

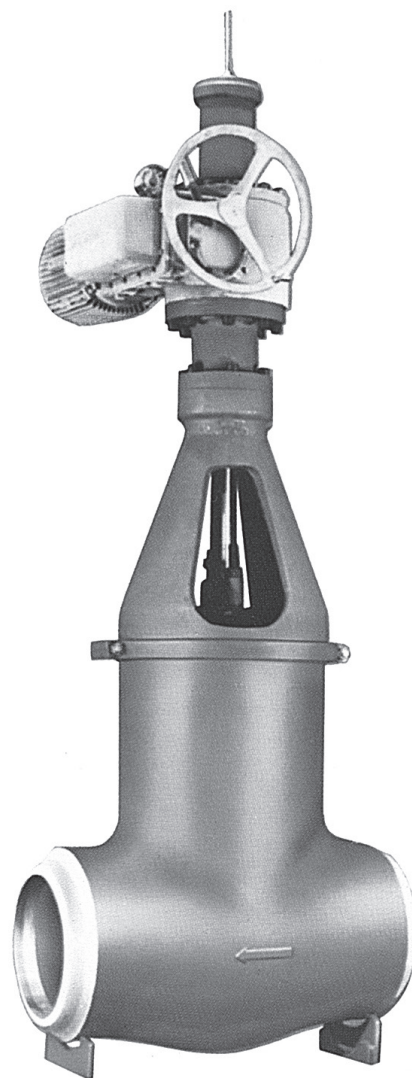


# *USER INSTRUCTIONS*

## *Anchor/Darling Double-Disc Gate Valves 2 1/2 and over with T-head stem*

*FCD ADENIM0003-01 - 07/14*

*Installation  
Operation  
Maintenance*



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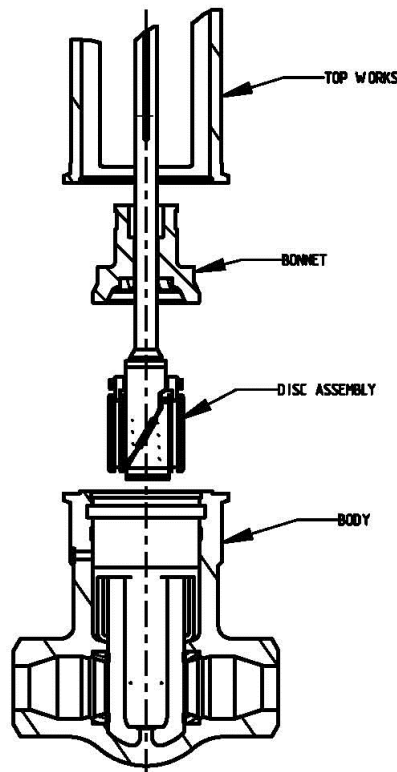


Figure 1

## 1.0 Valve Description

### 1.1 Recommended uses

Anchor/Darling Double Disc gate valves are designed to provide isolation of a piping system or a component when closed. They are not suitable for modulation of flow; i.e., throttling, and should not be used for that purpose.

### 1.2 Principles of operation

The principle parts of a double disc valve are the body, bonnet, disc assembly, stem and top works (Fig. 1). The body and bonnet contain the fluid within the system. The disc assembly is positioned by the stem to either block flow through the body or is raised to leave an unobstructed flow passage.

- 4** The disc to seat seal in the double disc gate valve is created by a combination of internal pressure and mechanical wedging force. When the line pressure is high, the differential between the upstream and downstream ports forces the downstream disc against the downstream seat and creates a seal. At lower line pressures (under approximately

100 psi), the pressure force alone may not be sufficient to create a seal. A mechanical force resulting from the discs being expanded against the seat rings by wedging mechanism between them provides the additional force necessary to seal.

### 1.3 Design features

- 1.3.1 Bonnet Seals:** Anchor/Darling Double Disc Gate valves are supplied with two basic types of body-bonnet closures; bolted bonnet or pressure seal.

The bolted bonnet closure (Fig. 2) is a bolted flange tongue and groove joint with spiral-wound stainless steel gasket with graphite filler. The seal depends on the bolt preload to maintain sufficient compressive force on the gasket.

Pressure seal type closures (Figs. 3 & 4) utilize a tapered soft metal or graphite gasket for sealing. The gasket is contained within the body neck bore by a retaining ring. The tapered inner surface of the gasket bears against a mating annular surface on the valve bonnet. Under internal pressure, the bonnet is forced against the pressure seal gasket, wedging it against the body neck wall. A slight interference angle produces a line contact

Figure 2

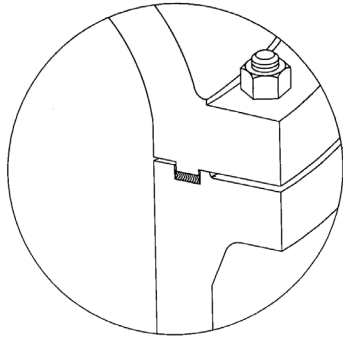


Figure 3

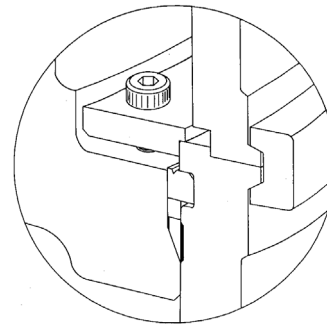
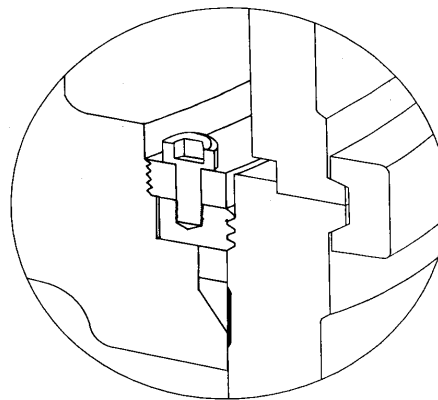


Figure 4



and high sealing pressure. The greater the valve pressure the tighter the seal. No bolting force is required to maintain the seal although the bonnet is initially drawn into contact with the pressure seal by cap screws.

1.3.2 **Disc Assembly:** The Anchor/Darling Double Disc assembly (Fig. 5) consists of dual floating discs with a two piece wedging mechanism between them. Trunnion on the back of each disc fit into holes in the upper wedge. The upper wedge in turn is connected to the stem, which allows it to serve as a carrier for the discs. A lower wedge is loosely hung on a land on the upper wedge between the discs.

As the disc assembly is lowered into the seat (Fig. 6), the lower wedge contacts a bridge in the bottom of the body between the seats. Further travel of the upper wedge (Fig. 7) causes it to contact the lower wedge on the beveled interface and spread both the wedges and the discs out against the seats.

When the stem is raised, the upper wedge immediately pulls away from the lower wedge, eliminating the force of the discs on the seat.

Body seat rings are set into machined recesses in the body which support and retain the rings (Fig. 8). A seal weld is provided between the body and the rings. This weld is for sealing only and is not structural. The seat rings are replaceable.

### 1.3.3 Valve Actuation (Topworks)

A gate valve is actuated by moving the disc assembly in and out of the seats with the stem. The necessary thrust for opening or closing is imparted to the stem by the valve actuator which is supported and restrained by the yoke structure. Five (5) types of actuators are normally supplied; handwheel, manual gear, electric motor, pneumatic cylinder and hydraulic cylinder. The first three impart rotary motion to a stem nut which converts the rotary motion to linear stem movement via

Figure 5

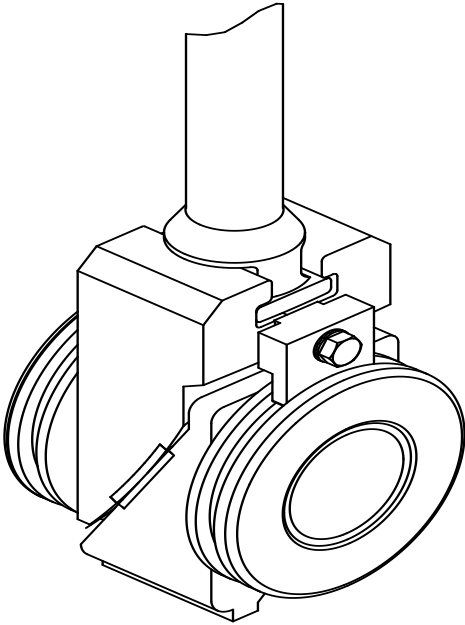


Figure 6

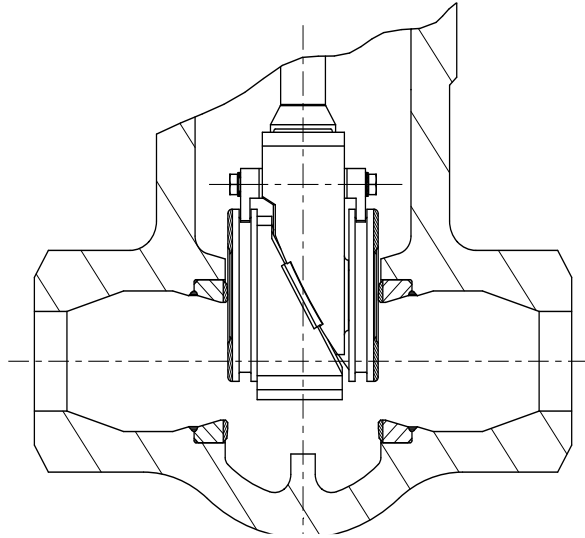


Figure 7

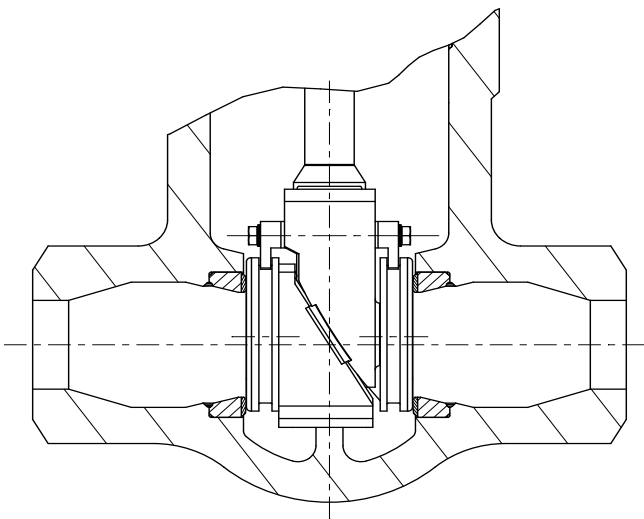
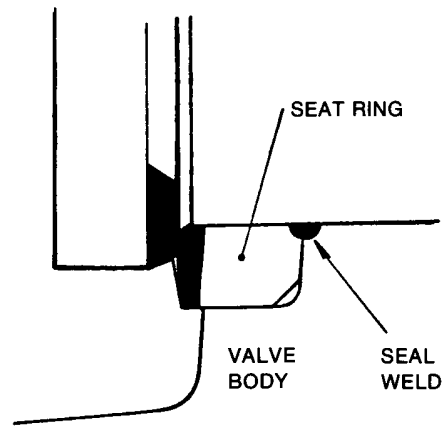


Figure 8



the acme stem threads. The pneumatic and hydraulic cylinder actuators provide direct linear motion to the stem. Always consult the maintenance manual for the specific actuator or actuator accessory before using or performing maintenance on these components.

Sealing of the bonnet-stem penetration is accomplished by a bolted gland stuffing box containing ring type packing. An emergency back up seal is provided in the form of a backseat rigidly mounted in the bonnet.

## 2.0 Care of Valve Prior to Installation

### 2.1 Receiving inspection

Upon receipt of the valve, thoroughly inspect it for shipping damage. As a minimum, the following items should be checked:

1. Handwheel and shaft - check for bending or impact damage.
2. Switches and actuating mechanisms - bent or broken parts?
3. Missing or loose bolting?
4. End covers in place?
5. Is valve securely fastened to shipping skid?
6. Are spare parts shipped with valve in place and secure?

### 2.2 Handling

The valves are shipped strapped to wooden skids designed to be moved by forklift. It is recommended that when being handled prior to installation, the valve be kept on its skids and a forklift truck be used for moving. If an overhead crane is used, care must be exercised to center the load. The slings should not lift the valve by the wooden skid structure alone, but must pass under the valve.

### 2.3 Storage

Store valves on their shipping skids in a clean dry area protected from the weather.

Valves are generally shipped without the permanent packing installed. Experience indicates that stem corrosion pitting can result when valves are stored with the packing in place. For this reason we do not recommend installing the packing until valve is to be put in service.

The service packing is shipped with the valve, contained in a plastic bag placed in the valve port or attached to the yoke. If the packing is

removed for storage elsewhere, reseal the valve end covers to protect the internal cleanliness of the valve.

Motor actuated valves, if stored for more than a few months require special care of the actuator. Motor and switch compartment heaters, if supplied, should be connected. The major concern is condensation on the internal parts of the actuator. For this reason, rapid and/or extreme temperature and humidity changes should be avoided. Storage in a temperature and humidity controlled environment is desirable. Long term storage of motor actuators may affect the terms of the warranty and the manufacturer should be contacted for specific information.

## 3.0 Installation Instructions

### 3.1 Rigging

When lifting the valve for installation in the line, it is important that slings of adequate size be used. The capacity of the sling must exceed the weight of the valve. Slings should pass under the valve body and through the yoke arms. Block carefully to prevent damage or abrasion of component parts and finishes.

### 3.2 Cleaning

Prior to installation remove the valve end covers and inspect for cleanliness. If any sign of foreign matter is observed in the valve internals, open the valve and place it on its side (stem horizontal) and flush thoroughly with water. Steam or air may be used if water is not available but exercise caution that the high velocity does not drive debris into clearance spaces.

### 3.3 Installing valve in line

3.3.1 The pipe must be properly supported and aligned with the valve. Seat leakage in valves is frequently caused by seat misalignment resulting from excessive end movements introduced in the cold springing of the connecting pipe.

3.3.2 Before weld end valves are welded into the line, raise the disc assembly off the seat a sufficient distance to prevent arcing.

3.3.3 The preferred installation of double disc gate valves is with the lower wedge on the downstream side. The only exception is that when in a vertical pipe with flow down, the lower wedge should be on the upstream side. Although standard convention at Flowserve locates the lower wedge on the right hand side of the valve when facing the nameplate, it is recommended the assembly drawing be checked to verify orientation.

- 3.3.4 It is recommended that the valve be installed with the stem vertical, when possible. This orientation provides enhanced packing life and simplifies disassembly/reassembly.
- 3.3.5 Following installation of the valve in the line, install the packing supplied with the valve. (See maintenance Section 5.4 for specific instructions). This operation may be performed following valve cleaning if more convenient.
- 3.3.6 Before the valve is placed in operation, check all bolting for tightness and lubrication per section 5.5.

## 4.0 Operating The Valve

Prior to operating the valve for the first time, verify that the valve has been prepared in accordance with the preceding sections of this manual.

### 4.1 Hand actuated

Handwheel actuated valves close on clockwise rotation of the wheel and open counter-clockwise. This is true also for the handwheel on gear and motor actuators.

- 4.1.1 Flowserve valves, if properly set up and maintained, will close with ordinary effort on the handwheel. The required total force at the rim of the handwheel should not exceed 100 lbs. and will usually be much less. If tight shut-off is not achieved do not use “cheaters” or other means of extra leverage. Instead, open and close the valve once in an attempt to dislodge any foreign matter on the sealing area that may be interfering with closure. If this fails, disassemble the valve and inspect the internals for galling or other damage.
- 4.1.2 The impactor feature on valves supplied with impactor handwheels is intended to be used only in unseating the disc. If the impactor is used to seat the disc it may be difficult to reopen the valve.

### 4.2 Motor actuated

- 4.2.1 The motor actuators are adjusted for correct operation when shipped from the plant. It should not be necessary to re-adjust the torque and limit switches when the valve is placed in operation unless the actuator has been removed from the valve or the switch adjustments have been tampered with.

- 4.2.2 Adjustments of torque or limit switches should not be attempted without first consulting Service Engineers. Failure to obtain proper authorization when resetting torque or limit switches may void the warranty.  
  
Under no circumstances should the torque and/or limit switches be completely bypassed. They are included to provide protection of the valve internals. Removal of their protection can cause extensive damage to the equipment.

- 4.2.3 The valve is normally supplied with the torque switch wired to stop the actuator in the closed position and the limit switch wired to stop in the full open position. Using the torque switch to control travel in the opening direction may damage the backseat. The valve should be backseated only by using the handwheel.

- 4.2.4 When powering the actuator for the first time, observe that the direction of rotation is correct. If not, the power leads must be reversed.

- 4.2.5 Manual operation may be performed at any time by pulling the declutch lever downward.

The lever will stay in the manual mode until the electric motor is actuated whereupon it will automatically disengage.

### 4.3 Operating tips

Do:

- Operate valves at least every 6 months.
- Keep stem clean and lubricated.
- Inspect valves regularly.
- Lap seats promptly if valve leaks.
- Use normal torque on handwheel.
- Check packing regularly.

Do Not:

- Over tighten packing.
- Torque-out motor operator against backseat.
- Keep valve backseated during normal operation.
- Keep gate valve in a partially open position for any length of time or use for throttling.
- Bypass or reset torque or limit switches.



- Use unauthorized actuator assists such as – pipe wrenches – cheaters.
- Bring valve to fully backseated position immediately upon opening a valve in a hot system. Allow 15 minutes for stem to cool before backseating valve.

- Motor Actuator
- Yoke Clamp
- Mounting of accessories, (i.e. limit switches)

## 5.0 VALVE MAINTENANCE

Double Disc Gate valves are designed to be essentially maintenance free pieces of equipment. When used in the proper application and operated correctly, they will provide reliable operation for many years. The only area that is expected to require regular attention is the adjustment and (if necessary) replacement of the stem packing. The frequency of this operation will be dependent on the service conditions, the type of packing used and the care with which it is installed. Some other maintenance recommendations are included in the following sections for information.

### 5.1 Inspection

The most important aspect of valve maintenance is periodic inspection. The early detection of a malfunction can, in many cases, prevent a minor defect from becoming a major problem. It is very important that leakage from any of the major seals (packing, disc/seat, body-bonnet) be addressed immediately. The smallest weepage can quickly become a major problem if it is not treated promptly. Some other areas that should be included in a periodic inspection program are:

1. Lubrication:
  - Stem
  - Yoke Sleeve
  - Motor Actuator Drive Sleeve
  - Pneumatic Actuator Sliding Surfaces
2. Cleaning:
  - Stem
  - Packing Area
  - Pressure Seal Area
  - Body Bonnet Studs
3. Bolting:
  - Body-Bonnet
  - Bonnet Yoke

### 5.2 Lubrication

1. Stem: Keep stem threads lubricated with a light coating of grease such as Dow Corning Molykote P37 paste, Mobil grease 28 or MOV Long Life.
2. Yoke Sleeve: Lubricate with general purpose grease every six months. Apply with grease gun to grease fitting.
3. Air cylinder operated valves require only a light coating of grease or oil on the Cylinder Rod.
4. Motor Actuator: Every six months lubricate drive sleeve top bearing, using grease gun on pressure fitting in housing cover. See Motor Actuator Manual for further information.
5. Bolting: Lubricate with Nuclear Grade Never Seize or equal.

### 5.3 Cleaning

The frequency and extent of cleaning will depend on the valves' location and service conditions. It is important that the stem and packing gland parts be kept clean and free of foreign material. Do not allow water or dirt to collect in the body neck bore area above the pressure seal of pressure seal valves. The build up of corrosion or extraneous material may interfere with removal of the bonnet. For the same reason, excessive rust should not be allowed to build-up on the body-bonnet bolting of bolted bonnet valves.

### 5.4 Packing

6. Most Flowserve valves are supplied with graphite packing supported by braided graphite end rings. Other packing materials are furnished when specified.
7. Remove nuts from gland bolts and raise the gland flange and gland. These two parts may be held out of the way with wire.
8. Clean the threads and insure the nuts thread on easily. Any binding or sticking must be eliminated as this will adversely affect torque values.
9. Remove the old packing with a packing hook. The lantern ring in double packed valves must also be removed to expose the lower

set of packing. There are holes drilled in the top of the lantern ring to accommodate the packing hook. For valves with a 3/8" or larger diameter stem (5/8" and larger width packing) the drilled holes are threaded to accept a 1/4 - 20 threaded rod. Do not scratch the stem during these operations.

10. Clean the packing bore in the bonnet to remove residual packing and other foreign substances. Inspect the bore to insure it is clean, not damaged and has a surface finish of 125 RMS or better.
11. Install new rings one at a time in the sequence shown on the valve assembly drawing, being careful to insure the top and bottom rings are the braided end rings. The ends of the rings should butt together; no gap or overlap. Install the rings with the butt joints offset 180° from each other. Push each ring firmly in place with a packing iron (Fig. 9), Chesterton tamping tool or similar device. When packing double packing boxes with leak-off, it is essential that sufficient rings of lower packing be installed to position the lantern ring at the level of the leak-off.
12. When the stuffing box is full, tighten the gland nuts evenly to ensure the gland is concentric with the stem. Cocking of the gland flange can cause binding and scoring of the stem... Suggested
13. gland bolt torque values are included in Table 1. For non-standard packing designs, check the assembly drawing for packing torque values. If not there, contact Flowserve Engineering.
14. Cycle the valve several times to consolidate the packing and retorque the gland nuts. Repeat until fully consolidated and additional tightening is not needed.

## 5.5 Bolting torque values

At regular intervals, check the tightness of all bolting. Bolted bonnet valves should have the body-bonnet bolting torque to the values shown in Table 2. Packing glands should be torqued to the values shown in Table 1. Pressure Seal bonnet bolting should be torqued to the values show in Table 3. All other bolting should be torqued to the values shown in Table 4.

1. Torque values specified on certified assembly drawings always superceded this manual.
2. The maximum torque values are provided for guidance in field work where higher torques may be required because of material conditions such as rust and oxides.

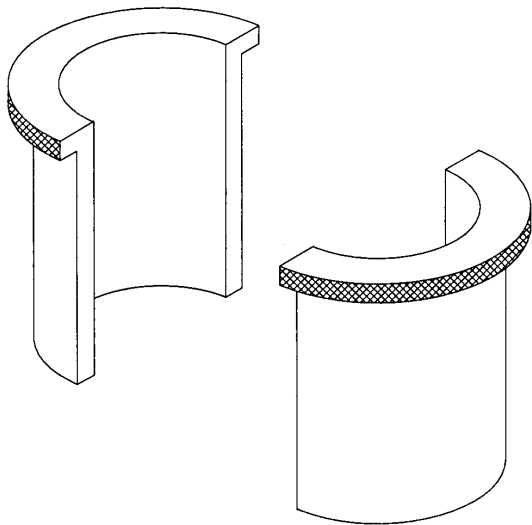


Figure 9 Packing Iron

Table 1 Recommended packing gland bolting torques (ft-lb) - dd gate valves

150 Pressure Class						
Valve Size	Gland Bolt Size	Stem Diameter	Packing Size	Bolt Torque	Packing I.D.	Packing O.D
2.5	0.5	0.875	0.25	15	0.875	1.375
3	0.5	1.25	0.375	32	1.25	2
4	0.5	1	0.25	16	1	1.5
6	0.5	1	0.25	16	1	1.5
8	0.75	1.25	0.25	29	1.25	1.75
10	0.75	1.25	0.25	29	1.25	1.75
12	0.75	1.625	0.5	83	1.625	2.625
14	0.75	1.625	0.375	59	1.625	2.375
16	0.75	1.75	0.5	88	1.75	2.75
18	0.75	1.875	0.375	66	1.875	2.625
20	0.75	2	0.375	70	2	2.75
22	0.75	2	0.375	70	2	2.75
24	0.75	2	0.375	70	2	2.75

300 PRESSURE CLASS						
Valve Size	Gland Bolt Size	Stem Diameter	Packing Size	Bolt Torque	Packing I.D.	Packing O.D
2.5	0.5	0.875	0.25	15	0.875	1.375
3	0.5	0.875	0.25	15	0.875	1.375
4	0.625	1.25	0.375	40	1.25	2
6	0.625	1.375	0.375	43	1.375	2.125
8	0.625	1.5	0.375	46	1.5	2.25
10	0.625	1.375	0.375	43	1.375	2.125
12	0.75	1.5	0.5	79	1.5	2.5
14	0.75	1.625	0.375	59	1.625	2.375
16	0.75	1.75	0.5	88	1.75	2.75
18	0.75	2	0.5	98	2	3
20	0.75	2	0.5	98	2	3
22	0.75	2.125	0.375	74	2.125	2.875
24	0.875	2.375	0.5	132	2.375	3.375



600 PRESSURE CLASS						
Valve Size	Gland Bolt Size	Stem Diameter	Packing Size	Bolt Torque	Packing I.D.	Packing O.D
2.5	0.375	0.75	0.25	10	0.75	1.25
3	0.5	0.875	0.25	15	0.875	1.375
4	0.5	1.25	0.25	20	1.25	1.75
6	0.625	1.5	0.375	46	1.5	2.25
8	0.625	1.625	0.375	49	1.625	2.375
10	0.625	2	0.375	58	2	2.75
12	0.875	2.25	0.375	90	2.25	3
14	0.75	2.125	0.375	74	2.125	2.875
16	1.125	2.5	0.5	177	2.5	3.5
18	0.875	2.375	0.5	132	2.375	3.375
20	0.875	2.625	0.5	143	2.625	3.625
22				0	0	0
24	1.25	4.25	0.625	399	4.25	5.5

900 PRESSURE CLASS						
Valve Size	Gland Bolt Size	Stem Diameter	Packing Size	Bolt Torque	Packing I.D.	Packing O.D
2.5	0.5	1	0.25	16	1	1.5
3	0.375	0.75	0.25	10	0.75	1.25
4	0.5	1.25	0.25	20	1.25	1.75
6	0.625	1.5	0.375	46	1.5	2.25
8	0.75	1.75	0.375	63	1.75	2.5
10	0.75	1.75	0.375	63	1.75	2.5
12	0.75	2	0.375	70	2	2.75
14	0.875	2.375	0.5	132	2.375	3.375
16	0.75	2.5	0.5	118	2.5	3.5
18	1	2.75	0.5	170	2.75	3.75
20	0.875	1.75	0.5	103	1.75	2.75
22	1.25	4.5	0.625	419	4.5	5.75
24	1.25	4.5	0.625	419	4.5	5.75

1500 PRESSURE CLASS						
Valve Size	Gland Bolt Size	Stem Diameter	Packing Size	Bolt Torque	Packing I.D.	Packing O.D
2.5	0.5	1	0.25	16	1	1.5
3	0.375	0.75	0.25	10	0.75	1.25
4	0.75	1.375	0.375	52	1.375	2.125
6	0.75	1.625	0.375	59	1.625	2.375
8	0.75	1.875	0.375	66	1.875	2.625
10	0.875	2	0.375	82	2	2.75
12	0.875	2.625	0.5	143	2.625	3.625
14	1.125	2.75	0.5	191	2.75	3.75
16	1	3	0.5	183	3	4
18	1.25	3.5	0.625	337	3.5	4.75
20	1.25	3.625	0.625	350	3.625	4.875
22	1.5	3.625	0.625	350	3.625	4.875
24	1.5	4	0.625	350	4	5.25

2500 PRESSURE CLASS						
Valve Size	Gland Bolt Size	Stem Diameter	Packing Size	Bolt Torque	Packing I.D.	Packing O.D
2.5	0.625	1.125	0.25	22	1.125	1.625
3	0.625	1.25	0.25	25	1.25	1.75
4	0.625	1.25	0.25	25	1.25	1.75
6	0.75	1.5	0.375	55	1.5	2.25
8	1.125	2.375	0.5	169	2.375	3.375
10	1.125	2.375	0.5	169	2.375	3.375
12	1.125	2.5	0.5	177	2.5	3.5
14	1.25	2.75	0.5	213	2.75	3.75
16	1.25	2.75	0.5	213	2.75	3.75
18	1.25	2.75	0.5	213	2.75	3.75
20	1.5	3.75	0.625	430	3.75	5
22	1.5	3.75	0.625	430	3.75	5
24	1.5	4.125	0.625	500	4.125	5.375

Table 2 Body - Bonnet Bolting Torque (ft-lb) Nominal / Maximum

STUD SIZE	A193 B7 - B16	A193 B8	A564 630-1100	A453 660
¼ - 20	3.5 / 5	2.5 / 3	3 / 6	4 / 6
5/16 - 18	7 / 11	5 / 6.5	8 / 13	6 / 12
3/8 - 16	12 / 20	9 / 12	14 / 23	10 / 20
7/16 - 14	20 / 30	15 / 19	22 / 36	15 / 30
½ - 13	30 / 45	25 / 28	35 / 55	25 / 50
9/16 - 12	45 / 70	30 / 40	50 / 80	35 / 70
5/8 - 11	60 / 90	45 / 55	70 / 110	50 / 100
¾ - 10	100 / 165	80 / 100	120 / 195	90 / 165
7/8 - 9	170 / 270	130 / 160	190 / 310	140 / 280
1 - 8	250 / 400	190 / 240	280 / 470	210 / 420
1 1/8 - 8	370 / 600	280 / 350	420 / 690	300 / 600
1 ¼ - 8	520 / 800	390 / 500	590 / 970	430 / 850
1 3/8 - 8	700 / 1100	530 / 680	800 / 1320	600 / 1200
1 ½ - 8	950 / 1500	700 / 900	1050 / 1750	800 / 1600
1 5/8 - 8	1200 / 1900	900 / 1150	1350 / 2250	1000 / 2000
1 ¾ - 8	1500 / 2400	1150 / 1450	1700 / 2850	1300 / 2500
1 7/8 - 8	1900 / 3000	1400 / 1800	2100 / 3500	1600 / 3200
2 - 8	2300 / 3700	1700 / 2200	2600 / 4300	2000 / 3900
2 1/8 - 8	2800 / 4400	2100 / 2650	3200 / 5200	2300 / 4700
2 ¼ - 8	3400 / 5300	2500 / 3200	3800 / 6200	2800 / 5600
2 ½ - 8	4700 / 7400	3500 / 4400	5200 / 8600	4000 / 8000
2 ¾ - 8	5500 / 8700	4700 / 5900	7000 / 11600	5200 / 10400
3 - 8	7200 / 11400	6100 / 7800	9200 / 15200	6900 / 13000

Table 3 Recommended Bonnet Retainer Bolting Torques Graphite Pressure Seal Gaskets

Bonnet Retainer Bolt Size	Recommended Torque Range (ft-lb)	
	Minimum	Maximum
0.250	2	4
0.313	4	5
0.375	4	6
0.500	8	12
0.625	12	16
0.750	20	24
0.875	26	32
1.000	32	38
1.250	40	48

Table 4 Nominal Torque for Non-Pressure Bolting, Including Capscrews

Bolt Size	A193-B7/B16 Studs	A193-B8/B8M AISI-304/316	A574	A574	A325
D [in]	Torque (ft-lb)				
¼-20	10	3	13	4	-
5/16-18	22	7	28	8	-
3/8-16	38	12	49	14	-
7/16-14	61	19	79	22	-
½-13	93	28	120	34	72
9/16-12	90	41	115	49	-
5/8-11	124	57	159	68	95
¾-10	220	100	282	120	169
7/8-9	354	162	455	194	273
1-8	530	242	682	291	409
1-1/8-8	780	356	-	-	600
1-1/8-7	753	344	966	412	580
1-¼-8	1090	500	-	-	843
1-¼-7	1060	485	1360	582	818
1-3/8-8	1480	678	-	-	1150
1-3/8-6	1390	635	1790	762	1070
1-½-8	1960	895	-	-	1510
1-½-6	1840	843	2370	1010	1420
1-5/8-8	2520	1150	-	-	-
1-¾-8	3190	1460	-	-	-
1-¾-5	2910	1330	3740	1600	-
1-7/8-8	3960	1810	-	-	-
2-8	4850	2220	-	-	-
2-4	4240	1940	5450	2326	-
2-1/8-8	5860	2680	-	-	-
2-1/8-4	5170	2360	6650	2340	-
2-¼-8	7000	3200	-	-	-
2-¼-4	6230	2850	8000	3410	-
2-½-8	9720	4440	-	-	-
2-½-4	8750	4000	11300	4800	-
2-¾-8	13100	5970	-	-	-
2-¾-4	11900	5430	15300	6510	-
3-8	17100	7810	-	-	-
3-4	15700	7160	20100	8590	-

## 5.6 Refinishing sealing surfaces

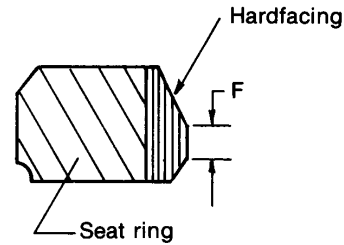
Minor discontinuities in both the disc and seat sealing surfaces, which may cause leakage, can, in many cases, be removed by lapping. Major defects such as cracks or deep gouges will generally require replacement of the part.

**NOTE:** Lapping is a polishing process in which a sealing surface is ground with an abrasive held in place by a special fixture. The abrasive is commonly found in paste form or bonded to a paper backing. Detailed instructions on the use of lapping abrasives and fixtures, normally supplied with such equipment, should be adhered to.

Anchor/Darling gate valves are supplied with a crowned sealing surface on the seat in order to provide precise seat width and tight sealing. Lapping of the seat will cause the sealing band width to be significantly increased. Subsequent to all seat refinishing operations, the seat width must be reduced to the dimension supplied on the valve assembly drawing. If seat widths are not on the drawing, use the nominal dimensions in Table 5. After refinishing seats, check and adjust the disc pack as necessary per 8.1.1. Failure to do so may create leakage problems, particularly at lower pressures.

Valve Size	F		
	600#	900#	1500#
2 1/2	.090	.090	.125
3	.090	.090	.125
4	.090	.090	.156
6	.125	.125	.187
8	.125	.156	.218
10	.156	.156	.250
12	.156	.187	.250
14	.156	.187	.250
16	.187	.218	.281
18	.187	.218	.312
20	.187	.218	.312
22	.187	.218	.312
24	.187	.218	.312
24	.187	.218	.312

Lapping may also change the distance between the seats. See Paragraph 8.1.1 for a description of checking and adjustments.



For 150# and 300# Class valves: F=3/32"

## 6.0 Disassembly

By carefully following these instructions any Flowserve valve can be easily disassembled and reassembled. If problems are encountered with equipment, Flowserve Field Service should be contacted. The use of improper tools or methods may cause severe damage to the valve and may void the warranty.

Prior to attempting disassembly of a particular valve, the specific assembly drawing for the valve should be referred to.

### 6.1 Actuator removal

Valves are supplied with a wide variety of actuating mechanisms. The degree of difficulty involved in their removal varies significantly. Simple bolt-on units such as handwheels, gear units and electric motor units are fairly commonplace. Their removal only requires the use of good mechanical practice. More complex pneumatic and hydraulic units may require specialized skills. Their removal and disassembly should only be attempted by trained personnel. More detailed information on special actuators will be provided in a separate manual when applicable. The following general guidelines are provided for information:

1. Before any attempt to remove the actuator is made, personnel should verify that the system is depressurized and drained.
2. The valve should then be cycled partially to remove any trapped pressure and to insure that the disc pack is not stuck in the seat.
3. The disc pack should then be gently lowered into the seat.



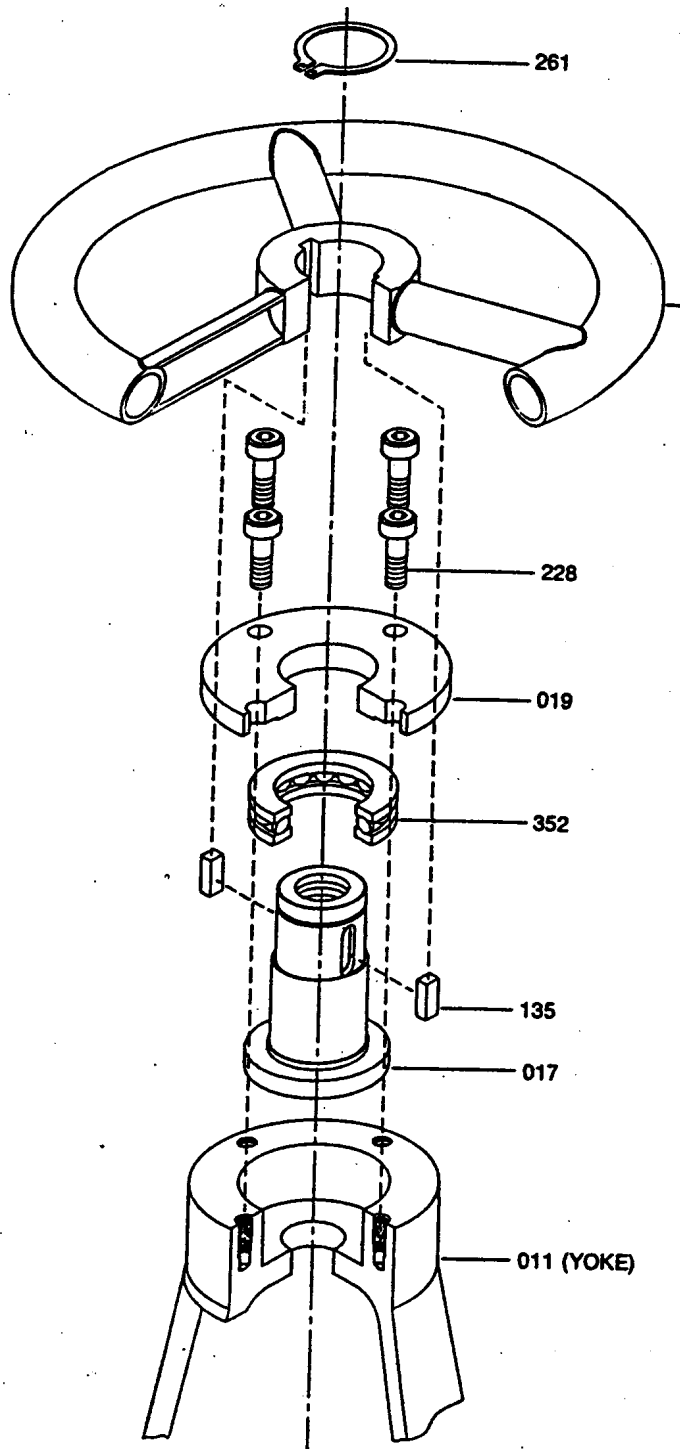


FIGURE 10

6.1.1 **Handwheels:** On handwheel actuated valves (Fig. 10) the handwheel can be removed by removing the retaining ring (261) and pulling the handwheel (136) off the yoke sleeve (017). Care should be taken not to lose the handwheel keys (135).

**NOTE:** If desired, the yoke and handwheel assembly may be separated from the valve in one piece. Once the yoke-bonnet fasteners are removed, the entire assembly can be raised off the stem by turning the handwheel while the yoke is held stationary.

If further disassembly of the handwheel mechanism is required, the yoke cap capscrews (228) and the yoke cap (019) must be removed first. Then the thrust bearing (352) and the yoke sleeve (017) can be lifted out of the yoke.

### 6.1.2 Gear Actuators

Gear actuators (Fig. 11.) are supplied as self-contained units that can be separated from the yoke by removing the actuator capscrews (218). If a stem protector is provided it should be removed. With the actuator properly supported, it may be raised off the yoke either by turning the handwheel or rotating the entire unit.

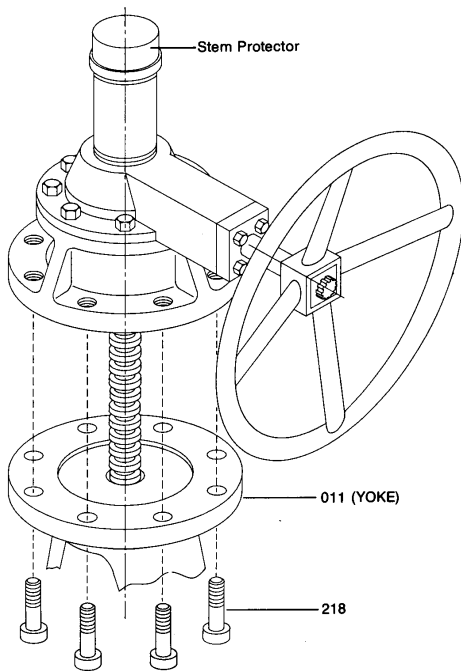


Figure 11

### 6.1.3 Electric Motor Actuators

Although various types of electric motor actuators (Fig. 12) are supplied, all follow the same pattern for their removal from the valve. Prior to removal, all power and control wiring should be disconnected from the actuator. With the stem protector (334) and capscrews (218) removed, and the actuator properly supported, it can be raised in the same manner as the gear unit.

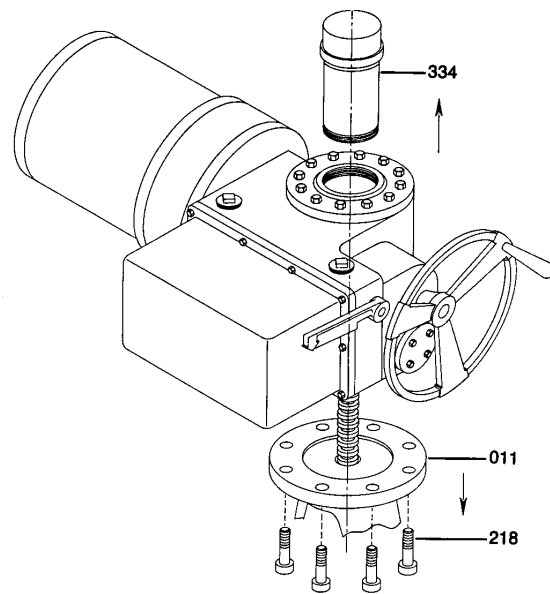


Figure 12

## 6.2 Bonnet Removal – Flanged Joint

6.2.1 Remove the gland nuts (234), the capscrews (217)/yoke studs (201), and yoke nuts (231) holding the yoke (011) to the bonnet (002). The yoke, gland flange and gland may now be lifted off the bonnet. Be careful to not damage the stem (See Fig. 13). For appropriate yoke configuration, reference customer certified assembly drawing.

6.2.2 Remove the packing per the instructions in 5.4.

6.2.3 Remove the nuts (230) from the bonnet studs (200). If the bonnet is too heavy to lift by hand, utilize a hoist with choker around the bonnet neck or two eye-bolts in the yoke bolt holes. Lift the bonnet clear of the valve body and stem. Remove the spiral-wound gasket (100) from its groove. This operation may require the use of a screwdriver or similar tool to pry the gasket from the groove. Be careful not to scratch the gasket seating surfaces.

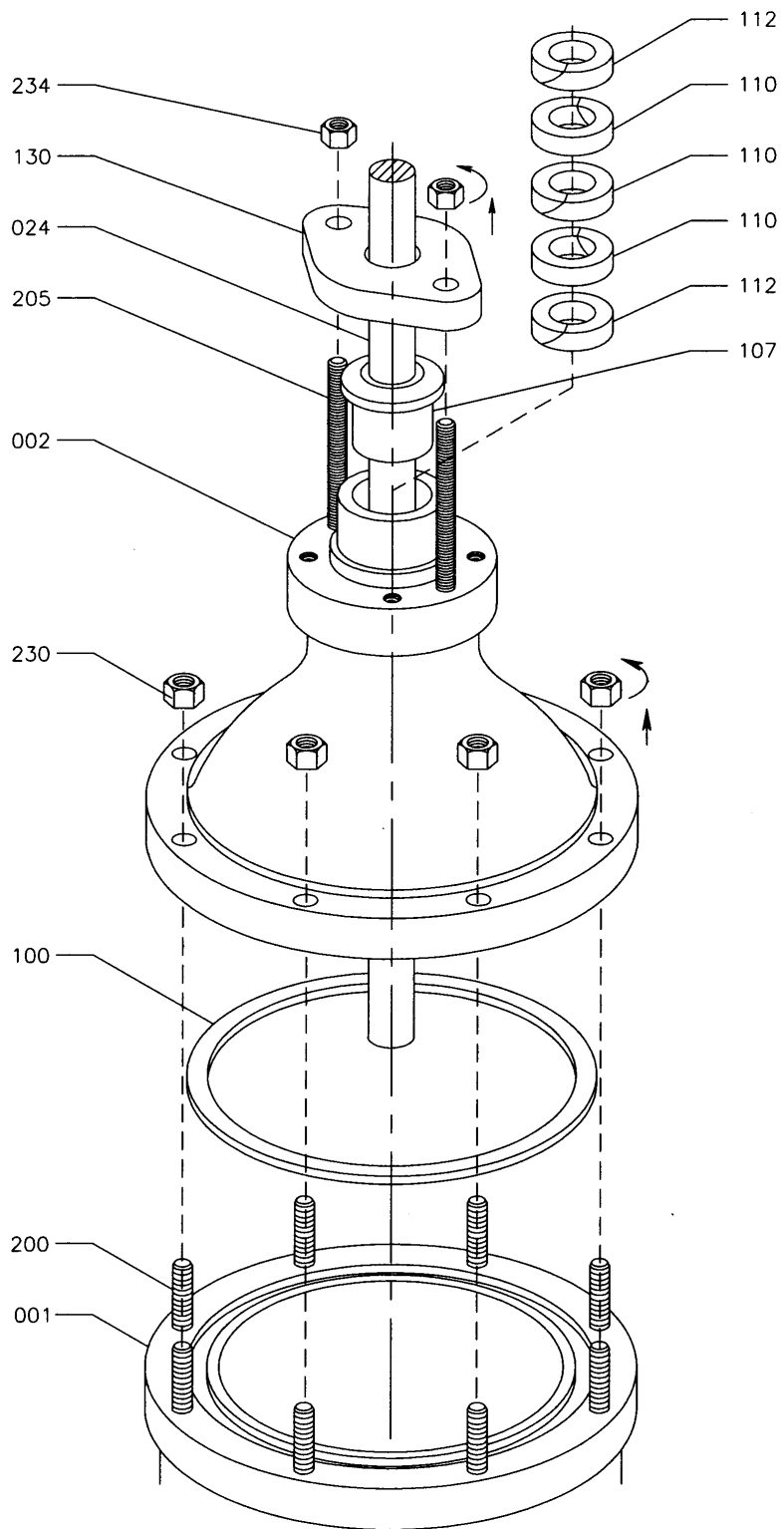


Figure 13

### 6.3 Bonnet Removal – Pressure Seal Joint

6.3.1 Unbolt the yoke clamp bolting (204 & 233) and remove the yoke clamp (012). (It is advisable to thread the yoke clamp back together to prevent losing the parts.) The yoke (011) is now free to be lifted directly from the valve (See Fig. 14)

### 6.3 Bonnet Removal – Pressure Seal Joint

6.3.1 Unbolt the yoke clamp bolting (204 & 233) and remove the yoke clamp (012). (It is advisable to thread the yoke clamp back together to prevent losing the parts.) The yoke (011) is now free to be lifted directly from the valve (See Fig. 14).

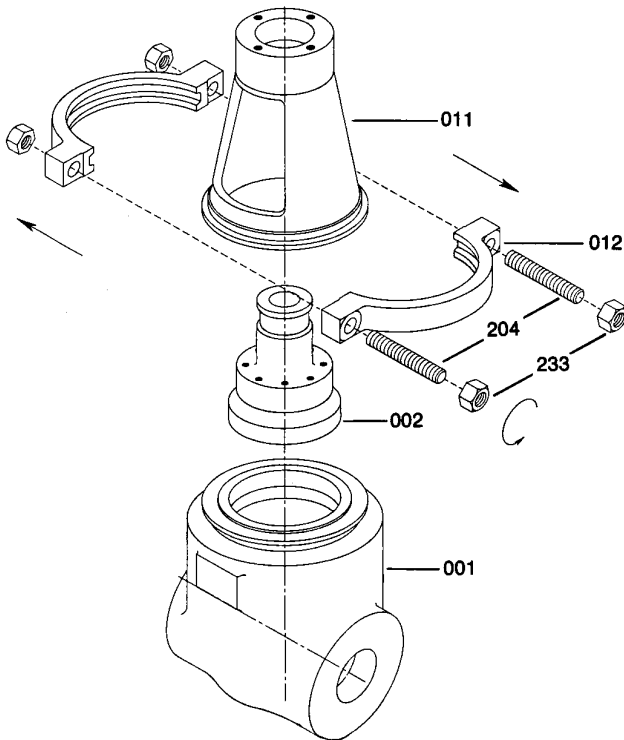


Figure 14

6.3.2 Unbolt the gland nuts (234) and remove the gland flange (130), gland (107), and packing per Paragraph 5.4 (Fig. 15).

**20** 6.3.3 The bonnet is held in the raised position by capscrews (216) that draw it up against a bonnet retainer (034). To disassemble, remove the capscrews and then lift of the bonnet retainer (Fig. 16).

Tap the bonnet sharply to break the seal between it and the pressure seal gasket (030). The bonnet will drop downward against its stop, uncovering the gasket retainer (033). If stuck, apply uniform force to push the bonnet down being careful to not allow it to cock. If not careful, the pressure seal area in the body can be damaged.

6.3.4 The gasket retainer (033) is a ring that has been segmented into four pieces. It is partially recessed in a groove machined in the body. Remove the segments starting with the piece, which has a small drilled hole. The groove in the top of the retainer gasket permits the use of a pry bar or screwdriver in removing the segments. In some cases, it may be necessary to loosen the segments by tapping with a hammer or bar.

6.3.5 Remove the spacer ring (032) and the pressure seal gasket (033) if they are loose enough to move. If not, they may be removed as a single unit with the bonnet per Paragraph 6.3.6.

6.3.6 The bonnet is now ready for removal from the body. The tight clearances between the body, bonnet, spacer ring, and gasket, necessary for a reliable seal, require that the bonnet be withdrawn squarely from the body neck bore. The slightest cocking of the bonnet during withdrawal can cause it to bind and can damage the pressure seal area of the body.

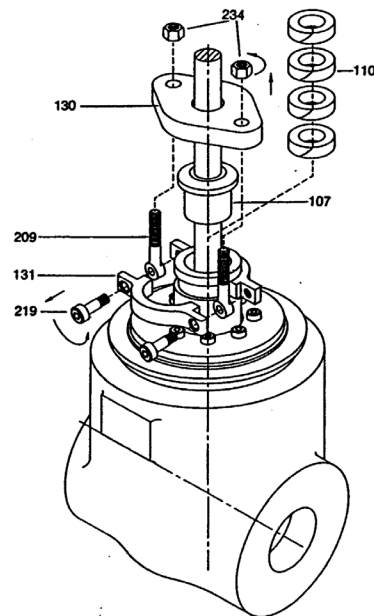


Figure 15

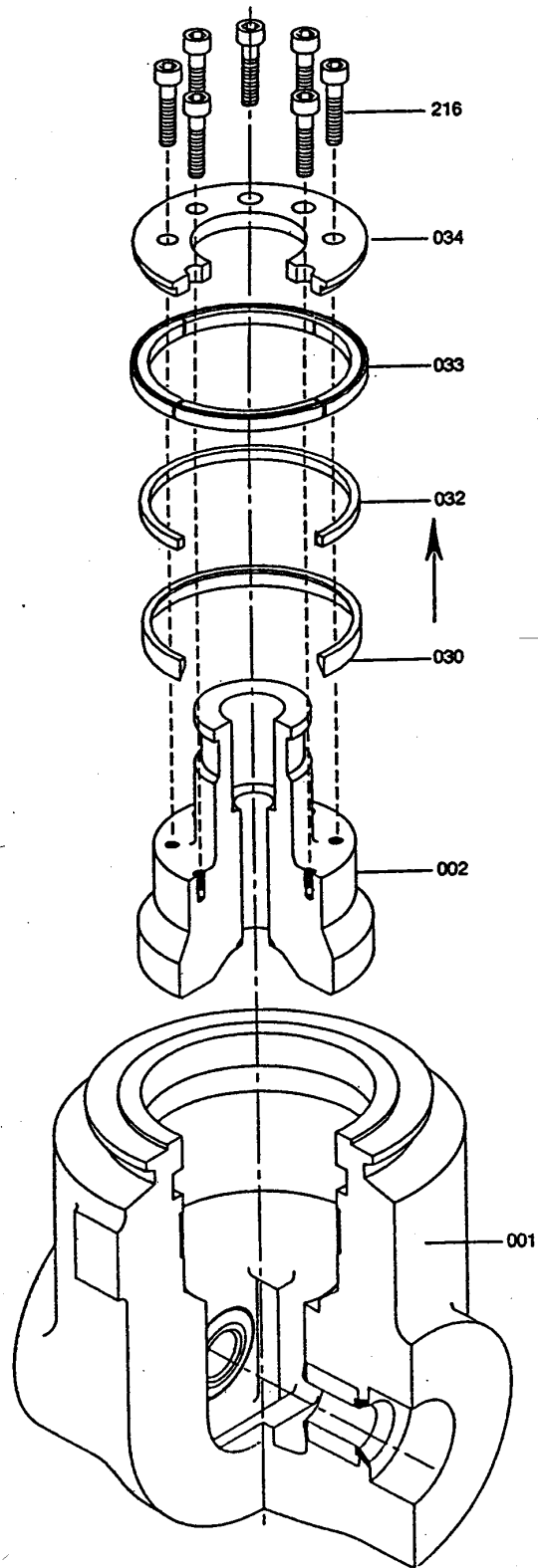


Figure 16

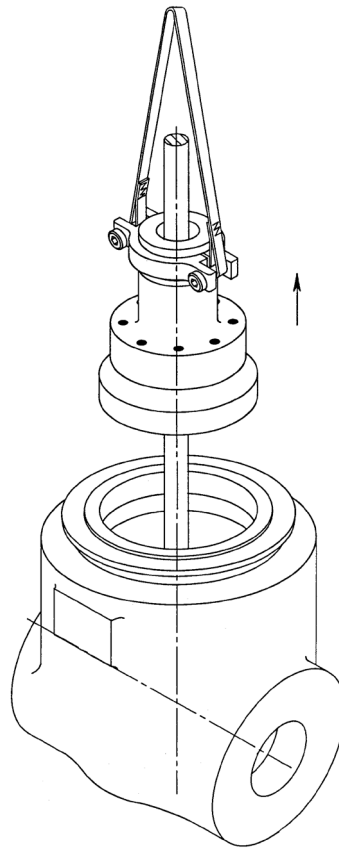


Figure 17

withdrawn squarely from the body neck bore. The slightest cocking of the bonnet during withdrawal can cause it to bind and can damage the pressure seal area of the body.

Therefore, it is recommended prior to removal, that the squareness of bonnet and gasket with respect to the body be checked. This is most easily accomplished by measuring the distance between the top of the gasket and top of the body neck. If the gasket is not square, it should be tapped with a brass rod until it is.

With large bonnets it is a good idea to periodically check the squareness of the bonnet as it is being withdrawn.

Binding any time during withdrawal indicates the bonnet has cocked. Further efforts to force the bonnet will generally make the situation worse. At the first sign of binding, stop and check the squareness of the bonnet.

This means of lifting minimizes cocking. In order to attain the best attachment, the gland bolts (209) should be removed and the retaining rings' halves reassembled on the bonnet.

If desired, the sling can be looped through the retaining ring ears prior to assembly on the bonnet.

Attempting to remove the bonnet by raising the stem, either with slings or the actuator, is not recommended. The load between the stem and the bonnet will be imparted to the backseat.

Excessive force on the backseat-sealing surface may cause it to deform or crack.

- 6.3.8 Following the above procedure will, in most cases, result in removal of the bonnet with little difficulty. However, certain circumstances, such as installation of the valve with stem in other than a vertical orientation, may cause complications.

If greater difficulty is encountered, a Flowserve service engineer should be consulted. Excessive force, which may damage critical surfaces, should be avoided.

## 6.4 Disc Pack & Stem Assembly (Figs. 18 & 19)

- a) The disc pack and stem assembly can be lifted out of the body utilizing an eye-bolt threaded in the tapped hole provided in the end of the stem.
- b) As the stem to upper wedge interface is a T-head design, caution must be applied to prevent the disc pack from disengaging from the stem.

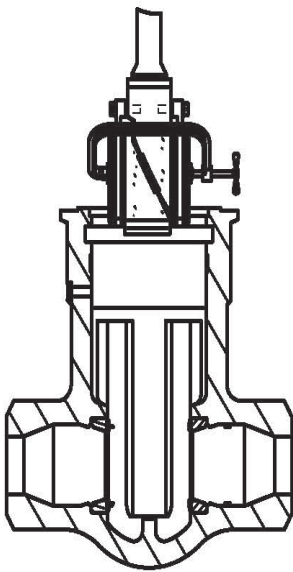


Figure 18

- c) Before the disc pack is free of the body guides, C-clamps should be installed as shown in Fig. 18. This will prevent the discs from disengaging from the upper wedge and falling causing damage or injury.
- d) Once the assembly is safely laid down or supported, the stem can be separated from the disc pack.
- e) The discs can be removed from the upper wedge by first removing the disc retainer fasteners and the disc retainer. At this point the discs can be separated from the wedge assembly and set aside. If they are in good condition and require no lapping, the seating surfaces should be covered with protective material to prevent scratching.
- f) If further disassembly is required, the lower wedge (071) can now be separated from the upper wedge (069). In most valves, a wedge spring (269) is fitted between the upper and lower wedges in order to prevent premature wedging if the valve is installed in a vertical

line. When separating the two wedges, care should be taken that the spring is not allowed to fly out and possibly cause injury or become lost.

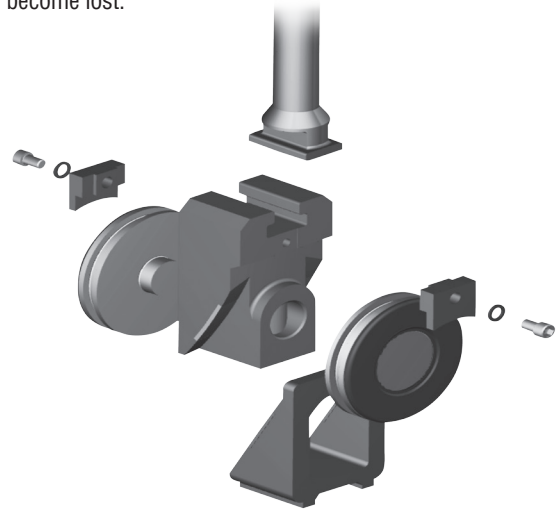


Figure 19

## 7.0 INSPECTION AND MAINTENANCE

Whenever a valve is disassembled, it should be inspected and deficiencies corrected as described in the following paragraphs.

### 7.1 DISCS

- a) Inspect the hardfaced seating area to insure it is not nicked, gouged, scratched or scored. The surface finish should be 16 RMS or better. Machine and/or lap to obtain the necessary finish. After lapping reestablish the radii on the hardfacing outside diameter and inside diameter. This is a very important step necessary to assure the seats don't score when the valve is operated.
- b) Liquid penetrant inspect the hardfacing to assure it is not cracked.
- c) Blue check the faces to assure flatness. The preferred method is to place a light coating of bluing on a flat plate, place the disc on the plate, turn the disc about 20° and back once and then check the disc for transfer of the bluing. An acceptable face shows an uninterrupted trace of bluing for 360° near the center of the disc face.
- d) Inspect the hardfacing thickness. Hardfacing resistance to galling starts to diminish when the hardfacing thickness is less than 1/8". This is caused by the effect of mixing base material into the hardfacing deposit when first welded. Although the rate of wear, (i.e. scoring or galling) is dependent upon the actual service

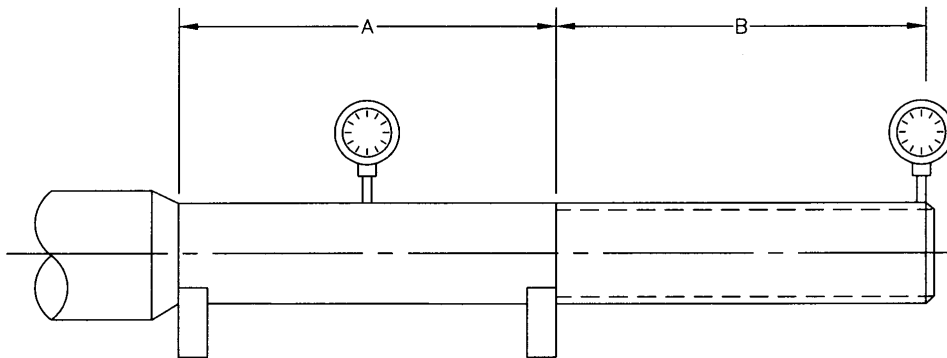


Figure 20

conditions, Flowserve recommends that parts be re-hardfaced or replaced when the hardfacing thickness is less than 1/16" thick.

- e) Visually inspect the trunnion on the back side of the disc for evidence of distortion or excessive wear. These are symptoms of a problem other than expected wear. Contact Flowserve engineering for assistance.
- f) Visually inspect the balance of the disc for signs of erosion, cavitation, material failure or other suspect conditions.

## 7.2 WEDGES

- a) Visually inspect the wedge angle contact points on both the upper and lower wedges to assure they are smooth and not deformed. Also inspect the feet on the bottom of the lower wedge for deformation and the entire wedges for signs of material failure or distortion. All these are symptoms of over torquing the valve.
- b) Visually inspect the disc trunnion hole in the upper wedge for excessive wear or distortion. Evidence of galling or an out-of-round condition are abnormal and the cause should be determined and corrected. Contact Flowserve Field Service for assistance if needed.

## 7.3 STEM

- a) Visually inspect the stem for scratches or galling, particularly in the area that goes through the packing bore. Machine or polish as necessary to achieve a 32 finish. If the stem diameter is reduced, contact Flowserve engineering to determine if the existing packing design is still adequate.

- b) Inspect the stem for straightness using the set-up shown in Fig. 20 and measuring the total indicator runout (TIR) at three locations in both the A and B areas. The TIR should not exceed 0.0005 in/ inch of length of unthreaded area or 0.002 in/inch of length of the threaded area.
- c) Visually inspect the backseat area for damage. It should have a 63 RMS finish.

## 7.4 Body

- a) Inspect the seat ring seating surfaces as specified for discs, Para. 7.1(a), (b), (c) and (d). For step (d), it is acceptable to use one of the discs for the bluing plate after the disc has been reworked to an acceptable condition (see 5.6). In the event seat rings must be replaced, consult Flowserve Field Service.
- b) For bolted bonnet designs, clean and inspect the gasket groove. Any radial scratches or other damage in the bottom of the groove will create a leak path and should be corrected prior to reassembly.
- c) For pressure seal designs, inspect the bore of the body where the pressure seal gasket is located. The finish requirement is 63 RMS with no scratches, nicks, blends, etc. in the sealing area. Repairs to the pressure seal area should not be attempted without consulting Flowserve Field Service. **NOTE:** Converting from a metal pressure seal gasket to a graphite gasket will require a new spacer rings designed to accommodate the gasket compression.
- d) Visually inspect the inside of the valve, especially around the seat rings for signs of cavitation or erosion. Also check the feet at the bottom of the body between the seats for any deformation from the lower wedge. All these conditions are considered abnormal and



should be evaluated for cause and corrective measures. Contact Flowserve Engineering if assistance is desired.

## 7.5 Bonnet

- a) Inspect the backseat hardfacing for obvious distortion or cracks. Since the hardfacing is not subject to sliding wear, the thickness of the deposit is not as critical as it is on seat rings and discs and therefore doesn't need to be checked.
- b) Visually inspect the stuffing box for damage and surface finish. It should have a 125 RMS finish. If remachined, contact Flowserve Engineering to determine if the packing size, gland or other parts are affected.
- c) For flanged bonnets, visually inspect the gasket surface for scratches, nicks, etc. that may impact sealing. If remachined, face all surfaces of the flange to maintain the original depth to the gasket ring and therefore the correct gasket compression.
- d) For pressure seal bonnets, visually inspect the surface of the bonnet that engages the pressure seal gasket for scratches, nicks or other discontinuities that exceed a 63 RMS finish. Because the tolerances associated with a pressure seal joint are very tight, Flowserve Field Service should be contacted prior to attempting any rework.

## 7.6 Stem nut and yoke sleeve

- a) Visually inspect the acme threads for obviously excessive wear or galling of the threads. Lubricate the threads by applying a light coating of grease (Molykote P37, Mobilgrease 28, MOV Long Life or equivalent). Lubricate yoke sleeves by applying grease through the grease fitting.

## 7.7 Actuators

Refer to the actuator manufacturer's instructions for service and maintenance guidance.

## 7.8 Bolting

Visually inspect all bolting for excessive corrosion. Lubricate with Never-Seez or equal.

## 7.9 Gland, lantern ring, gland spacers

Visually inspect for nicks, scratches, burrs, etc. Any damages areas must be repaired or the piece replaced. Consult with Flowserve Field Service if there is any question concerning the acceptability of a part.

## 8.0 Assembly

### 8.1 Disc – stem assembly

8.1.1 The first step in the assembly process is to check the disc pack to seat ring clearance and adjust if necessary.

8.1.1.1 The clearance is calculated as follows:

$$C = F - W - D1 - D2$$

- Where C = Total clearance between the disc pack and the seat ring faces when the lower wedge is hanging freely (unwedged).
- F = Distance between the two seat ring faces.
- W = Upper Wedge thickness
- D1 + D2 = Thickness of each disc taken at the hardfaced region.

The required clearance is contained in Table 6.

Table 6 - Clearances

Valve Size	Min	Max
2.5"	.025	.073
3.0"	.025	.073
4.0"	.025	.073
6.0"	.025	.073
8.0"	.025	.073
10.0"	.030	.084
12.0"	.030	.084
14.0"	.030	.084
16.0"	.030	.084
18.0"	.033	.087
20.0"	.033	.087
22.0"	.038	.092
24.0"	.038	.092

8.1.1.2 If adjustment is necessary, weld build-up the lower wedge side of the upper wedge first mill parallel to the opposite face to add ½ the correction amount. Then weld the opposite side and mill parallel to add ½ the correction amount.

- 8.1.2 The lower wedge and wedge spring can now be positioned on the upper wedge. Assemble the discs, disc retainers and fasteners onto the wedge assembly.
- 8.1.3 Slide the stem T-head into the corresponding T-slot of the upper wedge.
- 8.1.4 Retain the discs on the disc stem assembly with a C-clamp and lower the assembly into the body. Once the discs are secured by the guides in the body, the C-clamps may be removed and the assembly lowered the rest of the way in place.
- 8.1.5 Check the location of the discs relative to the seat rings to determine if they are properly positioned to cover the seats. It may be necessary to remove material or add material to the lower wedge feet to properly position the discs.
- 8.1.6 Caution: Proper fit-up (clearance confirmation) of the disc retainers must be confirmed, especially if any new valve internal parts are used or if seating surface lapping has been performed. With the disc pack in the valve body and fully seated a 1/8" clearance (minimum) shall be confirmed between the wedge side of the disc retainer and the mating surface of the disc retainer groove of each disc. If this clearance is less than 1/8", the disc engaging end of the corresponding disc retainer shall be machined to establish the required clearance. After modification the clearances shall be rechecked to confirm.

**NOTE:** Disc retainers supplied as spare parts are furnished without disc retainer holes. Prior to drilling, the disc retainers must be properly located by placing the disc on the upper wedge and positioning the disc retainer on the wedge, in the disc groove against the disc. Slide the disc up as far as possible as limited by the disc trunnion hole in the upper wedge. Raise the retainer another 1/16" to properly locate it. Drill the disc retainer fastener hole (1/16" dia. larger than fastener nominal diameter) in the retainer. Repeat the above to locate the other disc retainer on the opposite side and drill the fastener hole.

## 8.2 Bonnet – flanged joint

- 8.2.1 Prior to lowering the bonnet (002) into position, a new gasket should be placed in the gasket groove on the body flange. Carefully insert the stem into the backseat bushing in the bonnet and lower it into position on the body. In lowering the bonnet be careful that neither the backseat nor the stem are scratched or gouged. Damage to either of these surfaces can impair their sealing ability. If orientation of the actuator is important, the bonnet should be rotated to its proper position prior to lowering

it onto the gasket. With the bonnet in place, the studs (200) and nuts (230) can be installed. Prior to installation the studs and nuts should be cleaned and thoroughly lubricated with a high quality lubricant. Any nuts or studs with damaged threads should be replaced (refer to figure 13).

- 8.2.2 It is very important that the body-bonnet bolting be torqued to specific values in accordance with a specific procedure. The torque values are shown in Table 2 for various diameter studs.
- 8.2.3 The nuts should be tightened evenly using a crisscross pattern similar to the one shown in Fig. 21. Tighten all of the nuts to 1/3 of the recommended value initially. Then repeat the sequence raising the torque to 2/3 of full torque. Finally, torque all the nuts to the recommended value following the crisscross pattern. It is essential that the flange faces remain parallel and all the bolting has uniform tension. Failure to achieve this may cause gasket weepage when the joint is subjected to operating pressures and temperatures.
- 8.2.4 Lower the yoke over the stem. And install and tighten the yoke capscrews.

## 8.3 Bonnet – pressure seal joint

- 8.3.1 Lower the bonnet over the stem and into the neck of the body. Care must be taken in lowering the bonnet on the stem, so that neither the backseat nor any surface of the stem is damaged. It is also very important to keep the bonnet from cocking as it is lowered into the body. If it does bind, the bonnet must be straightened before insertion can continue.

Measuring from the bonnet bolting surface to the top of the body is the simplest way to detect cocking.

- 8.3.2 With the bonnet resting on the counterbore in the neck, a new gasket (030) and the spacer ring (032) can be inserted. The gasket must also be inserted with care. Once these are in place, the four-piece gasket retainer can be put into place. It is important to remember that the piece with the drilled hole must be positioned last. If the valve is installed in other than a stem vertical position, it may be necessary to orient or hold the retainer such that the pieces stay in place until the bonnet is moved into its raised position (refer to figure 16).
- 8.3.3 With the gasket retainer in its proper position, the bonnet retainer (034) can be lowered over the stem and placed in its position on top of the body neck. The bonnet capscrews (216) should then be inserted through the bonnet retainer and threaded into their holes in the bonnet (refer to figure 16).

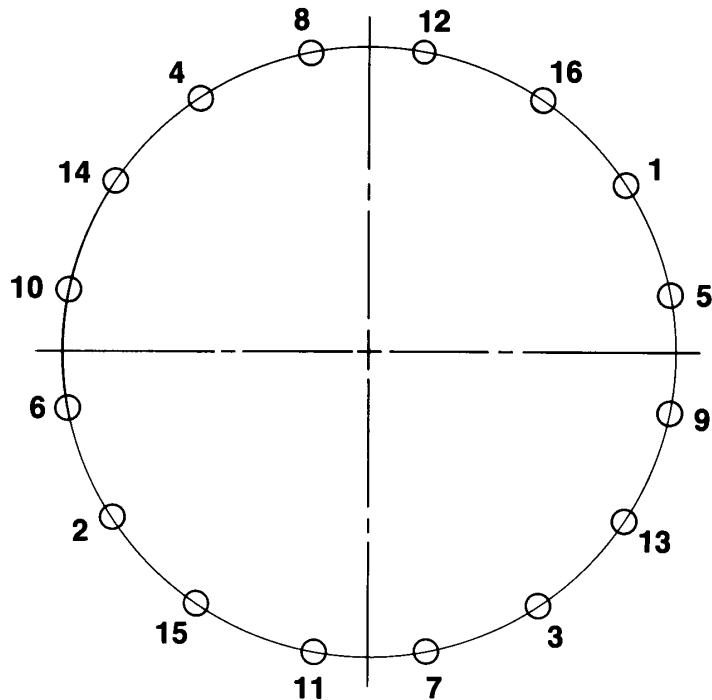


Figure 21  
Typical bolt tightening sequence

By turning each capscrew a couple of turns, proceeding to the adjacent capscrew, turning it and then repeating this around the bolt circle the bonnet will be raised squarely until it is firmly in contact with the gasket. Although gasket sealing is achieved by operating pressure pushing the bonnet tightly against the gasket, it may be necessary to torque the capscrews to the values shown in Table 3 to obtain a tight seal at low pressures.

**NOTE:** Although the assembly process is the same for both metal and graphite pressure seal gaskets, one cannot be substituted for the other without changing the spacer ring also. Contact Flowserve for the correct parts.

8.3.4 The same precautions that were used in lowering the bonnet over the stem should be taken when mounting the yoke. Remember – stem gouges cause packing leakage.

With yoke in its proper position on the body neck, the halves of the yoke clamp (012) should easily fit over the mating lips on the yoke and the body. The yoke clamp studs (204) can then be

inserted, and the nuts (233) threaded on and tightened (refer to figure 14).

**NOTE:** When the yoke has been removed, it is often easier to install the packing before the yoke is remounted. See section 5.4 for instructions on installing the packing.

## 8.4 Actuators

8.4.1 **Manual:** Reassembly of both gear actuators and handwheels can be accomplished by reversing the instructions provided in Section 6.1.

8.4.2 **Motor and Air Cylinder:** Instructions pertaining to the assembly of specific power actuators are included in supplements to this manual.



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