FLOWSERVE

USER INSTRUCTIONS

Durco BTV/BUV 2000
Butterfly Valves

FCD DVENIM0201-03-AQ (10/24)

Installation
Operation
Maintenance



Experience In Motion

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1. Introduction

The Flowserve Corporation, Flow Control Division has established this Installation, Operating and Maintenance Manual to facilitate field installation, operation and repair of BTV-2000 and BUV-2000 Series butterfly valves.

It is recommended that questions or concerns regarding the processes described in this manual be directed to a Flowserve Field Sales Representative, authorized stocking distributor or the Flowserve Corporation, Flow Control Division.

Part numbers referenced in the following sections are available from the Flowserve Corporation, Flow Control Division.

NOTE: Only Flowserve replacement repair parts and assembly tooling made or designed by the Flowserve Corporation should be used.

1.1 Safety Precautions

The safety terms **CAUTION** and **NOTE** are used in these instructions to highlight particular dangers and/or to provide additional information on aspects that may not be readily apparent.

CAUTION: indicates that minor personal injury and/or property damage can occur if proper precautions are not taken.

NOTE: indicates and provides additional technical information, which may not be obvious, even to qualified personnel.

Compliance with all other notes regarding transport, assembly, operation and maintenance and with regard to technical documentation (e.g., in the operating instruction, product documentation or on the product itself) is essential, in order to avoid conditions or occurrences which might directly or indirectly cause severe personal injury or property damage.

To ensure that the valve is installed in a safe manner, please adhere to the following precautions before removal or disassembly of any valve.

1. There is a possibility of pressurized media build up behind the valve liner. Wear suitable protective equipment for the fluid involved when removing a valve from the pipeline.
2. Depressurize and bleed the line on both sides of the valve before removing the valve.
3. Check nameplate before installation to ensure that the valve is not installed in systems where service conditions exceed those for which the valve was designed.
4. Remove or install the valve with the disc in the closed position.
5. Never attempt to adjust the disc in the seat while the valve is pressurized.

1.2 Design Changes

In order to follow the Flowserve commitment to continuous improvement, we reserve the right to change product and performance specifications without notice.

1.3 Pressure-Containing Fasteners

1.3.1 Material Selection

Selecting the proper fastener material is the ultimate responsibility of the customer because the supplier does not typically know in what service the valves will be used or what elements may be present in the environment. Flowserve normally supplies B7 (carbon steel) for ductile cast iron and carbon steel valves. For stainless steel and high alloy valves, B8 (stainless steel) fasteners are supplied as standard. All fasteners used must have a minimum yield strength of 40,000 PSI, a minimum elongation of 12% and be compatible with the process fluid. Determining compatibility to the process fluid goes beyond a material being resistant to general corrosion because the more important consideration is a material's resistance to stress corrosion cracking. Depending on the service, it may make sense to use B7 fasteners on high alloy valves. One such service would be marine environments because of stainless steel's susceptibility to stress corrosion cracking in chloride environments. Another key aspect of fasteners is frequent visual inspection. Because of the common practice of using steel fasteners rather than stainless steel to avoid chloride stress corrosion cracking, visual inspection is recommended to monitor the general corrosion of these fasteners. If jacketing or insulation is used on a valve, it must be periodically removed for visual inspection of the fasteners. If you need assistance in determining the proper fasteners to use, please refer to the attached chart or contact the Flowserve Materials Engineering Group at (937) 226-4475.

1.3.2 Design & Type

The Flowserve valve design standards adopt ANSI B18.2.1 (1981) as the standard for fastener type and design. This national standard requires that finished hex "head" cap screws be used when the head of the fastener is turned. A finished hex "head" cap screw and a heavy hex cap screw have a bearing surface under the head to minimize frictional resistance during tightening. They also comply to qualified body dimensions and fully formed head dimensions. Cookeville Flow Control Division's policy is to use finished hex "head" and heavy hex "head" cap screws for all pressure-retaining fasteners. This includes top caps, packing adjusters, plug adjusters, bottom caps, body halves or other pressure-retaining components. Compliance is made with ANSI B18.2.2 (1987), *Square and Hex Nuts*, when studs and heavy hex nuts are required. Additional information on these items may be obtained from the Flowserve Corporation, Cookeville Flow Control Division, Cookeville, Tennessee.

Fasteners

Table 1

Cap Screws-Studs	
HHCS	Finished Heavy Hex Head Cap Screw
HCS	Finished Hex Head Cap Screw
SCS	Socket Head Cap Screw
STUD	Stud
SCYC	Socket Head Cap Screws for Retainer plates per ASTM A574 4037 Alloy Steel, Yellow Zinc Dichromate Plated
Dimensions per ANSI B18.2.1 Alloy identification stamp required on each piece. Certification required. Alloy Specification (40 KSI Minimum Yield Strength, 12% Min. El.)	
ASTM Material Specifications	
B840	304 Stainless Steel per ASTM A193, Grade 8B, Class 1, 40 KSI Min. Yield Strength, 12% Min. El.
B7	Chromium - Molybdenum Alloy Steel per ASTM A193, Grade B7
B7M	Chromium - Molybdenum Alloy Steel per ASTM A193, Grade B7M, 100% hardness tested
B7MT	Chromium - Molybdenum Alloy Steel per ASTM A193, Grade B7M, 100% hardness tested, PTFE coated, DuPont SP11C, type B - Color blue or green.
B8M	316 Stainless Steel per ASTM A193, Grade B8M, Class 1, 40 KSI Min. Yield Strength, 12% Min. El.
B8C2	304 Stainless Steel per ASTM A193, Grade B8, Class 2.
C20	Carpenter C20, CB-3 (UNS N08020), ASTM B473, 40 KSI Min. Yield Strength, 12% Min. El.
HC	Hastelloy C276 (UNS N10276), ASTM B574
I625	Inconel 625 (UNS N006625), ASTM B446
I825	Incoloy 825 (UNS N08825), ASTM B425, 40 KSI Min. Yield Strength, 12% Min. El.
IN	Inconel 600 (UNS N0660), ASTM B166, 40 KSI Min. Yield Strength, 12% Min. El.
M	Monel (UNS N04400), ASTM B164, Class A or B, 40 KSI Min. Yield Strength, 12% Min. El.
HB	Hastelloy B (UNS 10665), ASTM B335
I718	Incoloy 718, AMS 5596B
MKH	Monel K-500, Cold drawn and aged hardened, QQN-286 and ASTM F468
L7	Chromium-Molybdenum Alloy Steel per ASTM A320, Grade L7
L7M	Chromium-Molybdenum Alloy Steel per ASTM A320, Grade L7M, 100% hardness tested
L7T	Chromium-Molybdenum Alloy Steel per ASTM A320, Grade L7, PTFE coated, DuPont SP11C, Type B - Color blue or green
L7MT	Chromium-Molybdenum Alloy Steel per ASTM A320, Grade L7M, 100% hardness tested, PTFE coated, DuPont SP11C, Type B - Color blue or green.
N	Nickel per ASTM B160 (UNS N0220), 40 KSI Min. Yield Strength, 12% Min. El.
B7YC	Chromium-Molybdenum Steel per A193, Grade B7, Yellow Zinc Dichromate Plated

Table 2

Nuts	
HN	Finished Heavy Hex Nut
XN	Finished Hex Nut
HXN	Regular Heavy Hex Nut
Dimensions per ANSI B18.2.2 Alloy identification stamp is required on each piece. Certification required.	
ASTM Material Specifications	
8	304 Stainless Steel per ASTM A194, Grade 8
8M	316 Stainless Steel per ASTM A194, Grade 8M
2H	ASTM A194, Grade 2H
2HM	ASTM A194, Grade 2HM
7M	ASTM A194, Grade 7M, 100% hardness tested
7MT	ASTM A194, Grade 7M, 100% hardness tested, PTFE coated, DuPont SP11C, Type B - Color blue or green
M	Monel (UNS N04400), ASTM B164, Class A or B, or QQN-281, Class B
HB	Hastelloy B (UNS N10665), ASTM B335
HC	Hastelloy C276 (UNS N10276), ASTM B574
I625	Inconel 625 (UNS N06625), ASTM B446
I718	Incoloy 718, AMS 5596B
I825	Incoloy 825 (UNS N08825), ASTM B425
L7	Chromium-Molybdenum Alloy Steel per ASTM A194, Grade 7
L7M	Chromium-Molybdenum Alloy Steel per ASTM A194, Grade 7M, 235 BHN Max, ASTM A320, Section 9
MKH	Monel K-500, Cold drawn and aged hardened, QQN-286 and ASTM F467
8F	303 Stainless Steel per ASTM A194, Grade 8F
2HYC	ASTM A194, Grade 2H, Yellow Zinc Dichromate Plated

2. Installation

1. The protective covers provided on each valve should remain in place during any storage and handling operations.
2. The Durco Butterfly Valve is designed for installation between ASME Class 150 flanged piping systems. All types of flanges are permissible if clearance is provided for the swing of the disc and support is provided for the valve liner. Table 3 lists disc swing clearance requirements for mating pipe flanges.

! **NOTE:** Fittings such as tees and elbows cannot be bolted directly to the valve. Spacers must be used.

3. Check the valve nameplate before installation to ensure that the pressure rating and materials of construction are compatible with the intended service conditions.
4. Inspect adjoining pipelines and remove any material that could damage the valve liner.
5. Use flange gaskets to protect the valve liner during installation.
6. Keep the valve in the closed position during all handling and installation operations. This is necessary to protect the disc sealing edge from damage and to ensure proper positioning of the liner until the valve is installed.
7. Keep the valve liner clean. Any dirt or debris left in the valve can scratch the liner or disc edge. Such damage can impair the bubble-tight shutoff provided by this valve.
8. Do not allow the liner to catch on the mating pipe I.D. and fold over. This will cause flange leakage and severe damage to the liner.
9. While the BTV valve is bidirectional and will function properly with the shaft orientation either vertical or horizontal, the preferred orientation is with the shaft horizontal and the disc lower edge opening downstream for optimal service life.
10. Proper alignment of the valve in mating flanges is required. This is especially true if oversize bolt holes are used in piping flanges.
11. Flange bolts should be torqued to values listed in Table 4.

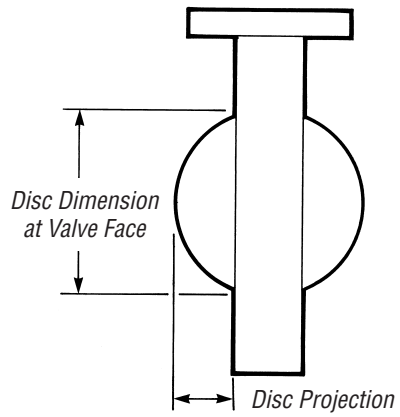


Figure 1

Dimensions are defined in Table 3

12. After the valve has been installed between flanges and all flange bolts have been tightened, slowly turn the disc and check for freedom of disc movement.
13. If the valve is to be removed from the pipeline for any reason, the valve must be closed before any of the flange bolts are loosened. The valve must remain closed until removed from the pipeline. SEE SAFETY PRECAUTIONS.
14. For recommended flange bolting sizes and lengths, refer to tables in Section 11 and 12.
15. **DO NOT** run sharp instruments between the valve and liner or between the liner and the pipe flanges. This practice will result in severe liner damage.

Table 3: Disc Projection and Face to Face Dimensions

Valve Size		Disc Projection		Disc Dimension at Valve Face	
IN	(MM)	IN	(MM)	IN	(MM)
2	(51)	0.390	(9.91)	1.805	(45.85)
3	(76)	0.672	(17.06)	2.586	(65.68)
4	(102)	0.994	(25.24)	3.487	(88.56)
6	(152)	1.860	(47.24)	5.510	(139.9)
8	(203)	2.688	(68.27)	7.379	(187.4)
10	(254)	3.626	(92.10)	9.569	(243.0)
12	(305)	4.438	(112.7)	11.564	(293.7)
14	(356)	5.071	(128.8)	12.758	(324.1)
16	(406)	5.626	(142.9)	14.718	(373.8)
18	(457)	6.407	(162.7)	16.719	(424.7)
20	(508)	7.157	(181.8)	18.656	(473.9)
24	(610)	7.781	(197.6)	20.750	(527.2)

Table 4: Flange Bolting Torques

Valve Size		Torque	
IN	(MM)	Ft.-Lbs.	(Nm)
2	(51)	49	(66)
3	(76)	84	(114)
4	(102)	61	(83)
6	(152)	123	(167)
8	(203)	164	(222)
10	(254)	155	(210)
12	(305)	198	(268)
14	(356)	246	(334)
16	(406)	230	(312)
18	(457)	331	(449)
20	(508)	303	(411)
24	(610)	458	(620)

These are minimum torque values as established in Section VIII of the ASME Boiler Code. Your piping practices, materials and gaskets may dictate the use of torque values greater than those listed. Refer to Section VIII of the ASME Code for proper bolting torques.

3. Disassembly Procedure

NOTE: Before removing the valve from the pipeline, the valve disc must be in the closed position so as not to damage the sealing edge of the disc.

1. Place the valve in a vice or other suitable support. Do not clamp on the face of the liner. Leave the disc in the closed position during disassembly.
2. Remove the wrench, gear or actuator assembly from the mounting plate.
3. Remove the mounting plate from the top of the valve by removing two socket head screws.
4. Loosen several turns but do not remove the retainer plate screws on the top and bottom. CAUTION – Retainer plates are under spring loading.
5. Loosen and remove the four bolts that hold the body halves together.
6. Remove the top body half. Be careful not to lose the body half bushings, as they may drop out.
7. Remove the disc and liner assembly from the bottom body half.
8. Complete the disassembly of top and bottom body halves by removing the retainer plate screws, glands, springs, bearings and stem seals.
9. CAREFULLY remove the disc from the liner. Use extreme caution to avoid damaging the disc stem seal convolutions or disc O.D. sealing surface. Once the liner has been removed from the disc, it cannot be reused.
10. Clean and inspect all parts not contained in the repair kit and replace if worn, damaged or heavily corroded.
11. If the disc is to be used again, carefully polish the sealing edge of the disc to remove any scratches. Use only 400 grit or finer sandpaper.

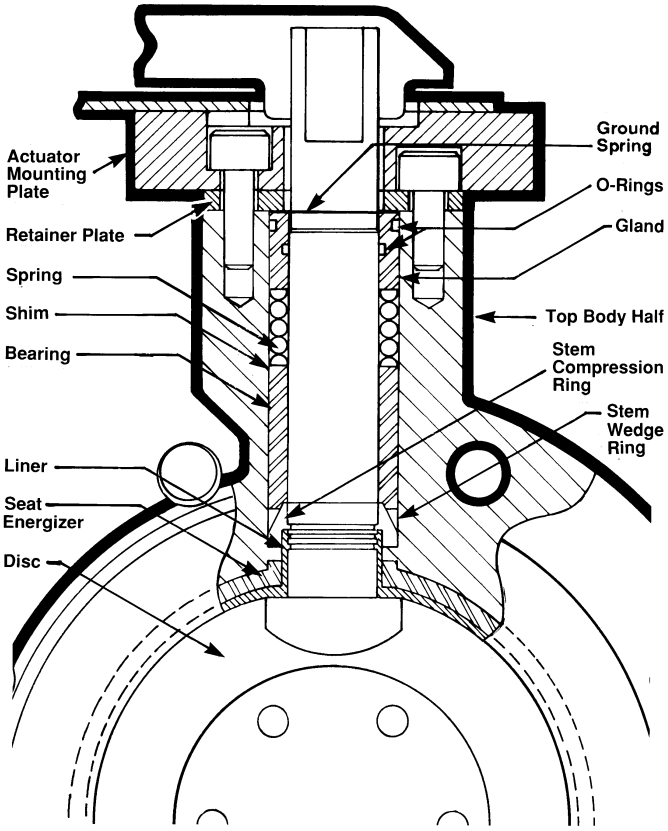
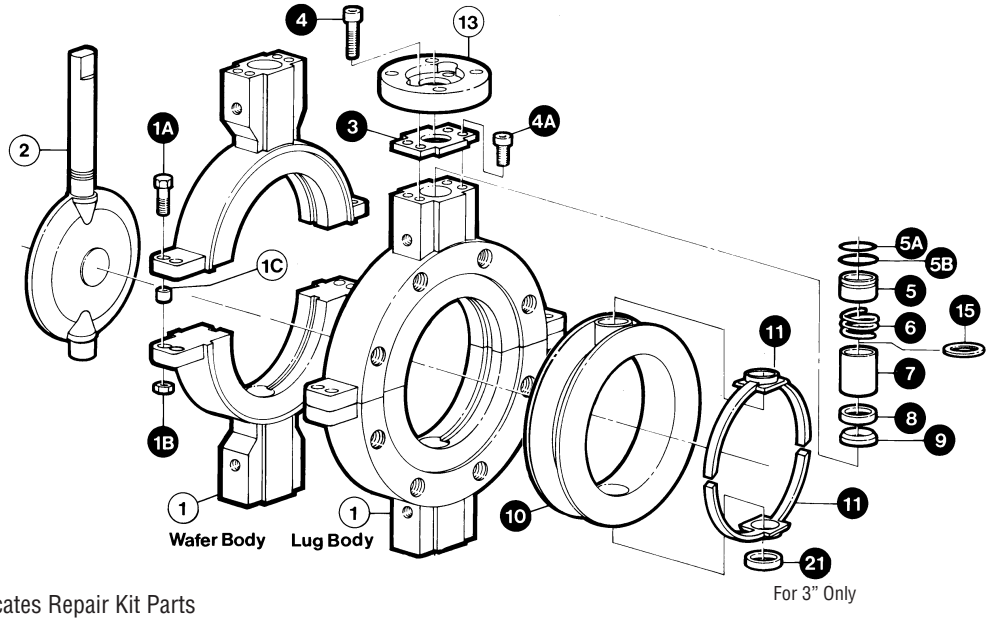


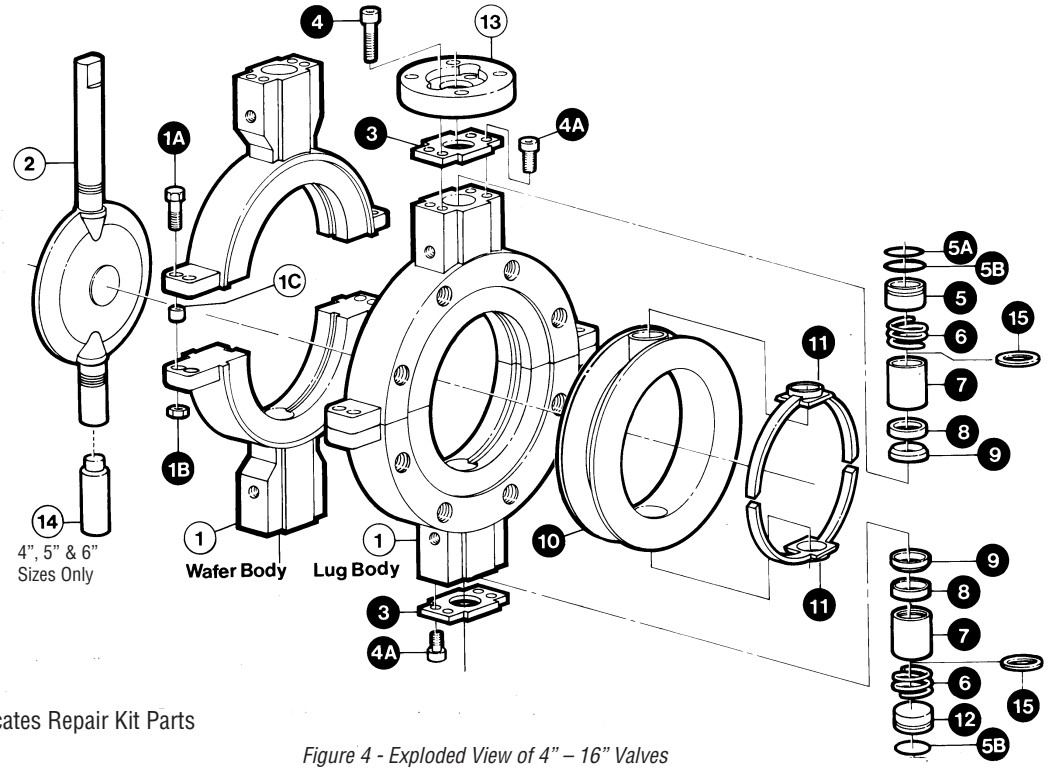
Figure 2

4. Parts List



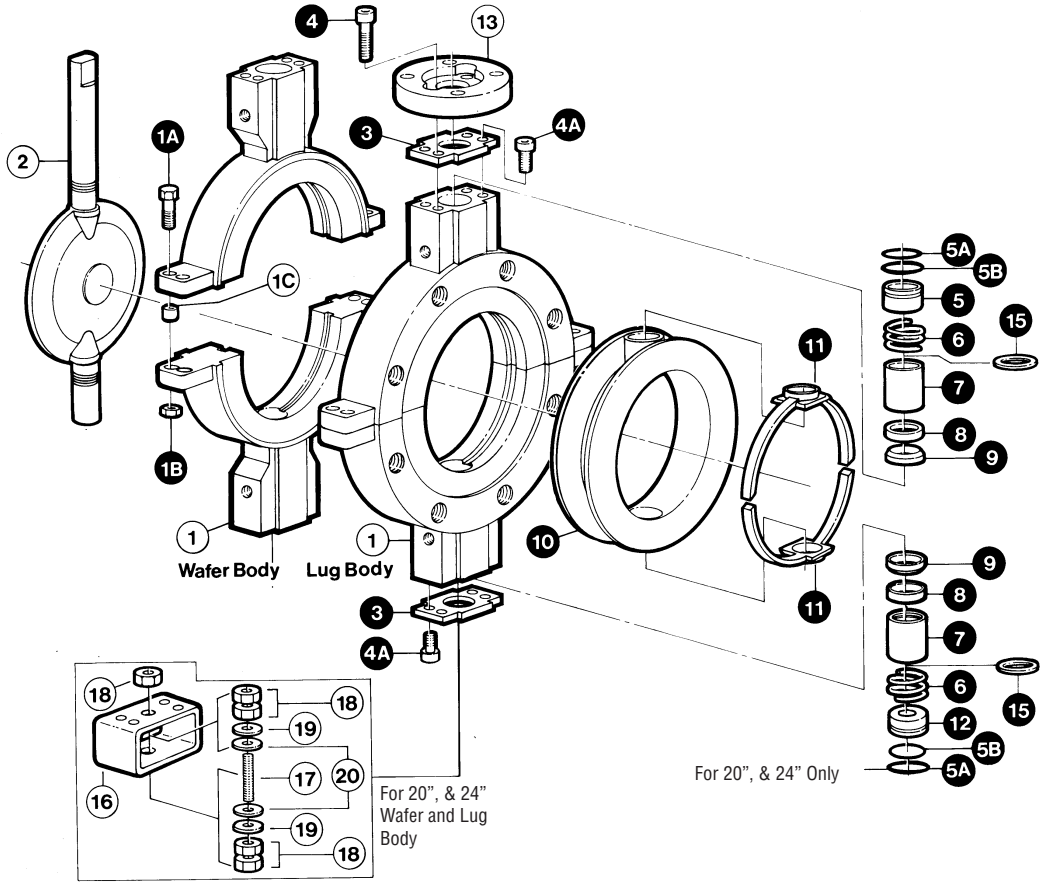
1A Indicates Repair Kit Parts

Figure 3 - Exploded View of 2" and 3" Valves



1A Indicates Repair Kit Parts

Figure 4 - Exploded View of 4" – 16" Valves



1A Indicates Repair Kit Parts

Figure 5 - Exploded View of 18" – 24" Valves

Table 5 - Bill of Materials

Item	Description	Material of Construction Standard	Material of Construction Stainless	Quantity Required by Size											
				2	3	4	5	6	8	10	12	14	16	18	20	24
1	Body - (2 Piece)	A395 GR. 60-40-18	A351-/A744 GR. CF8M	1	1	1	1	1	1	1	1	1	1	1	1	1
1A	Hex Head Cap Screw	A193 GR. B7	A193 GR. B8*	4	4	4	4	4	4	4	4	4	4	4	4	4
1B	Hex Nut	A194 GR. 2H	A194 GR. 8	4	4	4	4	4	4	4	4	4	4	4	4	4
1C	Body Bushing	Carbon Steel	304 Stainless Steel	2	2	2	2	2	2	2	2	2	2	2	2	2
2	Disc	See Chart How to Specify	See Chart How to Specify	1	1	1	1	1	1	1	1	1	1	1	1	1
3	Retainer Plate	Zinc Plated Carbon Steel	304 Stainless Steel	1	1	2	2	2	2	2	2	2	2	2	2	2
4	Socket Head Cap Screw	Zinc Plated A574-4037 Alloy Steel	A193 GR. B8*	2	2	2	2	2	2	2	2	2	2	2	2	2
4A	Socket Head Cap Screw	Zinc Plated A574-4037 Alloy Steel	A193 GR. B8*	2	2	6	6	6	6	6	6	6	6	6	6	6
5	Top Gland	304 Stainless Steel	304 Stainless Steel	1	1	1	1	1	1	1	1	1	1	1	1	1
5A	I.D. O-ring	Viton	Viton	1	1	1	1	1	1	1	1	1	1	1	2	2
5B	O.D. O-ring	Viton	Viton	1	1	2	2	2	2	2	2	2	2	2	2	2
6	Spring	302 Stainless Steel	302 Stainless Steel	1	1	2	2	2	2	2	2	2	2	2	2	2
7	Bearing	Glass-Filled Phenolic	Glass-Filled Phenolic	1	1	2	2	2	2	2	2	2	2	4	4	4
8	Stem Wedge Ring	302 Stainless Steel	302 Stainless Steel	1	1	2	2	2	2	2	2	2	2	2	2	2
9	Stem Compression Ring	Silicone or Viton	Silicone or Viton	1	1	2	2	2	2	2	2	2	2	2	2	2
10	Liner	PTFE or UHMWPE	PTFE or UHMWPE	1	1	1	1	1	1	1	1	1	1	1	1	1
11	Seat Energizer	Silicone or Viton	Silicone or Viton	2	2	2	2	2	2	2	2	2	2	2	2	2
12	Bottom Gland	304 Stainless Steel	304 Stainless Steel			1	1	1	1	1	1	1	1	1	1	1
13	Actuator Mounting Plate	Carbon Steel	Nickel Plated Carbon Steel	1	1	1	1	1	1	1	1	1	1	1	1	1
14	Stem Extension	304 Stainless Steel	304 Stainless Steel			1	1	1								
15	Shim	303 Stainless Steel	303 Stainless Steel	As Required												
16	Disc Support Bracket	Carbon Steel	Carbon Steel												1	1
17	Disc Support Stud	304 Stainless Steel	304 Stainless Steel												1	1
18	Hex Nut	A194 GR. 8	A194 GR. 8												5	5
19	Washer	303 Stainless Steel	303 Stainless Steel												2	2
20	Thrust Washer	PTFE	PTFE												2	2
21	Sleeve	Carbon Steel	304 Stainless Steel		1											
22	Ground Spring	300 Series Stainless	300 Series Stainless	1	1	1	1	1	1	1	1	1	1	1	1	1

*Grade B8 fasteners must have 40,000 PSI minimum yield strength.

5. Repair Kits

NOTE: The use of parts or repair tools other than those supplied by Flowserve Corporation could adversely affect the operation and performance of this valve. Unauthorized modifications or substitution of components could lead to premature valve failure due to corrosion and/or functional problems with the substituted parts.

Complete repair parts kits and repair tooling kits are available from Flowserve Corporation. Components of the parts kits are shown in Figures 3, 4, 5. Components of the repair tooling kits are shown in Figure 6.

NOTE: Stem packing/bearing kits are calibrated to a specific stack height. Top and bottom kits are packaged separately. DO NOT MIX parts between kits.

5.1 Repair Tools

Item	Description	Use
1	Liner Stem Seal Die	To re-form the liner stem seal around the disc stem prior to installing the disc-liner assembly into the body
2	Stem Seal Push Rod	To push the stem seal components and bearings into position in the body stem bore
3	Disc Stem Liner Guide	To protect the liner stem seal and ease assembly of the disc into the liner
4	Disc Stem Body Guide	To guide the disc-liner assembly into the stem bore of each body half*

*On the 14"– 24" sizes, there are two Disc Stem Body Guides. The longer one is for the long disc stem. The shorter one is for the short disc stem.



Figure 6 - Repair Tools

6. Assembly Procedure

1. **All Sizes:** To assemble the disc (2) into the liner (10), first slide the disc stem liner guide (repair tool item 3) over the long stem of the disc. Then slide the long stem through either of the liner stem seal necks (Figure 7). Push the liner down the stem until it touches the edge of the disc.



Figure 7

2. **Sizes 2"– 8":** Rotate the disc 90 degrees (open position in the liner). Using a vise, carefully squeeze the liner until the short disc stem can slide through the other liner stem seal neck (Figure 8). Exercise care to avoid gouging or damaging the liner.



Figure 8

Sizes 10"– 24": Clamp the long disc stem in a vise. Rotate the liner 90 degrees (disc open position) and by hand, squeeze the liner until the short disc stem can slide into the other liner stem seal neck (Figure 9). Exercise care to avoid gouging or damaging the liner. This is a strenuous operation, especially with UHMWPE liners. Heating the liner to 150°F prior to attempting this operation will help. Two people may be required to perform this operation on the larger sizes.



Figure 9

3. **All Sizes:** Make sure the liner and disc are clean and then close the disc into the liner to stretch the liner back into shape. Slide the liner stem seal die (repair tool item 1) and push it up tightly against the liner (Figure 10). Allow the dies to remain in place for at least five minutes. Note that the end of the liner stem seal die with the internal chamfer should be toward the liner when installed.



Figure 10

4. **All Sizes:** Clamp the bottom body half in a vise and place the body bushings (1C) into the counterbored holes on diagonal corners (Figure 11). Either body half can be used as top or bottom, except for the 2" and 3". On these sizes, the body half with the blind stem bore is the bottom.



Figure 11

5. **Sizes 2"– 12:** Place the seat energizer (11) in the bottom body half (Figure 12). Be sure that the energizer is firmly pushed into the groove in the body. Also note the orientation of the angled cuts on the ends of the energizer. When placing the seat energizer into the top body half, the orientation of the angled cuts must be opposite to the bottom half.

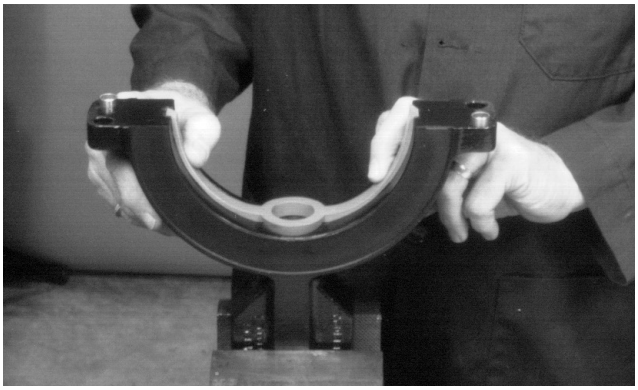


Figure 12

Sizes 14"– 24": The seat energizers on these sizes must be trimmed to length. Place the seat energizer in the bottom body half. Be sure that the energizer is firmly pushed into the groove in the body. Mark the seat energizer where it reaches the machined end of the body half (Figure 13). Remove the seat energizer and cut each end square at the mark. Place the seat energizer back into the groove, being sure it is firmly pushed into the groove. The cut end of the seat energizer should be flush to $^{1}/_{16}$" above the machined end of the body half.

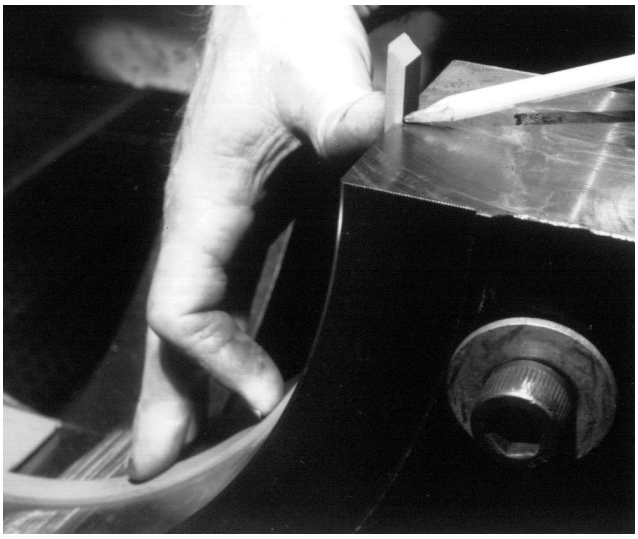


Figure 13

Sizes 20" and 24": Prior to putting the liner-disc assembly into the body, the disc support stud (17) must be attached to the short stem of the disc. Thread one nut (18) on the short threaded end of the stud all the way up to the flat on the stud. Apply a thread locking material such as LOCKTITE® to the threads on the short end of the stud and screw the stud into the tapped hole on the short stem end of the disc. Torque the stud to 100 ft-lbs, then tighten the nut against the disc stem end to a torque of 100 ft-lbs.

6. **Size 2":** Spread the liner flanges apart and firmly push the liner-disc assembly into the lower body half.

   Size 3": Slide the liner stem sleeve (21) over the liner stem seal neck on the short stem of the disc. Spread the liner flanges apart and firmly push the liner-disc assembly into the lower body half.

   Sizes 4"– 24": Remove the liner stem seal die from the short stem end of the disc. Place the disc stem body guide (repair tool item 4) over the short stem of the disc (Figure 14). The end of the disc stem body guide must cover the liner stem seal neck for the tool to work properly. Spread the liner flanges apart and carefully lower the liner-disc assembly into the lower body half (Figure 15). Firmly push the liner-disc assembly into the lower body half. Pull the disc stem body guide off the short disc stem.



Figure 14



Figure 15

7. **Sizes 2"– 12":** Orient the top body half so that when put together with the bottom half, the counterbored bolt holes will line up with the body bushings (1C) in the bottom half. The DURCO logo on the top body half should be on the opposite side of the bottom half when bolted together. Firmly push the seat energizer into the groove in the top body half. Orientate the angled cuts on the ends of the energizers such that when the body halves are bolted together, the ends on the top half will mate with the bottom half. (Figure 16).

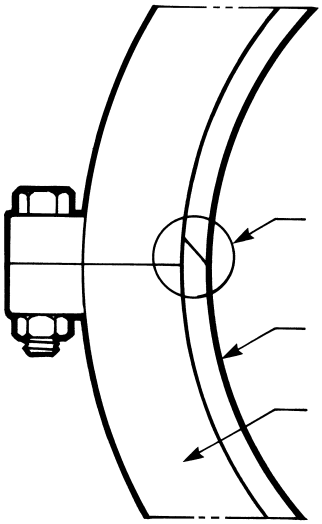


Figure 16

Sizes 14"– 24": Trim the seat energizers to length per instructions in Step 6 and firmly push the energizer into the groove in the body.

8. **All Sizes:** Remove the liner stem seal die from the long stem of the disc. Slide the disc stem body guide (repair tool item 4) over the long stem making sure that the end of the body guide covers the liner stem seal neck. Orient the top body half so that when put together with the bottom half, the counterbored bolt holes will line up with the body bushings (1C) in the bottom half. The DURCO logo on the top body half should be on the opposite side of the bottom half when bolted together. Carefully lower the top body half over the disc stem and push firmly in place (Figure 17). The gap between the body halves should be approximately 1/4" when properly assembled.



Figure 17

9. **All Sizes:** Install the four body bolts (1A) and finger tighten the nuts (1B) maintaining an even gap between body halves (Figure 18). See note – Table 6.

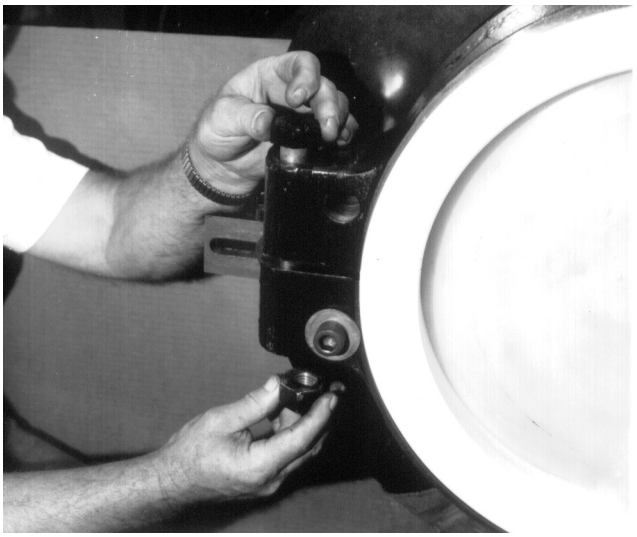


Figure 18

10. **All Sizes:** There are two individually packaged stem packing kits on all sizes (except for 2" and 3" which only have one). The packing sets are calibrated for stack height so it is very important not to mix parts between kits. Locate the top stem packing kit. This kit has a packing gland (5) with a large hole bored through for the disc stem. Place the rubber stem compression ring (9) into the top body stem bore with the conical end facing upward, away from disc. Next place the stem wedge ring (8) into the stem bore with the flat side upward, away from the disc (Figure 19). The conical end of the stem compression ring is designed to mate with the conical bore in the wedge ring. Using the stem seal push rod (repair tool item 2), push the compression ring and wedge ring to the bottom of the body stem bore (Figure 20).



Figure 19

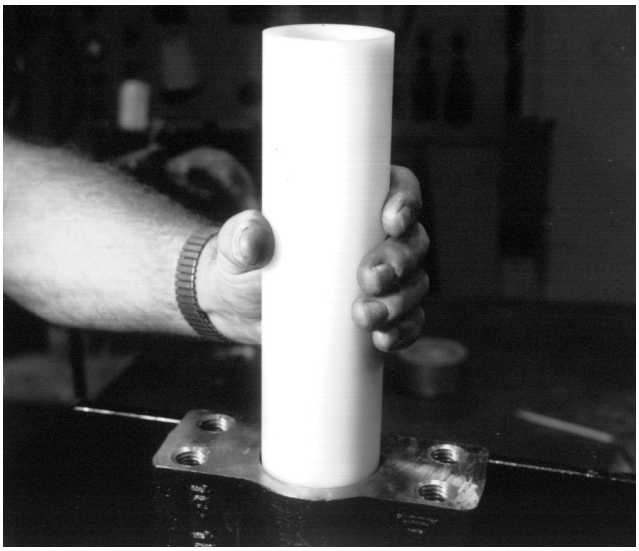


Figure 20

11. **All Sizes:** Next, place the bearing (7) over the disc stem and push it into the body stem bore. Do not use excessive force to prevent damage to the bearing. Using the stem seal push rod, push the bearing to the bottom of the body stem bore. If necessary, use a hammer and lightly tap on the stem seal push rod to push the bearing into position. The 18" - 24" sizes have two bearings. Install the second bearing in the same manner. Next place the metal shims (15) on top of the bearing. Slide the spring (6) over the stem and into the bore. Take the larger diameter O-ring (5B) and put it into the outside groove of the top gland (5). Place the smaller diameter O-ring into the inside groove of the gland. Slide the gland over the disc stem. The outside O-ring must be on top, away from the disc (Figure 21). Place the ground spring (22) over the disc stem.

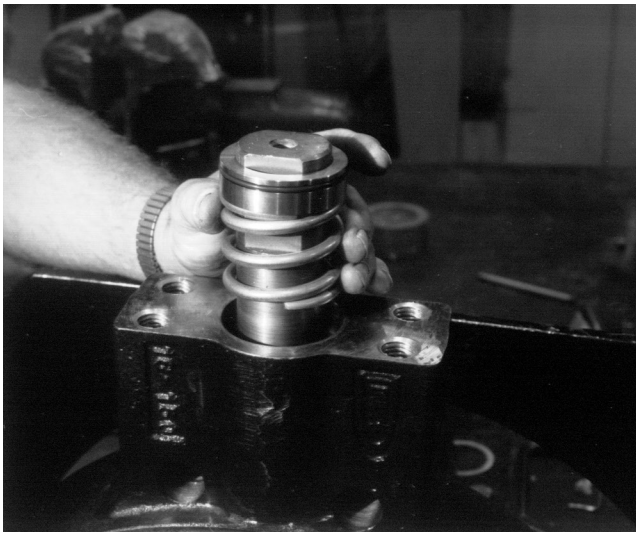


Figure 21

12. **All Sizes:** Place the retainer plate (3) over the disc stem on top of the ground spring and gland. Find the two longest socket head screws (4) and finger tighten them three to four turns into diagonally opposite holes as follows: facing the valve body, put one in the front hole on the left side of the body stem bore and the other in the back hole on the right side. Put two short socket screws (4A) in the other two holes and finger tighten three to four turns (Figure 22). See note – Table 6.

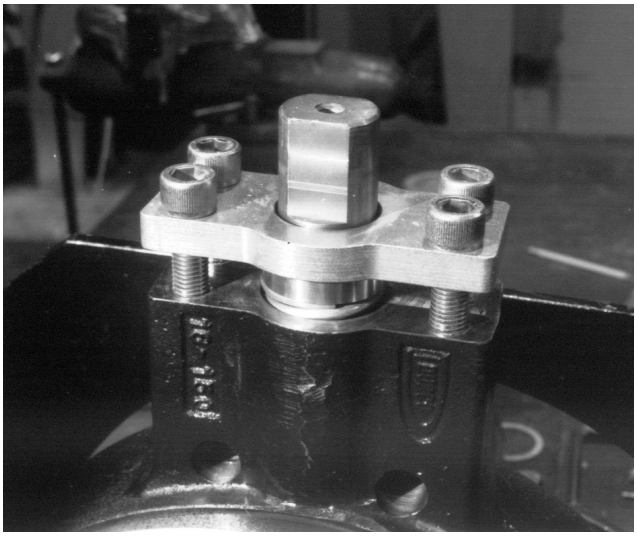


Figure 22

13. **Sizes 4"– 6":** Turn the valve over and place the stem extension (14) into the hole in the bottom disc stem. Install the stem compression ring, stem wedge ring, bearing, shims, spring, and bottom gland (12) with O-ring per the instructions in steps 10, 11 and 12. Note that the retainer plate screws on the bottom are all the same length. See note – Table 6.

    Sizes 8"– 18": Turn the valve over and install the stem compression ring, stem wedge ring, bearing, shims, spring, and bottom gland (12) with O-ring per the instructions in steps 10, 11, and 12. Note that the retainer plate screws on the bottom are all the same length. See note – Table 6.

    Sizes 20" and 24": Turn the valve over and install the stem compression ring, stem wedge ring, bearing, shims and spring per the instructions in steps 10, 11 and 12. Place the small O-ring (5B) in the groove on the inside bore and the large O-ring in the groove on the outside of the bottom gland. Orient the gland with the outside O-ring on top, away from the disc and carefully slide the gland over the disc support stud. Place the retainer plate on top of the gland. Next, thread two nuts (18) onto the disc support stud until they are touching the retainer plate. Slide the metal washer (19) over the disc support stud such that the recessed counterbore is facing upwards away from the disc. Next, place the PTFE thrust washer (20) on top of the metal washer. It should fit into the counterbore of the metal washer. Place the disc support

bracket on next with the large center hole facing down, toward the disc. Install 4 socket head screws and finger tighten three to four turns (Figure 23). See note – Table 6.

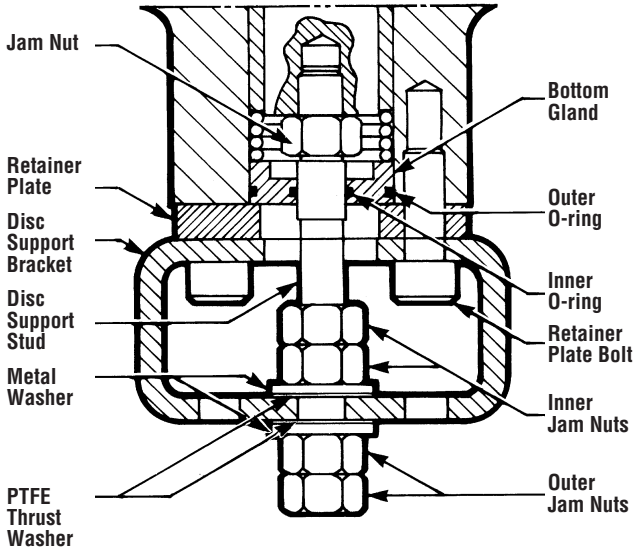


Figure 23 - 20" and 24" Disc Support Assembly Details

14. **All Sizes:** Align the disc in the closed position so it is centered in the liner. Close alignment is important so use a scale to ensure the disc is closely centered. Measure at the 3 o'clock and 9 o'clock positions (Figure 25). These measurements will be identical with the disc properly centered. In a criss-cross pattern, tighten the 4 body bolts and torque to the values listed in Table 4. Be sure to bring the body halves together evenly. This will require gradual tightening of each bolt. As the body bolts are tightened, the disc may rotate out of alignment with the seat. If this occurs, stop tightening immediately, realign the disc in the seat, and then continue tightening the bolts. Failure to bolt the body halves evenly will cause them to bind. This may prevent the body halves from mating completely using the specified bolting torques. DO NOT EXCEED TORQUE SPECIFICATIONS ON BODY BOLTS. See note – Table 6.

15. **Sizes 4" – 12":** Tighten the four bottom retainer plate screws in a criss-cross pattern and torque to the values listed in Table 6. Be sure to bring the retainer plate down evenly. This will require gradual tightening of each bolt. Failure to do so will cause the bolts to bind on the retainer plate and may bend the retainer plate. When properly installed, the retainer plate will be tight against the body end. DO NOT EXCEED TORQUE SPECIFICATIONS ON RETAINER PLATE BOLTS. See note – Table 6.

Sizes 14"– 18": Check to make sure that the bottom gland is aligned with the body stem bore. Tighten the four bottom retainer plate screws in a criss-cross pattern and torque to the values listed in Table 6. Be sure to bring the retainer plate down evenly. This will require gradual tightening of each bolt. Check to make sure that the bottom gland remains aligned with the body stem bore. If not properly aligned, the gland can bind in the stem bore and may bend the retainer plate. When properly installed, the retainer plate will be tight against the body end. DO NOT EXCEED TORQUE SPECIFICATIONS ON RETAINER PLATE BOLTS. See note – Table 6.

Table 6 - Bolting Torques

Carbon Steel Fasteners				
Part	Body	Body	Retainer	Retainer
Alloy Size	B7 Ft-Lbs	(8.8) (NM)	4037 Ft-Lbs	(8.8) (NM)
2	40	(54)	30	(41)
3	40	(54)	30	(41)
4	40	(54)	30	(41)
5	40	(54)	40	(54)
6	40	(54)	40	(54)
8	80	(108)	40	(54)
10	120	(163)	100	(136)
12	160	(217)	100	(136)
14	180	(244)	100	(136)
16	200	(271)	100	(136)
18	200	(271)	100	(136)
20	250	(339)	100	(136)
24	250	(339)	100	(136)

Stainless Steel Fasteners				
Part	Body	Body	Retainer	Retainer
Alloy Size	B8-40 Ft-Lbs	(A2-70) (NM)	B8-40 Ft-Lbs	(A2-70) (NM)
2	20	(41)	20	(41)
3	20	(41)	20	(41)
4	20	(41)	20	(41)
5	20	(41)	40	(54)
6	20	(41)	40	(54)
8	40	(54)	40	(54)
10	120	(81)	60	(81)
12	160	(81)	60	(81)
14	180	(163)	100	(136)
16	200	(217)	100	(136)
18	200	(217)	100	(136)
20	250	(339)	100	(136)
24	250	(339)	100	(136)

NOTE: For stainless steel or other high alloy fasteners with a yield strength below 70,000 psi, it may be necessary to use B7 fasteners for the initial assembly. Once the valve is fully assembled, each fastener must then be removed one at a time and replaced with the high alloy fastener. The high alloy fasteners must be torqued to the levels specified in Table 6.

Sizes 20" and 24": Check to make sure that the bottom gland is aligned with the body stem bore. Tighten the four bottom retainer plate screws in a criss-cross pattern and torque to the values listed in Table 6. Be sure to bring the retainer plate down evenly. This will require gradual tightening of each bolt. Check to make sure that the bottom gland remains aligned with the body stem bore. If not properly aligned, the gland can bind in the stem bore and may bend the retainer plate. Also, check to make sure that the jam nuts do not bottom on the disc support bracket as the retainer screws are tightened. It may be necessary to thread the nuts further down on the disc support stud as the retainer screws are tightened to maintain clearance. When properly installed, the retainer plate will be tight against the body end. DO NOT EXCEED TORQUE SPECIFICATIONS ON RETAINER PLATE BOLTS. See note – Table 6.

After the retainer bolts are tightened, finger tighten the inner jam nuts against the disc support bracket. Place the outer PTFE thrust washer, the metal thrust washer with the shallow counterbore facing down against the PTFE washer, and 2 outer jam nuts on the disc support stud. Finger tighten the jam nuts against the disc support bracket. Using a wrench on the inner and outer jam nuts located against the inner and outer metal washers, simultaneously torque the nuts to approximately 40 ft-lbs. This will seat the PTFE thrust washers against the bearing surface of the disc support bracket. Then tighten the second jam nut against the first jam nut to 100 ft-lbs. Make certain that when tightening the second jam nut, the first jam nut or the disc support stud does not turn. When complete, tack weld the jam nuts together (Figure 23).

16. **All Sizes:** Tighten the four top retainer plate screws following the instructions in step 15. After all four screws are torqued to the values listed in Table 6, remove the two longest retainer screws (installed in step 5). Place the mounting plate (13) on top of the retainer plate, reinstall the two long retainer screws (Figure 24) and torque to the values listed in Table 6. See note – Table 6.

17. **All Sizes:** Carefully clean all exposed liner surfaces. Cycle the valve five to six times making sure the disc swings completely through the liner in both directions. The initial breaking torque will be high. Cycling the disc several times helps to "set" the liner and seat energizer plus smooth out any ridges that may have formed in the liner during assembly. A small amount of lubricant, such as silicon, applied to the disc sealing diameter will help reduce the initial torque. BE CAREFUL to avoid dirt or grit contamination in the liner, as this can scratch the sealing edge of the disc or liner which will compromise the bubble tight shutoff provided by this valve.

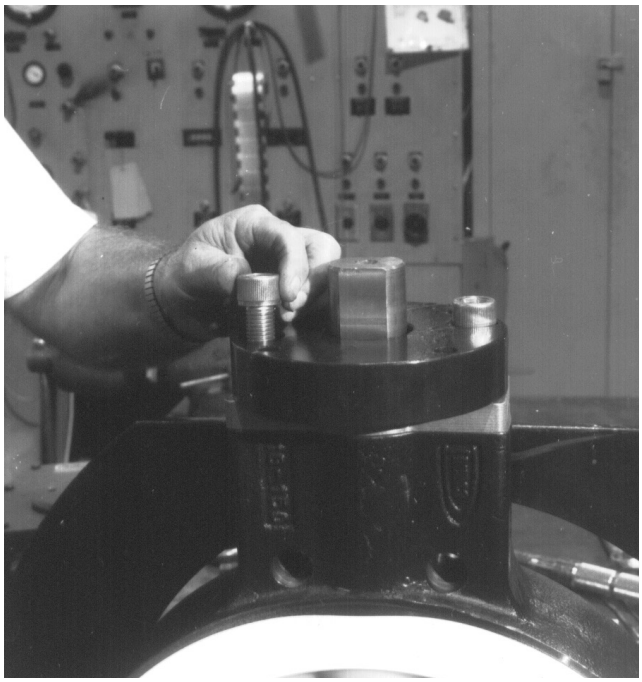


Figure 24

18. **All Sizes:** Align the disc in the closed position so that the disc is centered in the liner. Close alignment is important, so use a scale to ensure the disc is closely centered. Measure at 3 o'clock and 9 o'clock positions. These measurements will be identical with the disc properly centered (Figure 25). The valve is now ready for the actuator to be installed.



Figure 25

7. Manual Gear Operator Installation

1. Close the valve. The flats on top of the stem should be parallel with the valve flange face.

! **NOTE:** At this time adjustments should be made to assure that the valve body machined flanged surface (6) is parallel with the disc. To accomplish this, place the valve body machined flanged surface (6) on a level plate. Then position a bubble level on the upper side of the shaft square and adjust the shaft until completely level.

2. Rotate the gearbox handwheel (1) clockwise until the gearbox pointer (2) indicates the “shut” position.
3. Place the gearbox on the valve mounting pad as shown in Figure 26.
4. Loosen the gearbox stopping screws (3) and (7).
5. Install and tighten the gearbox bolts (4) with their lockwashers.
6. Turn the gearbox closing stop screw (7) clockwise until it stops, then tighten the lock nut (8).
7. Turn the gearbox handwheel (1) counterclockwise to open the valve until the disc face is perpendicular to the valve body flange face.
8. Turn the gearbox opening stop screw (3) clockwise until it stops, then tighten the lock nut (5).
9. Cycle the valve from closed to open to closed again using the gear operator. Recheck to make sure the disc is centered on the seat by measuring the distance from the machined surface on the disc edge to the inner edge of the liner flanged surface (6) on the body. This should be done at two points, at the 3 o’clock and 9 o’clock positions. Both measurements should be equal.

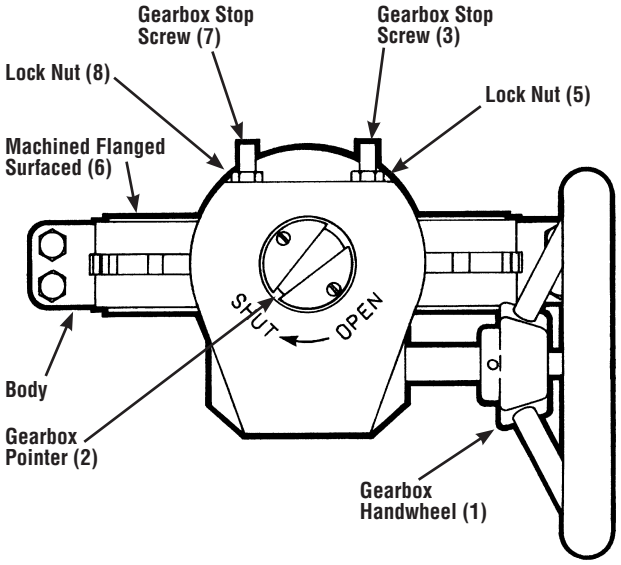


Figure 26



8. Changing Manual Gear Operator Quadrants

⚠ **CAUTION:** Do not attempt to change the manual gear operator quadrant while the valve is in service.

1. Close the valve. The flats on top of the stem should be parallel with the valve flange face. Depressurize system if valve is installed, as valve could open when manual gear operator is removed.
2. Remove manual gear operator. Rotate the gearbox handwheel (1) until the gearbox pointer (2) indicates the “shut” position.
3. Place the gearbox on the valve mounting pad in the desired quadrant.
4. Follow Steps 4 through 8 of the Manual Gear Operator Installation instructions.

9. Locking Lever and Indicator Plate Installation

1. Close the valve. The flats on top of the stem should be parallel with the valve flange face.

NOTE: At this time adjustments should be made to assure that the valve body machined flanged surface (5) is parallel with the disc. To accomplish this, place the valve body machined flanged surface (5) on a level plate. Then position a bubble level on the upper side of the shaft square and adjust the shaft until completely level.

2. Mount the indicator plate (1) to the valve as shown in Figure 27 with the shakeproof washers placed between the indicator plate (1) and the valve body mounting pad. Do not tighten the indicator plate bolts (4) at this time.

3. Place the locking lever (2) on the valve stem as shown in Figure 27. Tighten the pinch bolt (3) on the handle.

4. Position the indicator plate (1) so that the locking lever fits in the “closed” position of the indicator plate (1). Tighten the indicator plate bolts (4).

5. Cycle the valve from closed to open to closed again using the locking lever handle. Recheck to make sure the disc is centered on the seat by measuring the distance from the machined surface on the disc edge to the inner edge of the liner flanged surface (5) on the body. This should be done at two points, at the 3 o’clock and 9 o’clock positions. Both measurements should be equal.

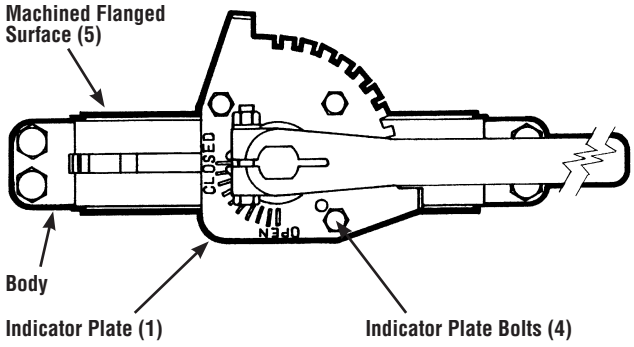


Figure 27



10. Changing Locking Lever Quadrants

CAUTION: Do not attempt to change locking lever handle quadrants while the valve is in service.

1. Close the valve. The flats on top of the stem should be parallel with the valve flange face. Depressurize system if valve is installed, as valve could open when locking lever handle is removed.

2. Remove the locking lever (2) and indicator plate (1).

3. Mount the indicator plate (1) 180° from the position shown in Figure 27. Do not tighten the indicator plate bolts (4) at this time.

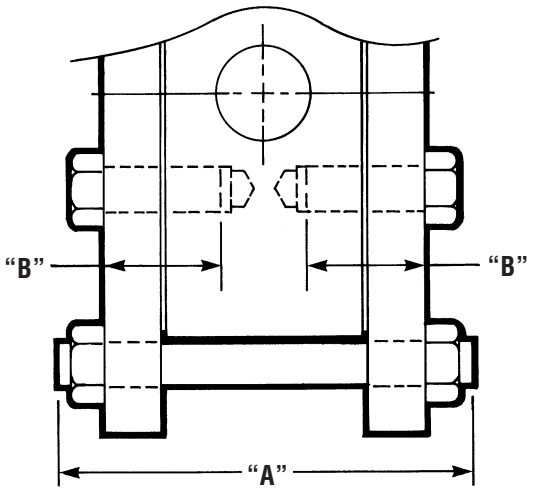
4. Follow Steps 3 and 4 in the Locking Lever and Indicator Plate Installation instructions.

11. Stud Bolts and Capscrews for Installation of Wafer Bodies

Valve Size	18	20	24
Number of Stud Bolts	12	16	16
Dia. & Thread	$1^1/_8$ – 8N		$1^1/_4$ – 8N
"A" Length of Stud Bolts	$10^3/_4$	$11^1/_2$	13
Number of Capscrews	8	8	8
Dia. & Thread	$1^1/_8$ – 8N		$1^1/_4$ – 8N
"B" Length of Capscrews	3	3	3

Class 150#
ANSI B16.5
Flange Thickness

$^1/_8$" Thick Gasket

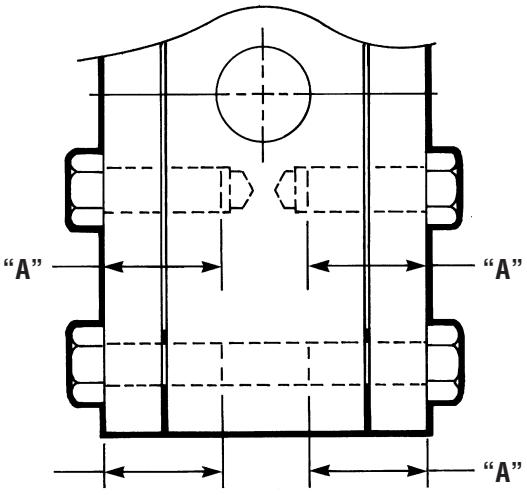


Valve Size	2	3	4	5	6	8	10	12	14	16
Number of Stud Bolts	4	4	8	8	8	8	12	12	12	16
Dia. & Thread	$^5/_8$ – 11 UNC			$^3/_4$ – 10 UNC			$^7/_8$ – 9 UNC		1 – 8 UNC	
"A" Length of Stud Bolts	5	$5^1/_2$	$5^3/_2$	$6^1/_2$	$6^1/_2$	$6^3/_4$	$7^3/_4$	$8^1/_4$	$8^3/_4$	$9^3/_4$

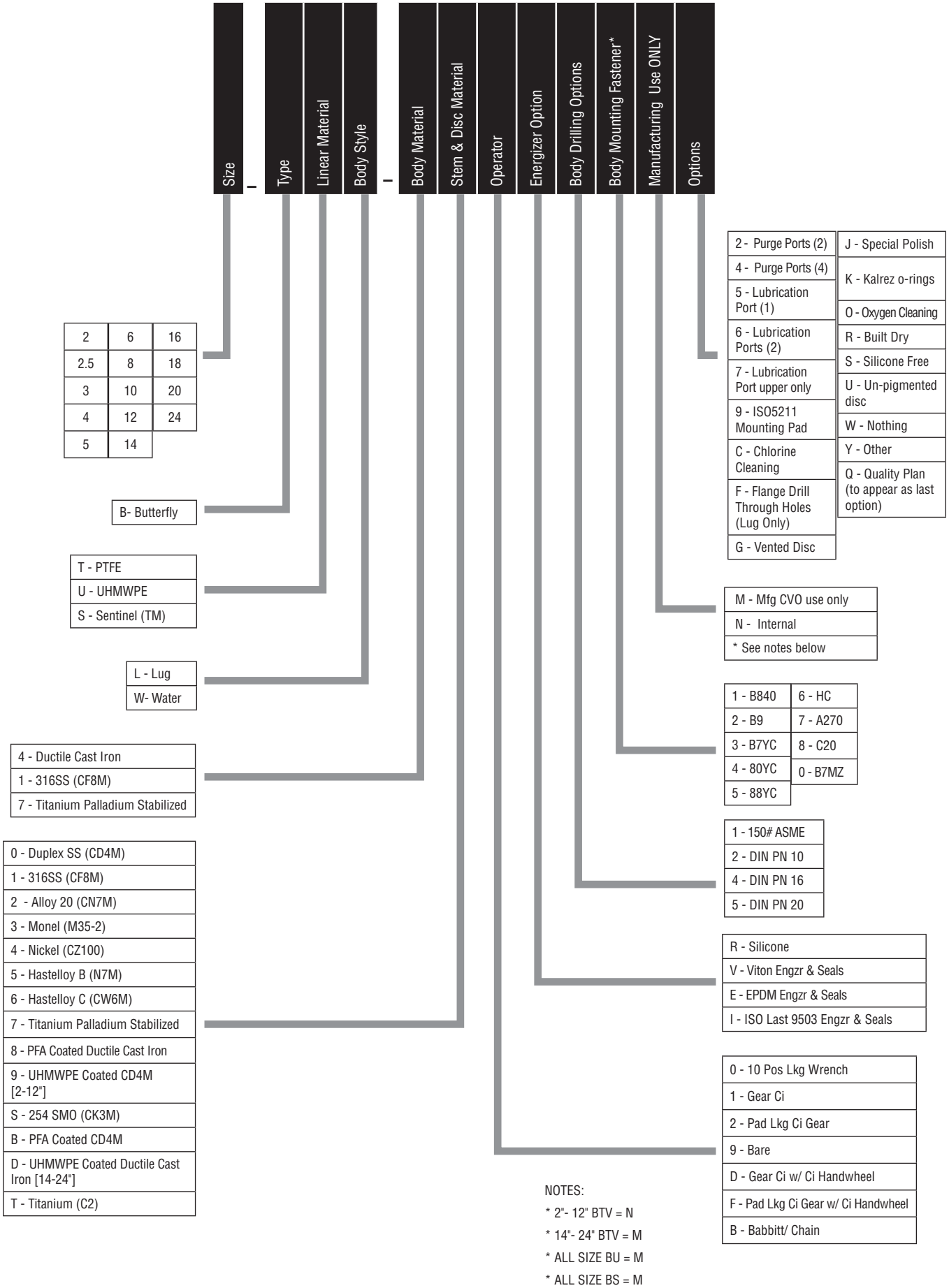
12. Cap Screws for Installation of Lug Bodies

Class 150#
ANSI B16.5
Flange Thickness

$^1/_8$" Thick Gasket



Valve Size	2	3	4	5	6	8	10	12	14	16	18	20	24
Number of Capscrews	8	8	16	16	16	16	24	24	24	32	32	40	40
Dia. & Thread	$^5/_8$ – 11 UNC			$^3/_4$ – 10 UNC			$^7/_8$ – 9 UNC		1 – 8 UNC		$1^1/_8$ – 8		$1^1/_4$ – 8
"A" Length of Capscrews	$1^1/_2$	$1^3/_4$	$1^3/_4$	$1^3/_4$	2	$2^1/_4$	$2^1/_2$	$2^1/_2$	$2^3/_4$	3	3	3	3



NOTES:

* 2"- 12" BTV = N
* 14"- 24" BTV = M
* ALL SIZE BU = M
* ALL SIZE BS = M

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