	Inches	kg
3	15.9	5/8	15.9	5/8	10.8	24
4	19.1	3/4	19.1	3/4	21.6	48
6	31.8	1-1/4	31.8	1-1/4	45.5	101
8	38.1	1-1/2	38.1	1-1/2	80.2	178
10	50.8	2	44.5	1-3/4	157	348
12	57.2	2-1/4	50.8	2	213	473
14	63.5	2-1/2	63.5	2-1/2	281	624
16	76.2	3	63.5	2-1/2	395	876
18	88.9	3-1/2	76.2	3	563	1250
20	101.6	4	76.2	3	721	1600
24	114.3	4-1/2	76.2	3	100	2220

1. Fisher actuator.

Figure 2. Available Seal Configurations



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Notes:

- 1 This unidirectional seal must be installed so that the retaining ring is downstream from the high pressure side of the valve at shutoff, as shown.
- 2 For this bidirectional seal, the "preferred" valve orientation places the retaining ring downstream from the high pressure side of the valve at shutoff.
- 3 NPS 3 only.

Table 3. Maximum Allowable Inlet Pressure for CW2M Valves

TEMPERATURE	CW2M <sup>(1)</sup>	
	600 <sup>(2)</sup>	
°C	Bar	
-29 to 38	103.4	
93	103.4	
149	100.3	
204	96.2	
260	91.7	
316	83.4	
371	78.3	
427	70.0	
482	62.1	
538	50.0	
°F	Psig	
-20 to 100	1500	
200	1500	
300	1455	
400	1395	
500	1330	
600	1210	
700	1135	
800	1015	
900	900	
1000	725	

1. This material is not listed in ASME B16.34. Also see the Installation section.

2. The designation 600 is used only to indicate relative pressure-retaining capabilities and is not an ASME pressure-temperature rating class designation.

Table 4. Material Temperature Ranges

PART NAME	MATERIAL	TEMP °C	TEMP °F
Valve Body	WCC Steel	-29 to 427	-20 to 800
	CF8M <sup>(1)</sup>	-254 to 538	-425 to 1000
	LCC	-45 to 343	-50 to 650
	CD3MN	-51 to 316	-60 to 600
	M35-2	-198 to 482	-325 to 900
	CW2M <sup>(1)</sup>	-198 to 538	-325 to 1000
Disk	CF8M with Chrome Plated Disk Edge	-254 to 427	-425 to 800
	CF8M with Chrome Coated Disk Edge <sup>(1)</sup>	-254 to 538	-425 to 1000
	CF8M with Chromium Carbide Disk Edge <sup>(1)</sup>	-254 to 538	-425 to 1000
	CD3MN (no plating) <sup>(2)</sup>	-51 to 316	-60 to 600
	M35-2 (no plating) <sup>(2)</sup>	-198 to 482	-325 to 900
	CW2M (no plating) <sup>(1)(2)</sup>	-198 to 538	-325 to 1000
Shaft	S17400 (H1025)	-46 to 427	-50 to 800
	S20910 <sup>(1)</sup>	-198 to 538	-325 to 1000
	S31803	-51 to 316	-60 to 600
	N05500	-198 to 482	-325 to 900
	N10276	-198 to 538	-325 to 1000
	N07718 <sup>(1)</sup>	-254 to 538	-425 to 1000
Bearings	PEEK <sup>(1)</sup>	-73 to 149	-100 to 300
	S31600 Nitrided <sup>(1)</sup>	-254 to 538	-425 to 1000
	R30006 (Alloy 6) <sup>(1)</sup>	-198 to 538	-325 to 1000
Seal	<b>ETFE Soft Seal Ring</b>		
	ETFE Soft Seal Ring with FKM Backup Ring	-29 to 149	-20 to 300
	ETFE Soft Seal Ring with EPR Backup Ring	-54 to 149	-65 to 300
	<b>S20910/ETFE Phoenix III Seal Ring</b>		
	S20910/ETFE Phoenix III Seal Ring with FKM Backup Ring	-40 to 149	-40 to 300
	S20910/ETFE Phoenix III Seal Ring with EPR Backup Ring	-62 to 149	-80 to 300
	<b>Metal Seal</b>		
	S21800 <sup>(1)</sup>	-198 to 538	-325 to 1000
	S20910 <sup>(1)</sup>	-198 to 538	-325 to 1000
	<b>High Pressure Seal</b>		
	S21800 Nitrided	-198 to 538	-325 to 1000
S20910 Nitrided	-198 to 538	-325 to 1000	
Packing	PTFE /Carbon-filled PTFE (standard)	-45 to 232	-50 to 450
	ENVIRO-SEAL™ PTFE	-45 to 232	-50 to 450
	Graphite Die-molded Ribbon	-198 to 538	-325 to 1000
	ENVIRO-SEAL Graphite	-198 to 371	-325 to 700

1. The maximum temperature for a standard of the CL600 Control-Disk valve is 538°C (1000°F). Contact your [Emerson sales office](#) or Local Business Partner for use in higher temperature applications

2. For use with soft seal only.

## Installation

Key numbers in this procedure are shown in figures 11, 12, and 13 unless otherwise indicated.

### **⚠ WARNING**

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

**To avoid personal injury or property damage resulting from the bursting of pressure retaining parts, be certain the service conditions do not exceed either the valve body rating or the flange joint rating, or other limits given in table 4 or on the nameplate. Use pressure-relieving or pressure-limiting devices to prevent the service conditions from exceeding these limits.**

**If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section on page 9 in this manual.**

**CAUTION**

The valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions specified in the customer's order. Because some valve body/trim material combinations are limited in their pressure drop and temperature range capabilities, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#) or Local Business Partner.

The maximum allowable inlet pressures for steel and stainless steel valve bodies are consistent with the pressure-temperature ratings shown in table 1, except where further limited by the trim and packing material temperature capabilities given in table 4. Valves are also available in CW2M valve body materials. The CW2M valve body material is not listed in ASME B16.34. Valve bodies constructed of this material mates with ASME flanges, but must not be installed in systems requiring conformance to ASME standards if not included in ASME pressure/temperature ratings. Maximum allowable inlet pressures for CL600 Control-Disk valve bodies made of CW2M construction materials are shown in table 3.

1. Install a three-valve bypass around the control valve assembly if continuous operation is necessary during inspection and maintenance of the valve body.
2. Inspect the valve body to be certain it is free of foreign material.
3. The valve is normally shipped as part of a control valve assembly, with an actuator mounted on the valve body.

If the valve body and actuator have been purchased separately or if the actuator has been removed for maintenance, mount the actuator, and adjust actuator travel to close the valve before inserting the valve body into the line. This is necessary due to the measurements that must be made during the actuator adjustment process. Refer to the Actuator Mounting section on page 20 of this manual and to the separate actuator instruction manual for mounting and adjusting instructions before proceeding.

4. Inspect adjacent pipelines to be certain they are free of any foreign material, such as pipe scale or welding slag, that could damage the valve body seating surfaces.

**CAUTION**

Damage to the disk (key 6) will occur if any pipe flanges or piping connected to the valve body interfere with the disk rotation path. However, the disk can be rotated without interference when the valve body is installed between adjacent pipe flanges or piping that has an inside diameter equal to or greater than either schedule 80 pipe or compatible EN pipe sizes. If piping with a smaller inner diameter than specified above is connected to the valve, measure carefully to be certain the disk rotates without interference before putting the valve into operation.

5. Flow is in the standard direction when the seal retainer (key 16) is facing downstream. Standard flow direction is also indicated by the flow direction arrow cast into the valve body. Flow in the forward direction is permissible within allowable pressure drop limits with the proper seal.

**CAUTION**

CL600 Control-Disk disk rotation is counterclockwise to open (when viewed from the actuator side of the valve body, see figure 10) through 90 degrees of disk rotation.

6. With the disk in the closed position, install line flange gaskets, and insert the valve between the pipeline flanges. Use either flat sheet gaskets or spiral-wound gaskets with compression-controlling centering rings. Spiral-wound gaskets without compression-controlling centering rings are not recommended for this purpose.

## Lifting Guidelines

Threaded holes for lifting are standard on the NPS 6 - 24 valve bodies. It is required that swivel hoists rings be used to lift the valve or valve and actuator assembly. An eyebolt cannot accommodate all lifting angles required to install or maintain the valve. The load carrying capability of an eyebolt decreases dramatically if used in any other orientation than axially. Therefore, the use of eyebolts is not permitted.

### CAUTION

Care must be taken when lifting the valve/actuator assembly to ensure the accessories and tubing are not damaged in the process. The valve weight is listed in table 2. For the actuator weight, refer to the appropriate instruction manual. Make sure to use appropriate lifting straps/hoists capable of lifting this combined weight.

### ⚠ WARNING

Avoid personal injury or property damage caused by uncontrolled movement or dropping of the valve assembly.

Ensure the disk is secure from rotating during lifting process. Failure to do so could result in personal injury if the disk rotates uncontrolled during lifting.

Swivel Hoist rings are sized to lift only the valve and actuator. Do not attach piping or other structures to the valve and actuator assembly when lifting with swivel hoists rings.

Take appropriate precautions to avoid unbalanced loading which may result in sudden swinging or movement of the assembled unit, including additional lifting and/or support methods when necessary.

Do not use eyebolts when lifting the valve or valve and actuator assembly due to variable loading angles inherent to valve maintenance and installation.

Failure to utilize safe lifting practices may result in equipment damage and/or personal injury.

## Lifting Valve/Actuator Assembly

To lift the assembly, install swivel hoist rings into one or two of the threaded holes on the valve body (see figure 3). Thread sizes are listed in table 5. When lifting the valve and actuator assembly, a strap around the actuator may be required to ensure lifting stability. If straps are used on the actuator, ensure the lifting location is above the center of gravity (CG) for the actuator to prevent load shifting during lifting. Refer to the appropriate assembly drawings for the CG for your assembly.

## Lifting Valve Only

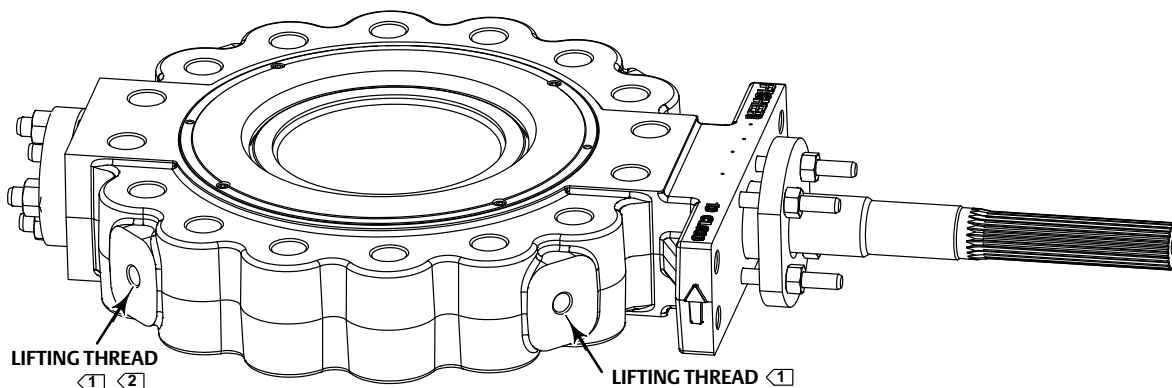
To lift the valve, insert two swivel hoist rings into the body. Thread sizes are listed in table 5. Ensure the valve is closed and that the packing is tightened to prevent shaft rotation during lifting. Without an actuator, the valve disk is free to rotate if enough momentum is generated during the lifting process by a sudden stop. The packing and seal friction should prevent the disk from rotating; however take proper precaution when lifting the valve.

7. Insert the valve between the flanges and install two or more line flange studs into the line flanges to help hold the valve in position while centering the valve. Carefully center the valve on the flanges to ensure disk clearance.

### Note

Lubricate line flange studs before inserting them into flanges. If necessary, provide additional support for the control valve assembly because of its combined weight.

Figure 3. Lifting Thread Locations (NPS 10 shown)



Notes:

- 1 Holes on opposite side are identical.
- 2 NPS 10-24 only.

Table 5. Valve Body Lifting Thread Information

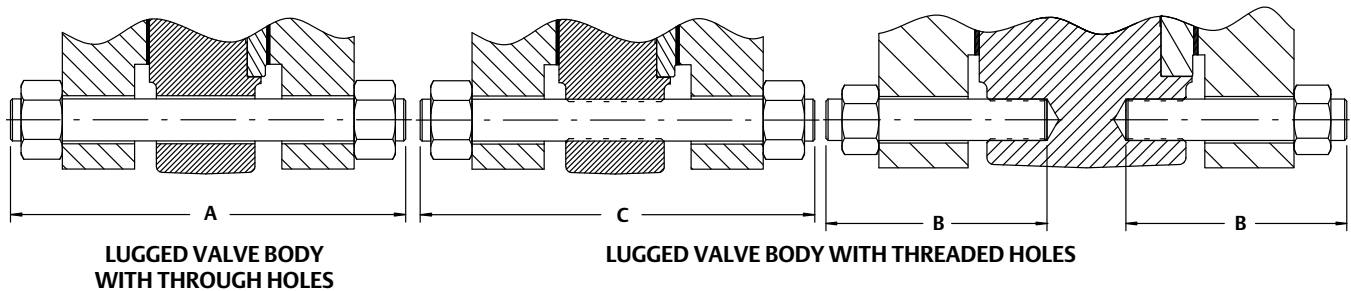
NPS	NUMBER OF THREADED HOLES	THREAD SIZE		
		Inches	mm	Inches
6	2	3/4 - 10	41.9	1.65
8	2			
10	4			
12	4	1 - 8	55.9	2.20
14	4			
16	4			
18	4	1-1/4 - 7	68.8	2.71
20	4			
24	4			
		1-1/2 - 6	82.8	3.26

Table 6. Recommended Line Bolting Lengths

VALVE SIZE	LUGGED BODY WITH THROUGH HOLES					LUGGED BODY WITH THREADED HOLES					
	NPS	Size Dia & Thread, Inch	No. of Stud Bolts	A Dimension, Inch	Next to Shaft Bore		No. of Stud Bolts	C Dimension, Inch	No. of Stud Bolts	B Dimension <sup>(1)</sup> , Inch	Next to Shaft Bore
No. of Stud Bolts					B Dimension <sup>(1)</sup> , Inch	No. of Stud Bolts					B Dimension <sup>(1)</sup> , Inch
3	3/4 - 10	8	7.5	---	---	8	7.5	---	---	---	---
4	7/8 - 9	8	9	---	---	8	9	---	---	---	---
6	1 - 8	12	10.5	---	---	12	10.5	---	---	---	---
8	1-1/8 - 8	12	12.5	---	---	12	12.5	---	---	---	---
10	1-1/4 - 8	12	13.5	8	6	---	---	24	7.5	8	6
12	1-1/4 - 8	16	14.5	8	6	---	---	32	7.5	8	6
14	1-3/8 - 8	16	15.75	8	6.5	---	---	32	8	8	6.5
16	1-1/2 - 8	16	17.25	8	7	---	---	32	8.5	8	7
18	1-5/8 - 8	16	19	8	7.5	---	---	32	9	8	7.5
20	1-5/8 - 8	20	20	8	8	---	---	40	9.5	8	8
24	1-7/8 - 8	20	22.25	8	9	---	---	40	11	8	9

1. Full stud thread engagement as shown in figure 4.

Figure 4. Stud Bolts for Installation (also see table 6)



### ⚠ WARNING

For lugged valve bodies with threaded line bolt holes, personal injury and property damage could result from sudden release of process pressure if line bolts are not properly installed. To ensure proper line bolt thread engagement, line studs must be centered in the threaded section of the valve body so that each stud has equal thread engagement in the body. See figure 4.

8. After centering the valve body, first lubricate and then install the remaining line flange bolting to secure the valve in the pipeline. Tighten the nuts to the line flange studs in a crisscross pattern to ensure proper alignment of valve, gaskets, and flanges.

### ⚠ WARNING

A CL600 Control-Disk valve body is not necessarily grounded when installed in a pipeline. If the valve is used in a flammable or hazardous atmosphere or for oxygen service, an explosion could result due to a discharge of static electricity from the valve components. To avoid personal injury or property damage, always make sure the valve body is grounded to the pipeline before putting the control valve assembly into operation in a flammable or hazardous atmosphere.

#### Note

Standard packings for the CL600 Control-Disk valve are composed of all conductive packing rings (graphite ribbon packing) or partially conductive packing rings (such as a carbon-filled PTFE female adaptor with PTFE V-ring packing) to electrically bond the shaft to the valve body for hazardous area service. For oxygen service applications, provide alternate shaft-to-valve body bonding according to the following step.

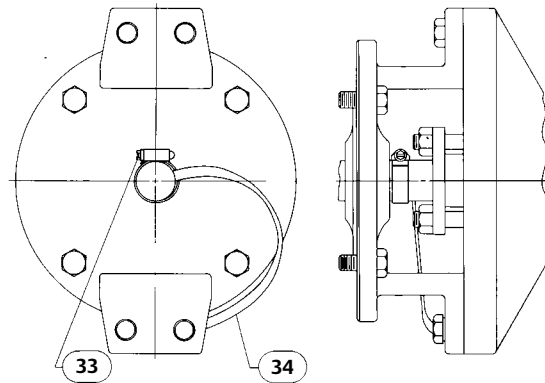
9. For oxygen service applications, attach the bonding strap assembly (key 34, figure 5) to the shaft with the clamp (key 33, figure 5), and connect the other end of the bonding strap assembly to the valve body with the cap screw (key 31).

### ⚠ WARNING

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



Figure 5. Optional Shaft-to-Valve Body Bonding Strap Assembly



Valves with ENVIRO-SEAL packing systems will not require this initial re-adjustment. See ENVIRO-SEAL Packing System for Rotary Valves Instruction Manual ([D101643X012](#)) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the parts kit sub-section on page 21 of this manual.

## Maintenance

Valve body parts are subject to normal wear and must be inspected regularly and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions. Instructions are given in this section for: replacing trim components, changing disk rotation or valve action, and mounting and adjusting the actuator.

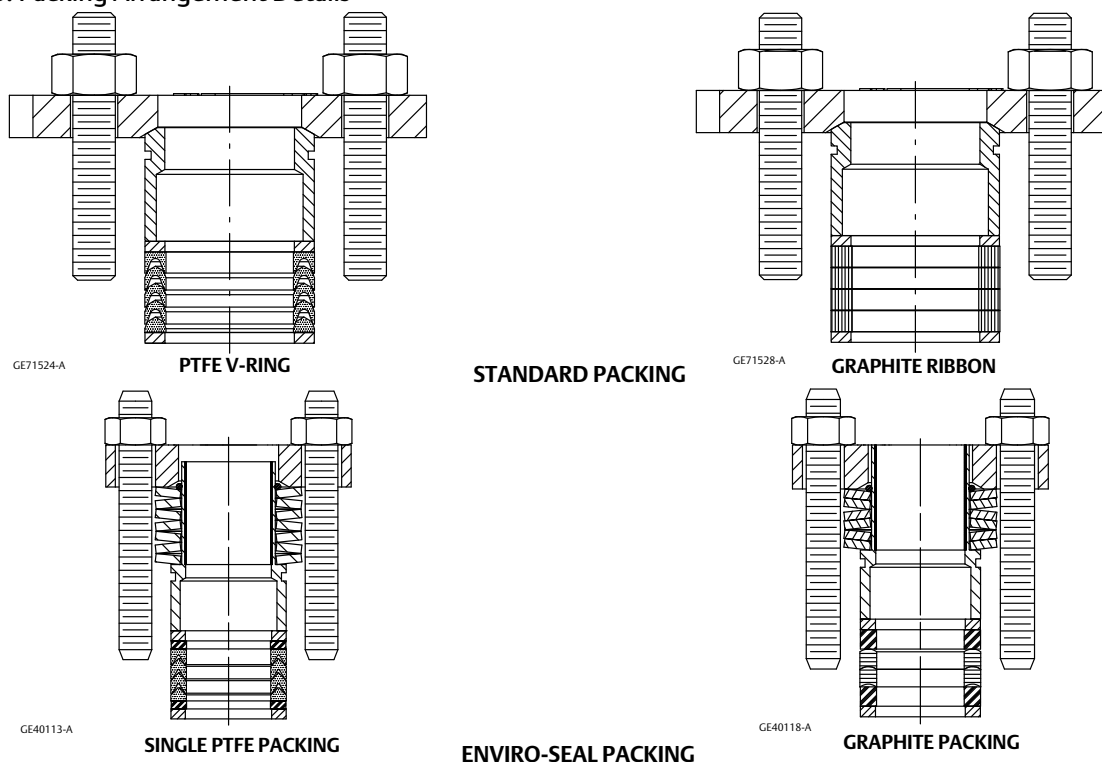
As used in these instructions, actuator refers to power actuators (such as pneumatic diaphragm, piston actuators, and rack and pinion actuators).

### **⚠ WARNING**

**Avoid personal injury and 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.
- 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 on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any spring precompression.
- Use lock-out procedures to be sure 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 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.

Figure 6. Packing Arrangement Details



NOTES:

1 WITH CONDUCTIVE PACKING, THE FEMALE ADAPTOR IN PTFE V-RING PACKING IS CARBON-FILLED PTFE.

## Packing Maintenance

Refer to figure 6 for available packing configurations. All maintenance operations in this section may be performed with the valve in the line. Packing may be PTFE V-ring or graphite.

An ENVIRO-SEAL packing system is also available with the CL600 Control-Disk valve. To install the ENVIRO-SEAL packing system in an existing valve, follow the instructions in the instruction manual included with the packing system ([D101643X012](#)). To remove packing parts in a valve with the ENVIRO-SEAL packing system, follow the procedures for valves with the ENVIRO-SEAL packing system in this section. Install the replacement packing following the instructions in the packing system instruction manual ([D101643X012](#)).

### Stopping Leakage

For valves with PTFE or graphite packing:

#### CAUTION

**Tighten the packing flange only enough to prevent shaft leakage. Excessive tightening will only accelerate wear of the packing and could produce higher torques on the valve.**

Leakage around the packing followers can be stopped by tightening the packing flange nuts (key 27).

If the packing is relatively new and tight on the shaft, and if tightening the packing flange nuts does not stop leakage, the shaft may be worn or nicked so that a seal cannot be made. If the leakage comes from the outside diameter of the packing, the leakage may be caused by nicks or scratches around the packing box wall. Inspect the shaft and packing box wall for nicks and scratches when performing the packing replacement procedures.

For valves with the ENVIRO-SEAL packing system:

Optimum performance of the ENVIRO-SEAL packing system is obtained when the Belleville springs are tightened to their “target load.” The target load is the point where the springs are compressed to 85% of their maximum deflection, or nearly flat. Maximum deflection is when the springs are 100% compressed, or completely flat.

Under normal conditions, the packing nuts should not require re-tightening. However, when servicing, if the springs do not remain at the target load of 85% compression, retighten the packing box nuts according to the following procedure:

1. Tighten the packing flange nuts alternately and evenly, keeping the packing flange parallel with the valve flange (see figure 6), until the Belleville springs are compressed 100% (or completely flat).
- For PTFE packing, loosen each packing flange nut one half turn (180° of rotation).
  - For Graphite packing, loosen each packing flange nut one quarter turn (90° of rotation).

The target load of 85% compression has now been reached. If leakage continues, replace the packing components as described in the following procedures.

## Replacing the Packing

To replace the packing, the actuator must be removed. Also, the valve should be removed from the pipeline to allow proper readjustment of the disk position.

### **⚠ WARNING**

**The edges of a rotating disk have a shearing effect that may result in personal injury. To help prevent such injury, stay clear of the disk edges when rotating the disk (key 6).**

### **CAUTION**

**Damage to the disk (key 6) may occur if the disk is not closed when the valve is being removed from the pipeline. If necessary, apply operating pressure to the actuator temporarily to retain the disk in the closed position while removing the valve from the pipeline.**

For valves with PTFE or graphite packing:

Key numbers in this procedure are shown in figures 11, 12, and 13 unless otherwise indicated.

1. 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. If using a power actuator, also shutoff all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.

### **CAUTION**

**When removing the actuator in the following step, use a wheel puller to separate the actuator parts from the valve shaft. Do not drive the actuator parts off the valve shaft because this could damage valve trim components.**

2. Remove the actuator per instructions in separate actuator instruction manuals, then remove the cap screws (key 31). Remove the clamp (key 33, figure 5) if the strap (key 34, figure 5) is used.

3. Remove the packing flange nuts (key 27) and the packing flange (key 25) and pull out the packing follower (key 24).
4. Remove the anti-blowout ring, if used (NPS 3-8) (key 23) from the drive shaft (key 7).
5. Remove the old packing rings (key 22) and the packing box ring (key 21). Carefully avoid scratching the shaft or packing box wall to avoid damage that could cause leakage around the shaft. Clean all accessible metal parts and surfaces to remove particles that would prevent the packing from sealing.

## **⚠ WARNING**

**Do not lubricate parts when used in oxygen service, or where the lubrication is incompatible with the process media. Any use of lubricant can lead to the sudden explosion of media due to the oil/oxygen mixture, causing personal injury or property damage.**

6. Use the appropriate procedures below for installing packing.
  - Install the packing as shown in figure 6. For NPS 3-8, two packing box rings (key 21) are used on the top and bottom of the packing set (see figures 6, 11, and 12 for details). For NPS 10-24, only one packing box ring (key 21) is used on the bottom of the packing set, at the end closest to the disk (see figure 13 for details).
  - With graphite ribbon packing, stack the packing rings and packing washers together, and slide the stack into the packing box as far as it will go while carefully avoiding trapping air between the rings.
  - Install the anti-blowout ring, if used (NPS 3-8) (key 23) in the groove on the drive shaft (key 7).
  - Install the packing follower and the packing flange.
  - Install the packing flange nuts, and tighten them only far enough to stop leakage under normal operating conditions.
  - For oxygen service applications, attach the bonding strap assembly (key 34, figure 5) to the shaft with the clamp (key 33, figure 5), and connect the other end of the bonding strap assembly to the valve body with a cap screw (key 31).
7. Mount the actuator and adjust the closed position of the valve, per the Actuator Mounting section on page 20 of this manual, before returning the valve to service.
8. When placing the control valve into operation, check around the packing follower for leakage; retighten the packing flange nuts as required according to accepted bolting procedures.

For valves with ENVIRO-SEAL packing systems:

1. 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. If using a power actuator, also shutoff 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.

## **CAUTION**

**When removing the actuator, use a wheel puller to separate the actuator parts from the valve shaft. Do not drive the actuator parts off the valve shaft because this could damage valve trim components.**

2. Remove the actuator per instructions in separate actuator instruction manuals, then remove the cap screws (key 31). Remove the clamp (key 33, figure 5) if the strap (key 34, figure 5) is used.
3. Loosen the two packing hex nuts evenly to remove spring tension, then remove the nuts.

4. Remove the packing flange and spring pack assembly. The spring pack assembly consists of the spring stack and packing follower. The spring stack is retained on the packing follower by an O-ring. Remove the anti-blowout ring, if used (NPS 3-8) (key 23) from the drive shaft (key 7). Remove the anti-extrusion washer, the packing set, and the packing ring.

## CAUTION

**The valve shaft surface condition is critical in making and maintaining a good seal. If the valve shaft surface is scratched, nicked, dented, or worn, replace the valve shaft before replacing the packing system.**

5. Inspect the existing valve shaft. If necessary, replace the valve shaft as described in the Replacing the Disk, Shafts, or Bearings section.
6. Install the new packing system components as described in the ENVIRO-SEAL Packing System for Rotary Valves Instruction Manual ([D101643X012](#)). For NPS 3-8, two packing box rings (key 21) are used on the top and bottom of the packing set (see figures 6, 11, and 12 for details). For NPS 10-24, only one packing box ring (key 21) is used on the bottom of the packing set, at the end closest to the disk (see figure 13 for details).
7. Install the anti-blowout ring, if used (NPS 3-8) (key 23) onto the drive shaft (key 7) before installing the packing follower.
8. Mount the actuator and adjust the closed position of the valve, per the Actuator Mounting section on page 20 of this manual, before returning the valve to service.

## Replacing the Seal Ring Assembly

Perform this procedure only if the control valve is not shutting off properly (that is, leaking downstream). This procedure does not require removing the actuator from the valve body.

Key numbers in this procedure are shown in figures 11, 12, and 13 unless otherwise indicated.

1. Isolate the control valve from line pressure, and relieve pressure from the valve body. Shut off and disconnect all lines from the power actuator.

## ⚠ WARNING

**The edges of a rotating disk have a shearing effect that may result in personal injury. To help prevent such injury, stay clear of the disk edges when rotating the disk (key 6).**

## CAUTION

**Damage to the disk (key 6) may occur if the disk is not closed when the valve is being removed from the pipeline. If necessary, apply operating pressure to the actuator temporarily to retain the disk in the closed position while removing the valve from the pipeline.**

2. Unscrew the flange bolts, and remove the valve from the pipeline.
3. Rotate the disk 180° from the closed position per figure 8.
4. Unscrew the retainer screws (key 17) and remove the seal retainer (key 16).
5. Thread the retainer screws into the jack screw retainer holes to unseat the retainer. These threaded holes may be used to lift the retainer. The thread size is listed in table 7.

6. Remove the retainer gasket and clean the body gasket groove and retainer surface.
7. Remove the seal ring assembly (key 19).

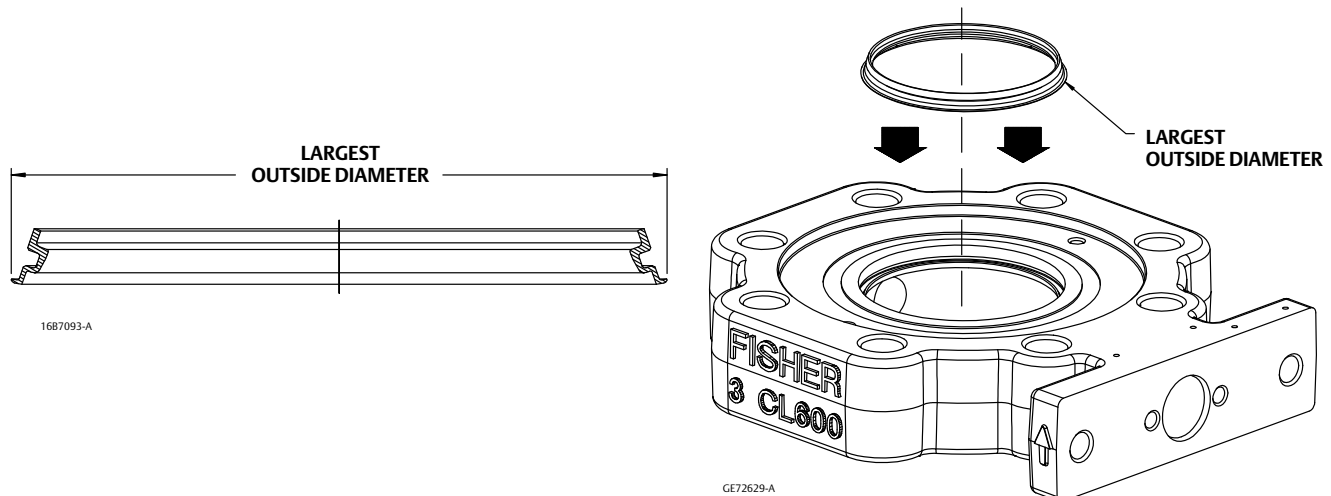
## Soft Seal Installation

1. Locate the replacement seal ring (key 19) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter as shown in figure 7. Around the outside circumference is one wide groove.

Before installing the seal ring into the valve body, the backup ring (key 20) must first be placed onto the wide, outer groove of the seal ring.

2. The seal ring and backup ring assembly must be installed in the valve. The wider outside diameter of the seal ring goes into the T-slot area of the valve body, shown in figure 7. Start the wider diameter edge of the seal ring into the T-slot of the valve body using a blunt end screwdriver.

Figure 7. Seal Installation Orientation



3. Carefully tuck the backup ring downward into the valve body T-slot until the seal ring and backup ring are completely entrapped in the valve body T-slot. Install the anti-extrusion ring per figure 2 (for NPS 3 only).
4. Place the retainer gasket (key 18) in the groove in the valve body.

## CAUTION

**The retainer gasket (key 18) is a thin graphite material. Take care to avoid damaging the gasket during handling.**

5. When the seal and gasket are seated, re-install the seal retainer (key 16) and screws (key 17). Tighten the retainer screws just enough to eliminate vertical movement of the seal retainer. With the use of the blunt end tool, carefully tuck the lip of the seal ring under the seal retainer.
6. When the seal is under the lip of the seal retainer, tighten the screws according to table 7. Manually rotate the valve shaft clockwise 180° to return the disk to its closed position. Ensure these screws are tightened prior to installation.
7. Be certain the disk is closed before installing the valve according to the Actuator Mounting section of this manual.

## Metal Seal Installation

1. With the disk in the closed position, place the seal ring (key 19) onto the disk (key 6). Set the retainer onto the seal, making sure proper alignment between the seal and retainer has been achieved. Install the anti-extrusion ring per figure 2 (for NPS 3 Phoenix III seal only).

2. Place the retainer gasket (key 18) in the groove in the valve body.

**CAUTION**

The retainer gasket (key 18) is a thin graphite material. Take care to avoid damaging the gasket during handling.

3. Attach the seal retainer (key 16) to the valve body and tighten the retainer screws (key 17). Tighten just enough to eliminate vertical movement of the retainer.
4. Rotate the valve shaft 90° open/closed 3 times.
5. With the disk in the closed position, tighten the retainer screws per table 7.
6. Be certain the disk is closed before installing the valve according to the Actuator Mounting section of this manual.

## Replacing the Disk, Shafts, or Bearings

Key numbers in this procedure are shown in figures 11, 12, and 13 unless otherwise indicated.

Table 7. Recommended Retainer Screw Torque

RAISED FACE FLANGE					RTJ FLANGE				
Valve Size, NPS	Number of Screws	Screw Size Inch	Torque		Valve Size, NPS	Number of Screws	Screw Size Inch	Torque	
			CL 12.9 / NCF1 Screws					B8M CL2 and B7M Screws	
			N • m	Lbf • ft				N • m	Lbf • ft
3	2	1/4 - 20	14	10.5	3	---	---	---	---
4					---	---	---	---	
6					12	1/4 - 20	9	6.75	
8					16	5/16 - 18	19	14	
10	22								
12	2	1/2 - 13	88	65	12	12	1/2 - 13	80	59
14					20				
16					24				
18	4				5/8 - 11	161	119	18	22
20								24	
24								12	1 - 8

Table 8. Follower Shaft Internal Threads

VALVE SIZE NPS	THREAD SIZE
3	10 - 24
4	1/4 - 20
6	3/8 - 16
8	
10	
12	1/2 - 13
14	
16	5/8 - 11
18	
20	
24	

1. 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. If using a power actuator, also shutoff 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.

## CAUTION

**When removing the actuator in the following step, use a wheel puller to separate the actuator parts from the valve shaft. Do not drive the actuator parts off the valve shaft because this could damage valve trim components.**

2. Remove the actuator per instructions in separate actuator instruction manuals, then remove the cap screws (key 31). Remove the clamp (key 33, figure 5) if the strap (key 34, figure 5) is used.
3. Remove the packing flange nuts (key 27) and the packing flange (key 25) and pull out the packing follower (key 24 or 29).

## Disassembly

1. Remove the seal ring assembly according to steps 3 through 7 of the Replacing Seal Ring Assembly section of this manual.
2. Remove hex nuts, blind flange, gasket, when used (keys 5, 2, and 3).
3. Clean the gasket surfaces on the blind flange (key 2) and on the end of the valve body (key 1).
4. Rotate the disk (key 6) 180 ° from the closed position, as shown in figure 8.
5. Remove shaft pins (key 9) from the disk. Pins can be removed by their internal thread tapping in table 9.

Table 9. Pin Removal Thread

VALVE SIZE		THREAD SIZE
NPS		Inch
3		6 - 32
4		10 - 24
6		
8		3/8 - 16
10		
12		
14		
16		
18		
20		
24		

## ⚠ WARNING

**Once the shafts have been removed in the following step, the disk may fall from the valve body. To avoid personal injury and disk damage, support the disk to prevent it from falling as the shafts are being removed.**

6. Pull the follower shaft (key 8), when used, out through the outboard end of the valve body. If the follower shaft cannot be pulled free, the end of the follower shaft is internally threaded (see table 8) for screwing in a bolt or stud to aid in pulling the follower shaft.
7. Pull the drive shaft (key 7) out through the actuator end of the valve body and remove the anti-blowout ring, when used (key 23), from the drive shaft. The end of the shaft is internally threaded (shown in table 8) for screwing in a bolt or stud to aid in pulling the drive shaft.



8. Remove the disk (key 6) from the valve body through the side opposite the seal.
9. Remove the packing (key 22, figure 6) and the packing box ring (key 21, figure 6).
10. If any of the bearings (keys 14 and 15) require replacement, remove them.
11. Clean the packing box.

Assembly

**⚠ WARNING**

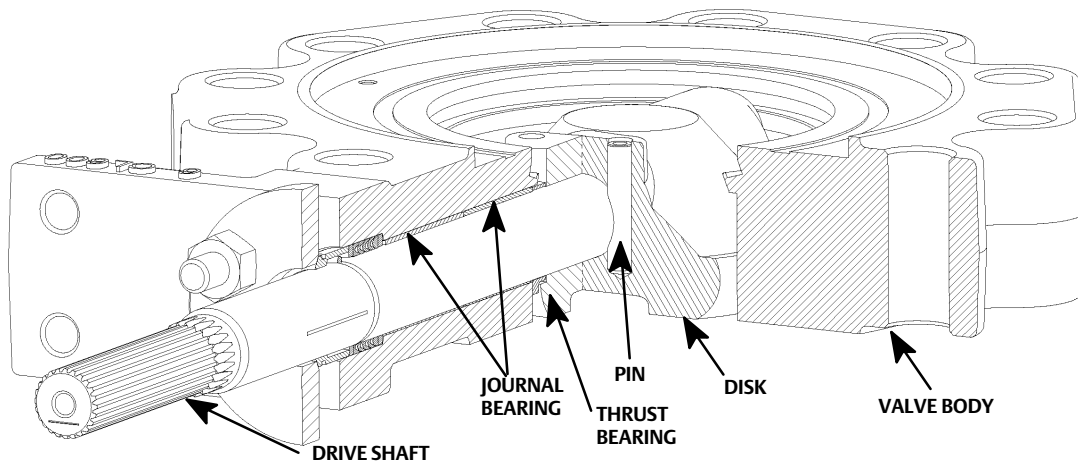
Do not lubricate bearings that will be used for oxygen service, or where the lubrication is incompatible with the process media. Any use of lubricant can lead to the sudden explosion of media due to the oil/oxygen mixture, causing personal injury or property damage.

Table 10. Required Blind Flange Bolt Torque

VALVE SIZE	STUD SIZE	STUD MATERIAL <sup>(1)</sup>			
		SA193 B8M CL2, SA193 B7M/NCF2, SA453 660, & SB164 N05500 Studs		N07718 Studs	
NPS	Inch	N•m	lbf•ft	N•m	lbf•ft
8	1/2 - 13	95	70	149	110
10	5/8 - 11	190	140	298	220
12	3/4 - 10	325	240	508	375
14	7/8 - 9	481	355	827	610
16					
18	1 - 8	719	530	1261	930
20	1-1/8 - 8	1044	770	1627	1200
24					

1. Stud and nut threads must be lubricated to achieve proper preload.

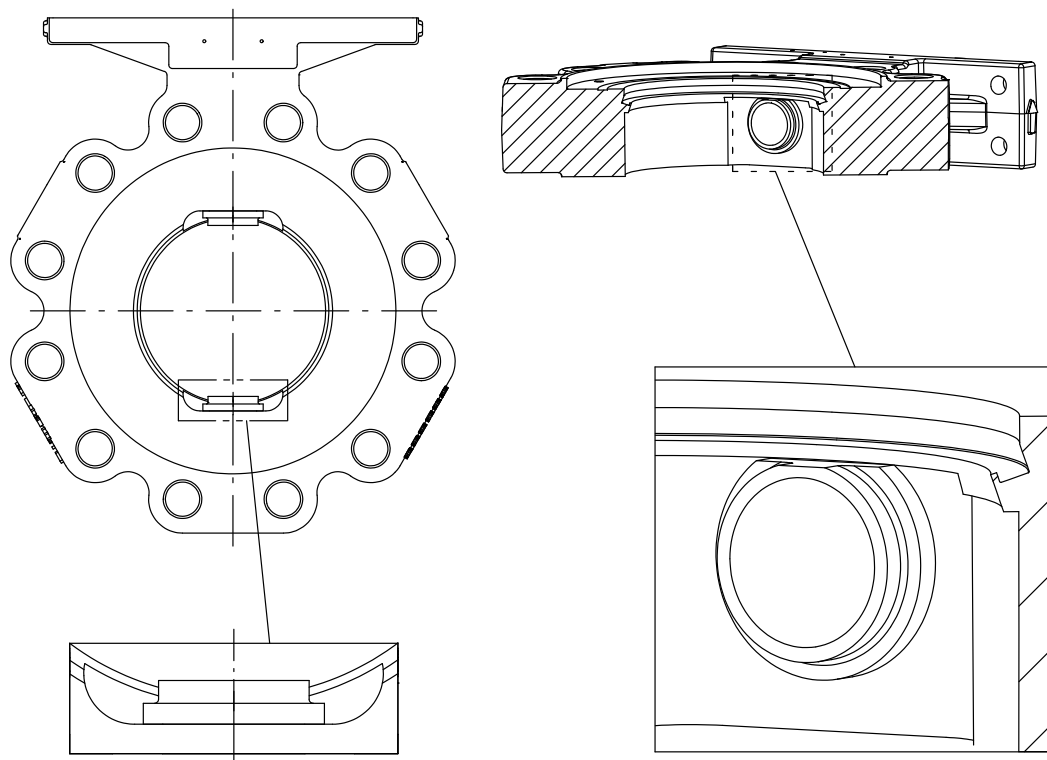
Figure 8. Disk Orientation for Pin Removal and Soft Seal Installation



**CAUTION**

To avoid possible product damage, ensure the NPS 3, 4, and 6 thrust bearings are oriented correctly when installing in the following procedure. See figure 9 for proper orientation of the thrust bearings.

Figure 9. Orientation of NPS 3, 4, and 6 Thrust Bearings



1. If new bearings (keys 14 and 15) are required, install them in the valve body. Install the journal bearings (key 14) before installing the thrust bearing (key 15). If installing a thrust bearing into NPS 3-6 valves, ensure the thrust bearing flat is oriented under the seal cavity, as shown in figure 9. If installing a NPS 8-24 thrust bearing, ensure the circular thrust bearing is fully seated in the body thrust bearing counterbore. For NPS 3-6 valves, three journal bearings (key 14 in figure 11) and two thrust bearings (key 15 in figure 11) are required per assembly. For NPS 8-24 valves, four journal bearings (key 14 in figures 12 and 13) and two thrust bearings (key 15 in figures 12 and 13) are required per assembly.
2. Insert the disk (key 6) into the valve body as shown in figure 8, ensuring the “T” stamped on the disk hub is oriented toward the actuator end of the valve body.
3. Install the drive shaft (key 7) and the follower shaft (key 8, when used) through the valve body and into the disk.
4. Align the holes in the shafts with the pin holes in the disk and drive the disk pins (key 9) into the disk. Once the pins are fully seated in the disk, use a punch or small chisel to stake the pins at three points.

## CAUTION

To prevent the disk pin from sliding out during operation, ensure the staking operation deforms the disk pin hole diameter sufficiently.

5. Install the blind flange gasket, blind flange, and hex nuts (keys 2, 3, and 5). Ensure the blind flange is oriented so the serrations face the gasket and valve body. Tighten the hex nuts (key 5) per table 10.

**CAUTION**

Once the final preload torque is applied, do not loosen or remove the blind flange nuts (key 5). If nut removal is necessary, a new gasket is required.

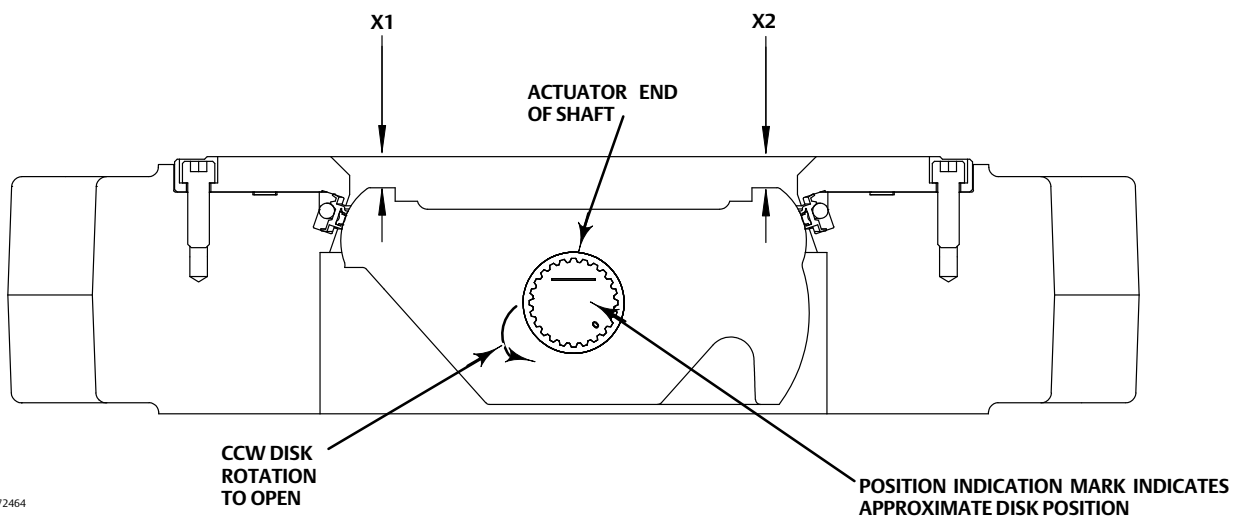
**Soft Seal Installation**

1. Locate the replacement seal ring (key 19) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter as shown in figure 7. Around the outside circumference is one wide groove, as shown in figure 2.

Before installing the seal ring into the valve body, the backup ring (key 20) must first be placed onto the wide, outer groove of the seal ring. Rotate the disk 180° from closed before installing the seal ring (shown in figure 8).

2. The seal ring and backup ring assembly must be installed in the valve. The wider outside diameter of the seal ring goes into the T-slot area of the valve body, shown in figure 7. Start the wider diameter edge of the seal ring into the T-slot of the valve body using a blunt end screwdriver.
3. Carefully tuck the backup ring downward into the valve body T-slot until the seal ring and backup ring are completely entrapped in the valve body T-slot. If installing for NPS 3, install the anti-extrusion ring per figure 2.
4. Place the retainer gasket (key 18) in the groove in the valve body.
5. When the seal and gasket are seated, install the seal retainer (key 16) and screws (key 17). Tighten the retainer screws just enough to eliminate vertical movement of the seal retainer. With the use of the blunt end tool, carefully tuck the lip of the seal ring under the seal retainer.
6. When the seal is under the lip of the seal retainer, tighten the screws according to table 7. Manually rotate the valve shaft clockwise 180° to return the disk to its closed position.

Figure 10. Sectional of Typical Valve Body



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**Metal Seal Installation**

1. With the disk in the closed position, place the seal ring (key 19) onto the disk (key 6). Set the retainer (key 16) onto the seal, making sure proper alignment between the seal and retainer has been achieved.

2. Place the retainer gasket (key 18) in the groove in the valve body.
3. Attach the seal retainer (key 16) to the valve body and tighten the retainer screws (key 17) just enough to eliminate the vertical movement of the retainer.
4. Rotate the valve shaft 90° open/closed 3 times.
5. Tighten the retainer screws per table 7.
6. Be certain the disk is closed before installing the valve according to the Actuator Installation section of this manual.

## General Valve Assembly

7. For **standard packing**, install the packing according to the appropriate instructions presented in step 5 of the Replacing Packing section of this manual.  
For **ENVIRO-SEAL packing**, install the new packing system components as described in the ENVIRO-SEAL Packing System for Rotary Valves Instruction Manual ([D101643X012](#)).
8. Install the anti-blowout ring (key 23) when used, in the groove in the drive shaft.

## Actuator Mounting

With the valve body out of the line, mount the actuator on the valve body in accordance with the instructions in the actuator instruction manual. Mount the actuator yoke to the valve body, and tighten the actuator-mounting cap screws (key 31) to the appropriate torque from table 11.

Table 11. Required Actuator-Mounting Bolt Torque

VALVE SIZE NPS	SCREW SIZE Inch	SAE J429 GRADE 5/NCF3 <sup>(1)</sup>	
		N•m	lbf•ft.
3	1/2 - 13	102	75
4			
6	5/8 - 11	190	140
8			
10	3/4 - 10	339	250
12			
14	7/8 - 9	508	375
16			
18	1-1/4 - 8	1491	1100
20			
24			

1. Screws must be lubricated to achieve proper preload.

## CAUTION

**CL600 Control-Disk valve disk rotation is counterclockwise to open (when viewed from the actuator side of the valve body, see figure 10). Rotating the disk (key 6) past the fully closed position will damage the seal ring (key 18).**

## Adjusting the Valve Closed Position

Adjust the actuator to bring the disk to the fully closed position at the end of the actuator stroke. To determine the fully closed disk position, measure the distances between the disk face and the seal retainer face at the top and bottom of the valve (X1 and X2) as shown in figure 10. Adjust the travel stops or turnbuckle to rotate the disk slightly until the two measurements are equal, but are allowed to be within 0.25 mm (0.010 inch) of each other. Refer to the appropriate actuator instruction manual for assistance.

## Parts Ordering

When corresponding with your [Emerson sales office](#) or Local Business Partner about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number, part name, desired material, using the Parts List.

### ⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions 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

### Retrofit Kits for ENVIRO-SEAL Packing

Retrofit kits are available for replacing the packing in an existing valve with an ENVIRO-SEAL packing system. These kits are available for single PTFE or graphite packing. All parts required for installation of the ENVIRO-SEAL packing system into an existing CL600 Control-Disk valve are included in the kits.

Worn shafts, packing box damage, or other components that do not meet Emerson finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of the retrofit kit.

#### ENVIRO-SEAL Packing System Retrofit Kits

SHAFT DIAMETER		SINGLE PTFE PACKING	GRAPHITE PACKING
mm	Inches		
15.9	5/8	RPACKXRT752	RPACKXRT862
19.1	3/4	RPACKXRT762	RPACKXRT872
31.8	1-1/4	RPACKXRT772	RPACKXRT882
38.1	1-1/2	RPACKXRT782	RPACKXRT892
50.8	2	RPACKXRT792	RPACKXRT902
57.2	2-1/4	RPACKXRT802	RPACKXRT912
63.5	2-1/2	RPACKXRT812	RPACKXRT922
76.2	3	RPACKXRT822	RPACKXRT932
88.9	3-1/2	RPACKXRT832	RPACKXRT942
101.6	4	RPACKXRT842	RPACKXRT952
114.3	4-1/2	RPACKXRT852	RPACKXRT962

## Parts List

Key Description

- 1 Valve Body
- 2 Blind Flange
- 3\* Gasket, Blind Flange
- 4 Stud, Blind Flange (4 req'd)
- 5 Nut, Blind Flange (4 req'd)

Key Description

- 10\* Disk/Shaft Assy
- 6 Disk
- 7 Drive Shaft
- 8 Follower Shaft
- 9 Pin, Disk/Shaft (NPS 3-8, 2 req'd, NPS 10-24, 3 req'd)
- 11\* Key
- 12 Washer
- 13 Cap Screw
- 14\* Journal Bearing (NPS 3-6, 3 req'd, NPS 8-24, 4 req'd)
- 15\* Thrust Bearing (2 req'd)
- 16 Seal Retainer

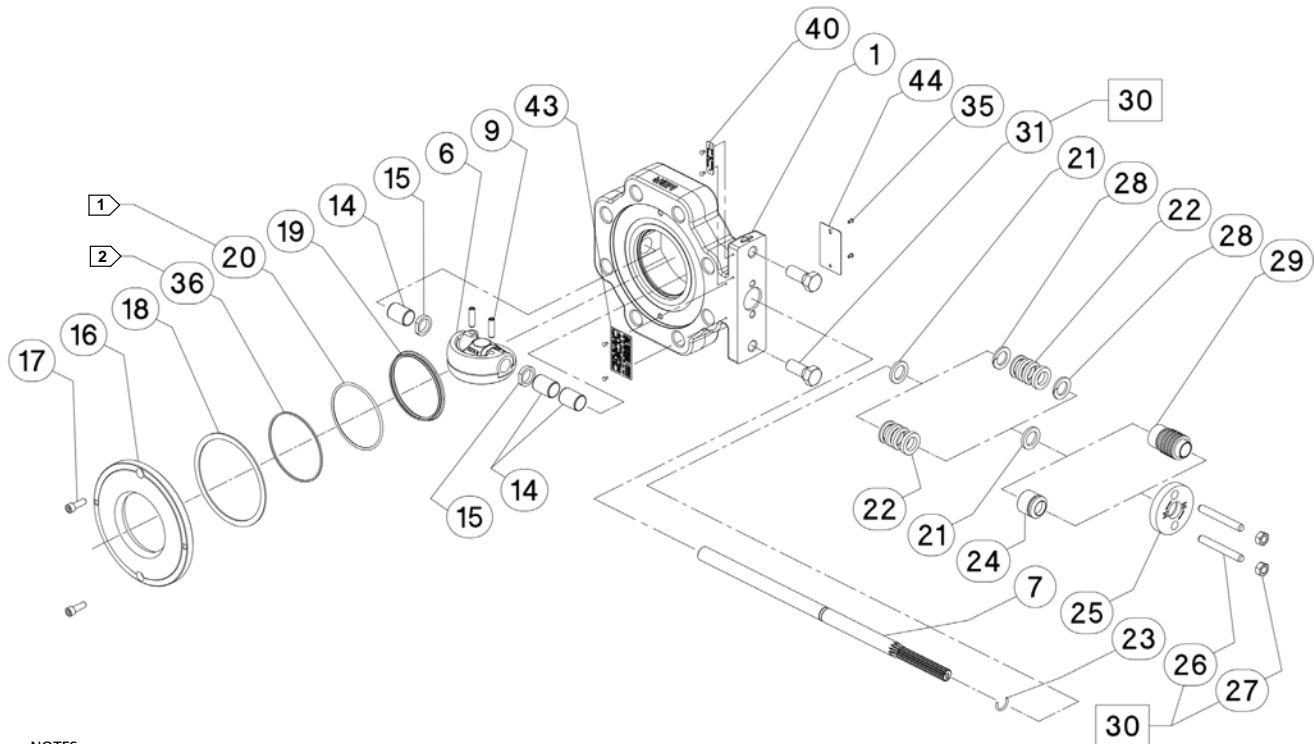
\*Recommended spare parts

Key	Description
17	Retainer Screw (NPS 3-8, 2 req'd, NPS 10-24, 3 req'd)
18*	Gasket, Retainer
19*	Seal
20*	O-ring, PTFE Seal
21*	Packing Box Ring
22*	Packing Set
23	Anti Blowout Ring
24	Packing Follower
25	Packing Flange
26	Packing Stud (NPS 3-8, 2 req'd, NPS 10-24, 4 req'd)
27	Packing Nut (NPS 3-8, 2 req'd, NPS 10-24, 4 req'd)
28*	Anti-Extrusion Ring
29	Spring Pack (PTFE ENVIRO-SEAL)
30	Lubricant
31	Mounting Cap Screw (NPS 3, 2 req'd, NPS 4-24, 4 req'd)
32*	Packing Washer (3 req'd)

Key	Description
33	Clamp
34	Ground Strap
35	Drive Screw
36*	Anti-Extrusion Ring (NPS 3 soft seal only)
37	Cable Tie (ENVIRO-SEAL Tag)
38	Tag, Warning (Packing)
39	Tag, ENVIRO-SEAL
40	Tag, Not Dead End
41	Tag, Phoenix III
42	Tag, Notice
43	Nameplate, Fisher
44	Nameplate, Mfr, CD
45	Mounting Bracket

\*Recommended spare parts

Figure 11. Fisher CL600 Control-Disk, NPS 3-6, CL600 Valve Assembly

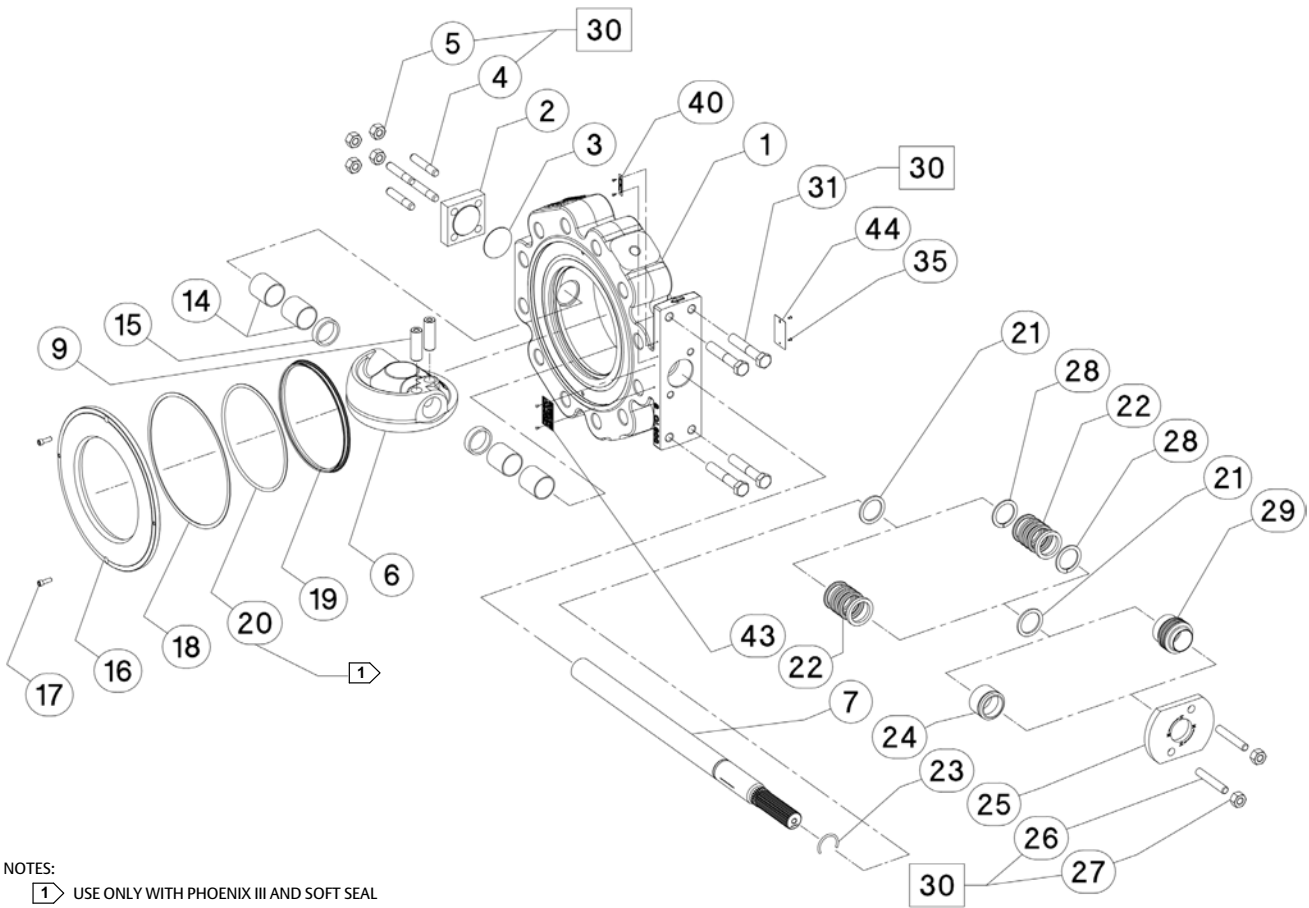


NOTES:

- 1 USE ONLY WITH PHOENIX III AND SOFT SEAL
- 2 USE ONLY WITH NPS 3 SOFT SEAL AND PHOENIX III SEAL

PARTS NOT SHOWN: 32, 33, 34, 37, 38, 39, 41, 42

Figure 12. Fisher CL600 Control-Disk, NPS 8, CL600 Valve Assembly

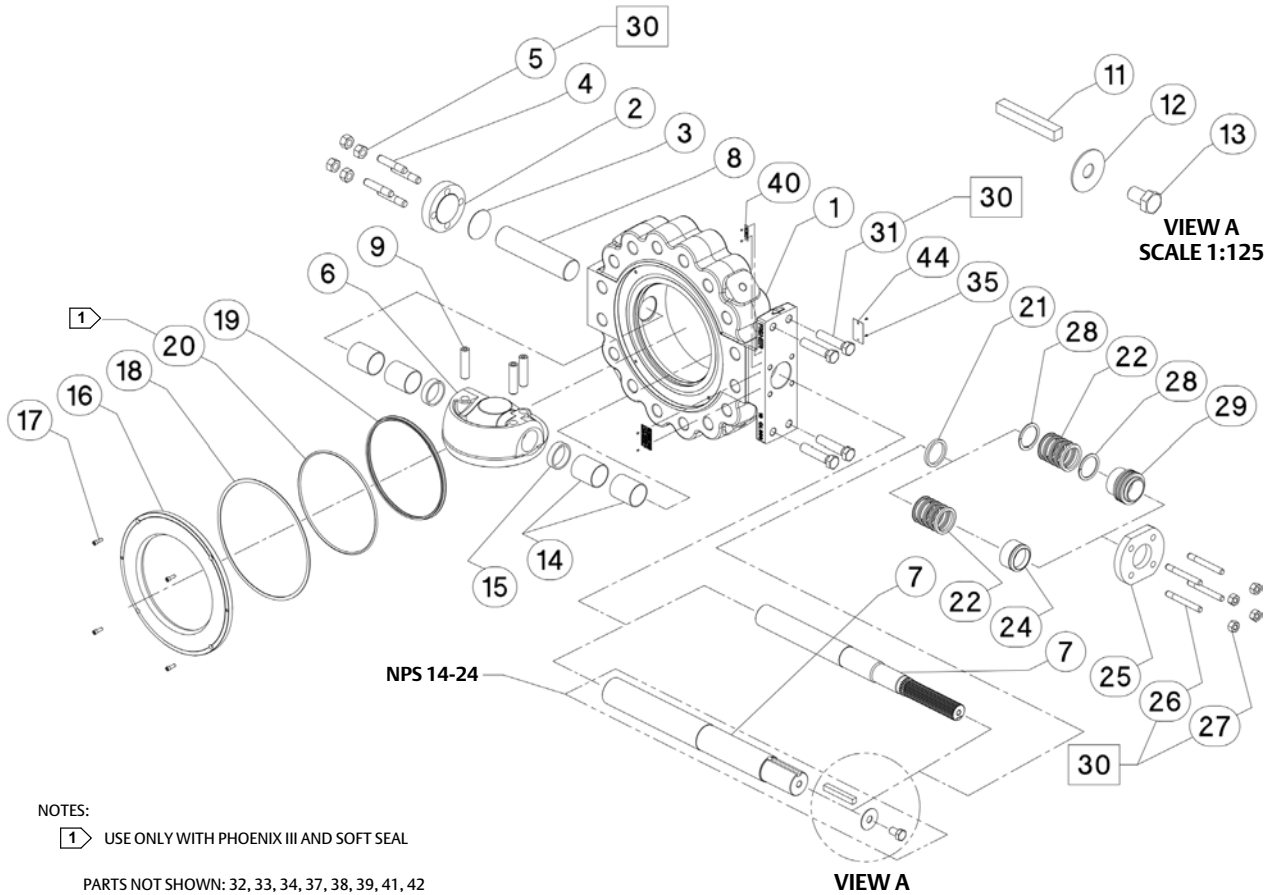


NOTES:

1 USE ONLY WITH PHOENIX III AND SOFT SEAL

PARTS NOT SHOWN: 32, 33, 34, 37, 38, 39, 41, 42

Figure 13. Fisher CL600 Control-Disk, NPS 10-24, CL600 Valve Assembly



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