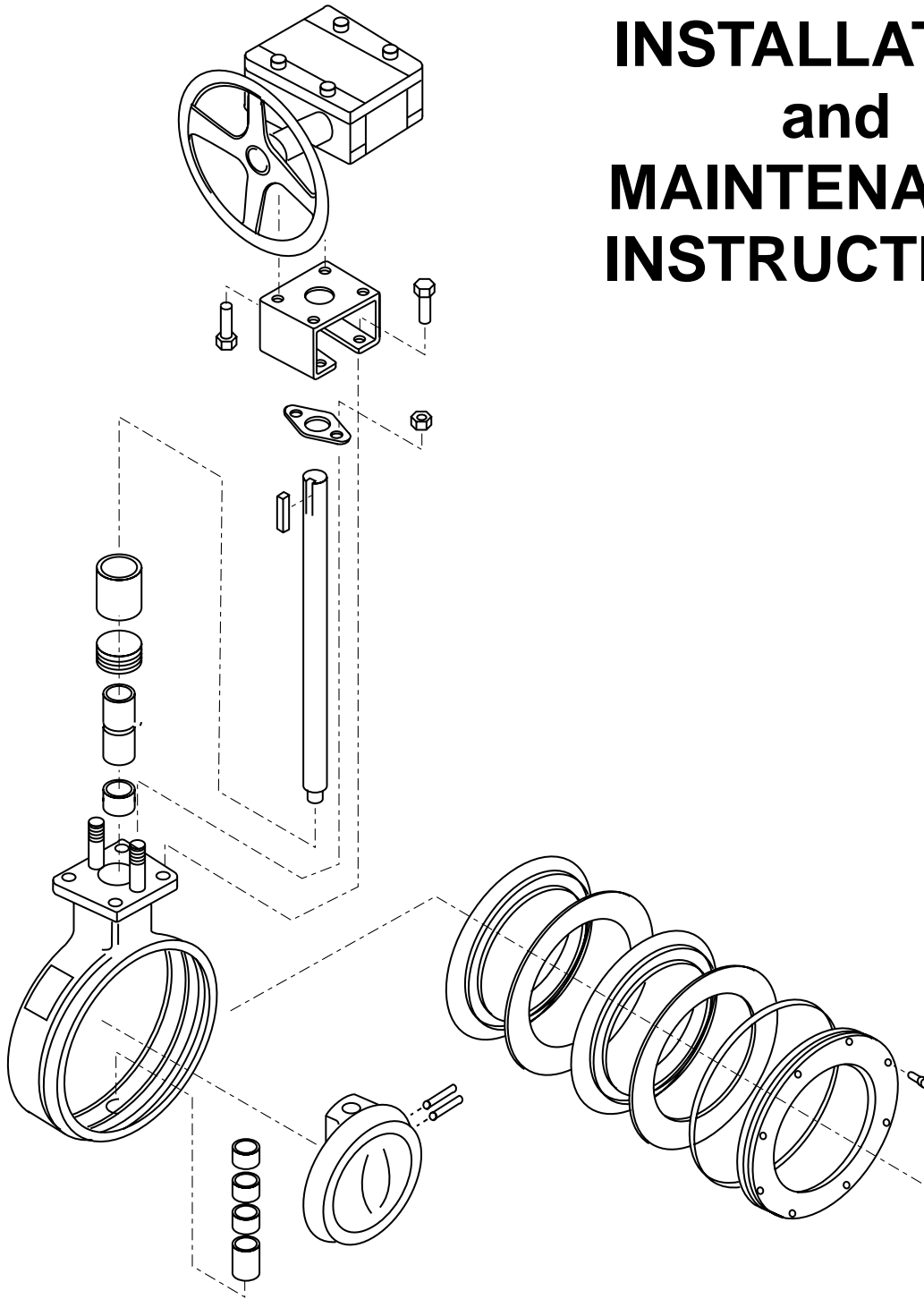


# FLOWSEAL

CRANE

A Crane Co. Company

## INSTALLATION and MAINTENANCE INSTRUCTIONS



MANUAL AND AUTOMATED

**HIGH PERFORMANCE BUTTERFLY VALVES**

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# INTRODUCTION

## SECTION 1

### Valve Description

The Flowseal High Performance Butterfly Valve (HPBV) is designed for ASME Class 150, 300 and 600 piping systems and is available in both Wafer and Lug style body designs. The standard size range available is as follows:

ASME Class 150 .....	2" through 48"
ASME Class 300 .....	2" through 30"
ASME Class 600 .....	2" through 16"

### Valve Design Features

- Flowseal's HPBV's feature a double offset (or double eccentric) shaft design to minimize seat abrasion and lower torque. This double offset design allows the disc to lift off and "cam" away from the seat as it rotates open.
- The Flowseal valve always rotates clockwise to close (when viewed from above) and counterclockwise to open.
- The valve body has an Overtravel Stop which prevents the disc from over rotating into the wrong quadrant. This stop is not to be used as a disc position stop; if the disc contacts the Overtravel Stop, this means it has rotated beyond the seat
- The Flowseal valve is bi-directional, but the preferred installation position is with the seat in the upstream position (SUS). Note the arrow on the metal tag attached to the valve body for preferred direction of flow.

### Flange Compatibility

The Flowseal valve is designed to fit between flanges as follows:

ASME Class 150 .....	2" through 24"
MSS SP-44 Class 150 .....	30" through 48"
ASME Class 300 .....	2" through 24"
MSS SP-44 Class 300 .....	30"
ASME Class 600 .....	2" through 16"

### Gasket Compatibility

The Flowseal valve is designed to accommodate the use of standard fiber gaskets (such as non-asbestos, flexible graphite, asbestos or equivalent gasket materials) of 1/16" or less, meeting the dimensional requirements of ASME B16.21. Thick elastomeric gaskets are not recommended. Metallic wound (Flexitallic) gaskets may be used with the wedge ring retainer configuration.

### Pipe Schedule Compatibility

The Flowseal valve is designed to allow the disc edge to rotate into the open position without interference with pipe of a schedule equal to or lighter to those shown below:

Size	ASME 150	ASME 300	ASME 600
2" – 12"	SCH 80	SCH 80	SCH 120
14" – 24"	SCH 40	SCH 80	SCH 120
30"	SCH 30	SCH 80	
36" – 42"	STD WT		
48"	XS		

### Product Identification

Every Flowseal valve has a metal identification tag attached to the valve body. Information on this tag includes the valve Figure Number, Size and Pressure Class, Materials of Construction, and Operating Pressures and Temperatures.

The metal tag also includes a Serial Number. This number, unique for each valve, is recorded by the Flowseal Quality Control Department along with the valve hydrostatic test results and material certification data for individual traceability and verification of every valve produced.

**FLOWSEAL**

SERIAL NO. \_\_\_\_\_

FIGURE NO. \_\_\_\_\_

SIZE/CLASS \_\_\_\_\_ BODY \_\_\_\_\_

STEM/PINS \_\_\_\_\_ DISC \_\_\_\_\_

SEAT \_\_\_\_\_ BRGS \_\_\_\_\_

BODY COLD WORKING PRESSURE \_\_\_\_\_ PSI

MAX. SHUT-OFF PRESS. @ 100 °F \_\_\_\_\_ PSI

@ \_\_\_\_\_ °F \_\_\_\_\_ PSI

TAG NO. \_\_\_\_\_

PREFERRED FLOW DIRECTION ↑

### Operating Pressures

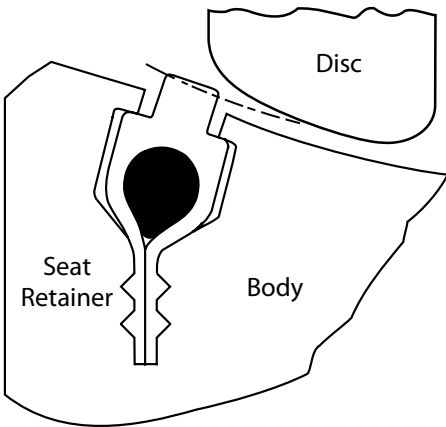
All Flowseal HPBV's may be applied to full ASME ratings. However, different materials of construction may affect the rated pressure. The shut-off pressure rating is determined by the valve shaft and disc materials as well as the seat design, and is reflected on the metal identification tag attached to the valve.

# INTRODUCTION

## Seat Alternatives

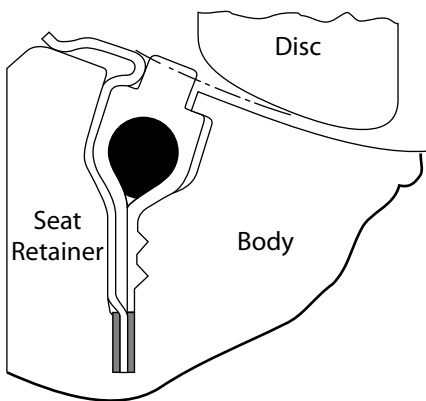
Flowseal HPBV's have three seat alternatives, all of which are bi-directional.

**Soft Seats** provide tight shut-off to zero leakage specifications. Standard Soft Seat material includes virgin TFE or reinforced TFE (RTFE).



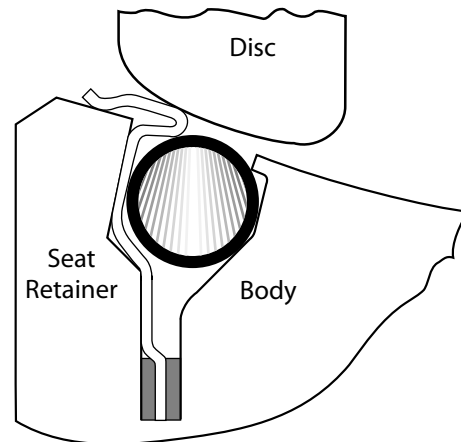
**Soft Seat Profile**

**Fire-Flow™ Seats** are designed for critical piping applications in installations such as Refinery and Petrochemical Plants. These seats are a combination of both metal and soft seats with the metal seat being designed to function during and after a fire. Valves of this type are referred to as "Fire-Safe" and are tested to meet API 607 "Fire-Safe" specifications and operation criteria.



**Fire-Flow™ Seat Profile**

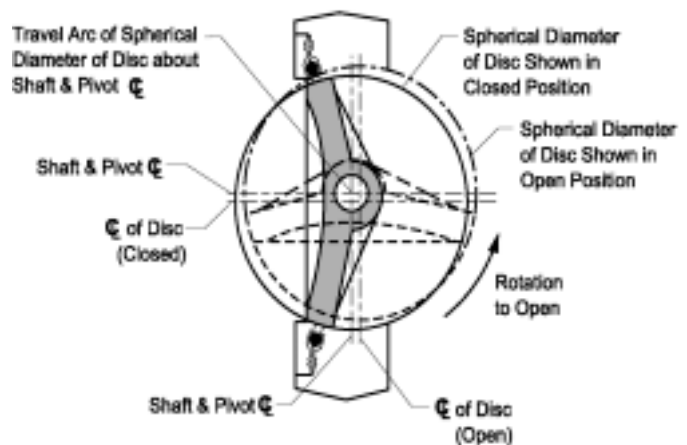
**Metal Seats** are well suited for higher temperature applications and provide shut-off to ASME B16.104 Class IV.



**Metal Seat Profile**

## Offset Disc Design

All Flowseal HPBV's have both off-set discs and eccentric shafts. The off-set is applicable to the disc edge seating surface relative to the shaft center line. By off-setting the seating surface from the rotational center line, a contact with the seat is possible throughout the 360° circumference. The shaft is eccentric in the body by 0.060 inches and this enhances seat life by imparting a camming action to the disc as it rotates both in and out of the seat. Seat wear points are eliminated at the top and bottom of the disc and operating torque is reduced.



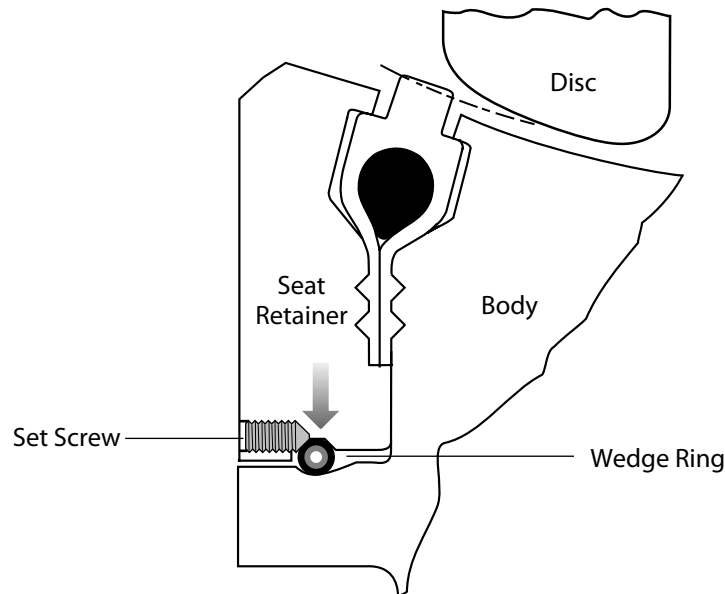
# INTRODUCTION

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## Seat Retainer Alternatives

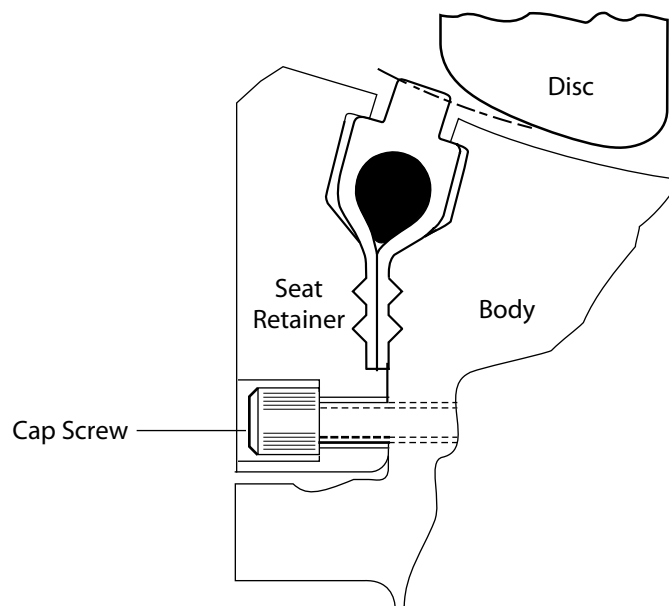
Flowseal HPBV's are designed to be easily maintained and, in particular, to allow rapid and simple replacement of the seat. The seat is held in the valve body by a seat retainer

which, when assembled, becomes part of the raised face flange mating surface. Two types of seat retainer fastening designs are used in Flowseal HPBFV's.



### Wedge Ring Retainer (Wafer and old-style lug valves)

This wedge ring design is for wafer and old design standard lug style valves. A wedge ring is forced outward into a groove machined in the body by the insertion of set screws in the face of the retainer.



### Cap Screw Retainer (Double-Deadend lug style)

The cap screws in retainer rings on double deadend service lug valves. The retainer is held to the valve body by cap screws recessed in the retainer face.

# INSTALLATION RECOMMENDATIONS

## SECTION 2

### Valve Ratings

Flowseal HPBV's are intended for use at the pressure and temperatures indicated on the metal nameplate attached to each individual valve. Check the valve operating temperature and pressure ratings on the valve nameplate before proceeding with installation.

### Seat Upstream vs Seat Downstream

Although all Flowseal seat designs are completely bi-directional, every effort should be made to install the valve with pressure and flow from the seat side of the valve (seat upstream). Positive shutoff will be achieved with the valve in either orientation. However, installation with the seat in the upstream position will result in longer service life and lower torque valves.

### Disc Clearances

Prior to installing the valve, it is important to make sure the ID of the pipe and pipe flanges is large enough to allow the disc edge to swing into the opening without interference. Damage to the disc edge can severely affect the performance of the valve. Pipe schedule compatibility for Flowseal valves is shown in Section 1 of this manual.

### Opening Rotation

The Flowseal valve is designed to open with counterclockwise rotation of the shaft, and to close with clockwise rotation of the shaft when viewed from above with the shaft in the vertical position. An over-travel stop is provided in the body to prevent over-travel of the disc in the wrong direction. This stop is not to be used as a disc position stop. Contact with this stop means the disc has travelled past the seat.

### Installation Position

To prevent damage during installation the valve disc must be fully closed before installing the valve in the line. It is preferable to install HPBV's with the shaft horizontal. This is important for valves applied to fluids which contain particulates. For HPBV's 16" and larger, installation should always be made with the shaft horizontal.

### Valve and Flange Preparation

If the valve and mating pipe are properly prepared for installation, future problems can be avoided. All valve and pipe flange faces should be free of dirt, grit, dents, or surface irregularities which may disrupt flange sealing and cause external leakage. The valve seat and disc sealing surface should also be inspected to eliminate any dirt or foreign material that will adversely affect the operation of the valve.

### Installation Tools

The only tool required in the installation of a Flowseal HPBFV is a wrench suitable for tightening the flange bolts and/or nuts required to secure the valve in-line. A hoist may be required to help manipulate valves 10" and larger. Smaller sized valves can usually be installed by hand. Temporary pipe supports may be used to keep mating flange faces parallel in order to aid in valve installation.

### Required Bolting

The tables outlined on the following pages are furnished to provide information regarding the size, type, and quantity of bolting recommended for the installation of Flowseal HPBFV's. These tables are intended for use as a planning and procurement guide. All recommendations are based on pipe flanges in accordance with ASME B16.5 for 2" through 24" valves and MSS-SP-44 for valves 30" and larger. Flange bolting is not included with the valve shipment.

### Unpacking and Storage Instructions

1. Check the packing list against the valve received to verify that the size, material, and trim are correct.
2. Check to make sure that the valve and operator were not damaged during shipment.
3. When lifting the valve, take care to avoid damage to the flange faces, disc sealing edge, or operator. On larger valves, lifting holes are provided on the periphery of the valve body to aid in valve handling.
4. If the valve is to be stored before being installed, it should be protected from harsh environmental conditions.
5. Store the valve with the disc in the closed position to protect the sealing edge and the seat.
6. Keep the valve in a clean location, away from dirt, debris and corrosive materials.
7. Keep the valve in a dry area with the flange protectors attached and on a suitable skid or pallet.
8. Keep the valve in a cool location if possible, out of direct sunlight.

# INSTALLATION RECOMMENDATIONS

## Pre-Installation Procedure

1. Remove the protective flange covers from the valve.
2. Inspect the valve to be certain the waterway is free from dirt and foreign matter. Be certain the adjoining pipeline is free from any foreign material such as rust and pipe scale or welding slag that could damage the seat and disc sealing surfaces.
3. Actuators should be mounted on the valve prior to installation to facilitate proper alignment of the disc in the valve seat.
4. The valve should be in the **closed position**. Make sure the open and closed positions of the actuator correspond to the counter-clockwise to open direction of rotation of the valve.
5. Cycle the valve to the fully open position, then back to the fully closed position, checking the actuator travel stop settings for proper disc alignment.
6. Check the valve identification tag for valve class, materials, and operating pressure to be sure they are correct for the application.
7. Check the flange bolts or studs for proper size, threading, and length.

**WARNING!** *Personal injury or property damage may result if the valve is installed where service conditions could exceed the valve ratings.*

## Valve Installation Procedure

The Flowseal High Performance Butterfly Valve can be installed in the pipeline with the shaft in the vertical, horizontal, or other intermediate position. Based on applications experience, however, in media with concentrations of solid or abrasive particles or media subject to solidification buildup, valve performance and service life will be enhanced by mounting the valve with the shaft in the horizontal position.

All Flowseal valves are bi-directional and can be mounted in the pipeline in either flow direction; however, the preferred flow direction for all seat styles and materials is with the seat retainer ring located upstream (SUS) to provide maximum seat protection.

### 1. For Wafer Style Valves:

- a. Loosely install the lower flange bolts to form a cradle between the flanges. (See Figure 1.)
- b. Noting the flow direction arrow on the tag, place the valve and flange gaskets between the flanges, making sure the arrow on the tag points in the direction of the flow.
- c. Install the remaining flange bolts, shifting the valve as necessary to permit the bolts to pass by or through the valve body.

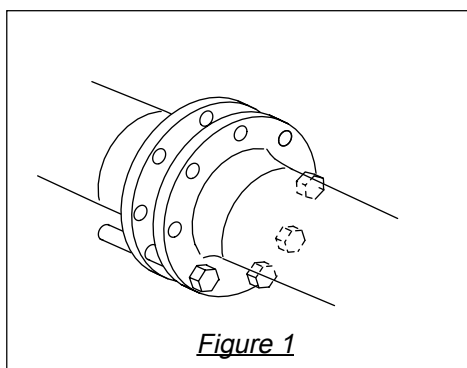


Figure 1

### For Lug Style Valves:

- a. Noting the flow direction arrow on the tag, place the valve between the flanges, making sure the arrow on the tag points in the direction of the flow.
  - b. Install the lower flange bolts loosely, leaving space for the flange gaskets.
  - c. After inserting the flange gaskets, install the remaining bolts.
2. Using the sequence shown in Figure 2, tighten the flange bolts evenly to assure uniform gasket compression.

**CAUTION!** *The Flowseal valve should be centered between the flanges and gaskets to prevent damage to the disc edge and shaft as a result of the disc striking the flange, gasket, or pipe.*

3. If an actuator is to be used, air hoses or electricity should be connected to the unit as specified by the actuator manufacturer.
4. The valve is now ready for operation.

**Remember:** *Install the valve with the disc in the FULL CLOSED POSITION.*

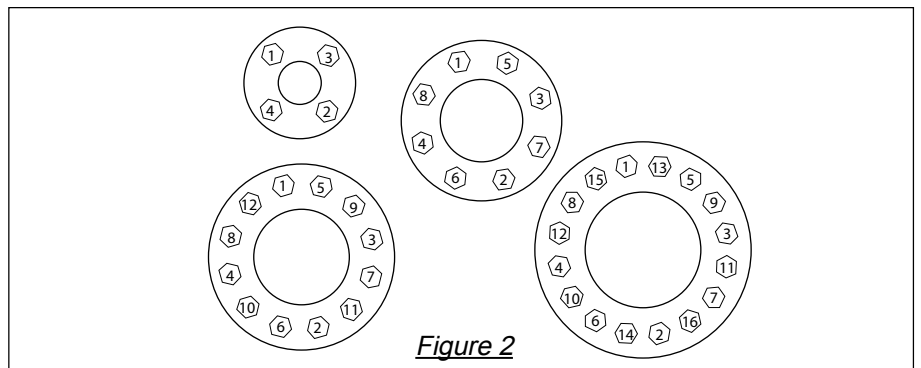
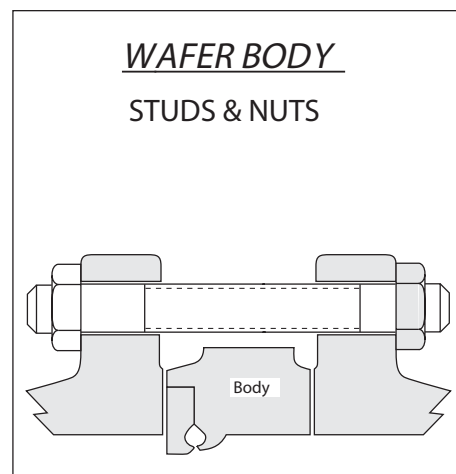
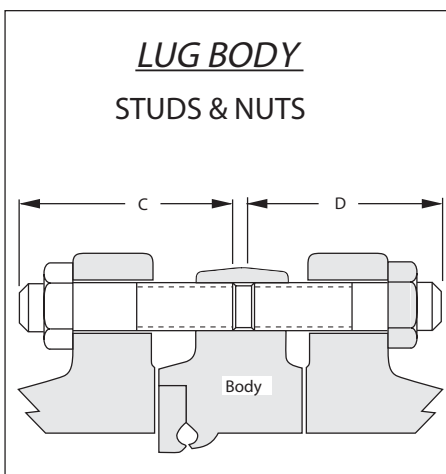
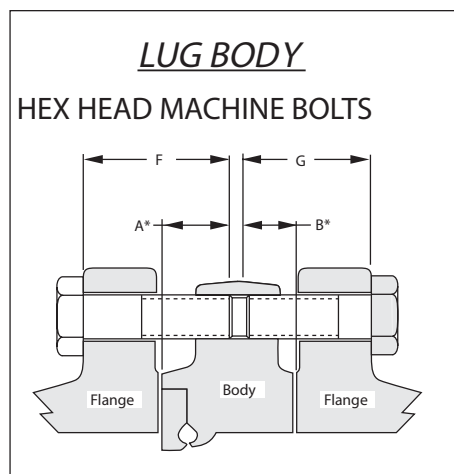


Figure 2

# INSTALLATION RECOMENDATIONS

## BOLTING DIMENSIONS



### ASME Class 150 2" – 24" MSS SP-44 Class 150 30" – 48"

VALVE SIZE VALVE SERIES THREAD SIZE			LUG VALVES												WAFER VALVES	
			BOLT ENGAGEMENT IN VALVE*				STUDS & NUTS				MACHINE BOLTS				STUDS & NUTS	
			QTY	LG	QTY	LG	QTY	LG	QTY	LG	QTY	LG	QTY	LG	QTY	LG
			A	A	B	B	C	C	D	D	F	F	G	G	E	E
2"	J	$\frac{5}{8}$ -11	4	.940	4	.570	4	2.50	4	2.12	4	1.75	4	1.50	4	5.00
2½"	J	$\frac{5}{8}$ -11	4	.960	4	.680	4	2.62	4	2.38	4	2.00	4	1.62	4	5.25
3"	J	$\frac{5}{8}$ -11	4	1.139	4	.725	4	3.00	4	3.00	4	1.88	4	1.62	4	6.00
4"	J	$\frac{5}{8}$ -11	8	1.071	8	.745	8	3.00	8	3.00	8	2.00	8	1.62	8	6.00
5"	J	$\frac{3}{4}$ -10	8	1.220	8	.790	8	3.12	8	2.62	8	2.25	8	1.75	8	6.00
6"	J	$\frac{3}{4}$ -10	8	1.401	8	.839	8	3.50	8	2.75	8	2.38	8	1.75	8	6.50
8"	J	$\frac{3}{4}$ -10	8	1.492	8	.948	8	3.75	8	3.00	8	2.50	8	2.00	8	6.50
10"	J	$\frac{7}{8}$ -9	12	1.752	12	1.000	12	4.50	12	3.25	12	2.62	12	2.38	12	7.50
12"	J	$\frac{7}{8}$ -9	12	2.147	12	1.025	12	4.50	12	3.25	12	3.38	12	2.25	12	8.00
14"	J	1-8	12	2.330	12	1.210	12	5.00	12	3.75	12	3.62	12	2.62	12	9.00
16"	J	1-8	16	2.648	16	1.270	16	5.25	16	4.00	16	4.00	16	2.62	16	10.00
18"	J	1½-8	16	2.723	16	1.645	16	5.50	16	4.50	16	4.25	16	3.12	16	10.50
20"	J	1½-8	16	3.396	20	1.434	16	6.25	20	4.50	16	5.12	20	3.19	16	11.00
	J	1½-8	4**	2.325	–	–	4**	5.25	–	–	4**	4.06	–	–	8**	5.25
24"	J	1¾-8	20	3.690	20	2.250	20	6.75	20	5.25	20	5.50	20	4.12	20	12.50
30"	H	1¾-8	24	3.471	24	3.159	24	7.75	24	7.50	24	6.47	24	6.15	24	15.25
	H	1¾-8	4**	1.908	4**	1.592	4**	6.00	4**	5.75	4**	4.91	4**	4.59	8**	6.00
36"	H	1½-8	28	3.760	28	3.740	28	9.00	28	9.00	28	7.19	28	5.25	28	18.25
	H	1½-8	4**	1.760	4**	1.740	4**	6.75	4**	6.75	4**	5.25	4**	5.25	8**	6.75
42"	H	1½-8	32	4.160	32	4.090	32	9.75	32	9.50	32	6.62	32	4.25	32	19.25
	H	1½-8	4**	1.782	4**	1.718	4**	7.25	4**	7.25	4**	4.25	4**	4.25	8**	7.25
48"	H	1½-8	40	5.520	40	4.850	40	11.75	40	11.00	40	9.83	40	9.16	40	21.00
	H	1½-8	4**	2.815	4**	2.190	4**	7.75	4**	7.75	4**	7.12	4**	6.50	8**	7.75

Length of machine bolts based on:

1. Gasket thickness of 0.06 inches.
2. Minimum flange thickness of weld neck flanges per ASME B16.5.

Every effort is made to provide accurate information, but no liability for claims arising from erroneous data will be accepted by Flowseal.



# INSTALLATION RECOMONDATIONS

## BOLTING DIMENSIONS

ASME Class 300 2" – 24"																
MSS SP-44 Class 300 30"																
VALVE SIZE			LUG VALVES												WAFER VALVES	
			BOLT ENGAGEMENT IN VALVE*				STUDS & NUTS				MACHINE BOLTS				STUDS & NUTS	
			QTY	LENGTH	QTY	LENGTH	QTY	LENGTH	QTY	LENGTH	QTY	LENGTH	QTY	LENGTH	QTY	LENGTH
VALVE SIZE	VALVE SERIES	THREAD SIZE	A	A	B	B	C	C	D	D	F	F	G	G	E	E
2"	J	5/8-11	8	.940	8	.570	8	2.25	8	2.62	8	1.50	8	2.00	8	5.25
2 1/2"	J	5/8-11	8	.970	8	.670	8	2.75	8	3.00	8	1.75	8	2.00	8	5.75
3"	J	3/4-10	8	1.034	8	.826	8	3.00	8	3.00	8	2.12	8	.75	8	6.00
4"	J	3/4-10	8	1.196	8	.870	8	3.50	8	3.25	8	2.50	8	2.00	8	6.50
5"	J	3/4-10	8	1.220	8	.790	8	5.25	8	3.62	8	2.25	8	2.75	8	7.00
6"	J	3/4-10	12	1.301	12	.929	12	3.75	12	3.50	12	2.75	12	2.25	12	7.00
8"	J	7/8-9	12	1.702	12	1.128	12	4.50	12	4.00	12	3.25	12	2.75	12	8.25
10"	J	1-8	16	1.867	16	1.300	16	5.00	16	4.50	16	3.25	16	3.12	14	9.25
	J	1-8	–	–	–	–	–	–	–	–	–	–	–	–	4**	5.00
12"	J	1 1/8-8	16	2.057	16	1.475	16	5.50	16	5.00	16	4.00	16	3.38	12	10.00
	J	1 1/8-8	–	–	–	–	–	–	–	–	–	–	–	–	8**	5.25
14"	H	1 1/8-8	16	2.442	16	2.118	16	6.00	16	5.75	16	4.62	16	4.25	16	11.50
	H	1 1/8-8	4**	1.608	4**	1.267	4**	5.25	4**	4.75	4**	3.75	4**	3.44	8**	5.25
16"	H	1 1/4-8	16	2.562	16	2.628	16	6.50	16	6.50	16	4.88	16	4.88	16	13.00
	H	1 1/4-8	4**	1.538	4**	1.588	4**	5.25	4**	5.25	4**	3.88	4**	4.25	8**	5.25
18"	H	1 1/4-8	20	2.870	20	2.890	20	7.00	20	7.00	20	5.25	20	5.25	20	14.00
	H	1 1/4-8	4**	1.657	4**	1.437	4**	5.50	4**	5.50	4**	4.00	4**	3.88	8**	5.50
20"	H	1 1/4-8	20	3.184	20	3.006	20	7.50	20	7.25	20	5.69	20	5.69	20	14.50
	H	1 1/4-8	4**	1.681	4**	1.750	4**	5.75	4**	5.50	4**	4.19	4**	4.00	8**	5.75
24"	H	1 1/2-8	20	3.560	20	3.510	20	8.25	20	8.25	20	6.31	20	6.25	20	16.50
	H	1 1/2-8	4**	1.800	4**	1.750	4**	6.25	4**	6.25	4**	4.56	4**	4.50	8**	6.25
30"	H	1 3/4-8	24	4.331	24	4.429	24	10.25	24	10.50	24	7.88	24	7.88	24	20.50
	H	1 3/4-8	4**	2.039	4**	2.071	4**	8.00	4**	8.00	4**	5.44	4**	5.47	8**	8.00

ASME Class 600 3" – 14"																
VALVE SIZE			LUG VALVES												WAFER VALVES	
			BOLT ENGAGEMENT IN VALVE*				STUDS & NUTS				MACHINE BOLTS				STUDS & NUTS	
			QTY	LENGTH	QTY	LENGTH	QTY	LENGTH	QTY	LENGTH	QTY	LENGTH	QTY	LENGTH	QTY	LENGTH
VALVE SIZE	VALVE SERIES	THREAD SIZE	A	A	B	B	C	C	D	D	F	F	G	G	E	E
3"	J	3/4-10	8	1.034	8	1.026	8	3.50	8	3.50	8	2.25	8	2.38	8	7.00
4"	J	7/8-9	8	1.274	8	1.165	8	3.50	8	3.25	8	2.75	8	2.75	8	7.75
6"	J	1-8	12	1.274	12	1.306	12	4.75	12	4.75	12	3.25	12	3.25	12	9.50
8"	J	1 1/8-8	12	1.794	12	1.795	12	5.75	12	5.75	12	4.12	12	4.12	12	11.50
10"	H	1 1/4-8	12	2.495	12	2.000	12	6.75	12	6.25	12	5.00	12	4.50	12	13.00
	H	1 1/4-8	4**	1.375	4**	2.000	4**	5.50	4**	6.25	4**	3.88	4**	4.50	8**	6.25
12"	H	1 1/4-8	16	2.683	16	2.697	16	7.00	16	7.00	16	5.38	16	5.38	16	14.00
	H	1 1/4-8	4**	1.325	4**	1.765	4**	5.25	4**	6.00	4**	4.00	4**	4.38	8**	6.00
14"	H	1 3/8-8	16	2.994	16	2.996	16	7.50	16	7.50	16	CF	16	CF	16	15.00
	H	1 3/8-8	4**	1.506	4**	1.869	4**	6.00	4**	6.50	4**	CF	4**	CF	8**	6.50

\* Bolt lengths "A" & "B" are from face of valve body to minimum depth in lug. Flange & gasket thickness must be added to calculate minimum bolt length.

\*\* Special length required for tapped blind holes on either side of the valve shaft at the top and bottom ends of the valve body.

# MAINTENANCE INSTRUCTIONS

## SECTION 3

### Safety Precautions

Before removing the valve from the line or loosening any bolts, it is important to verify the following conditions:

1. Be sure the line is depressurized and drained.
2. Be sure of the pipeline media. Proper care should be taken for protection against toxic and/or flammable fluids.
3. Never install the valve without an Operator (Manual or Automatic) already attached to the valve shaft.
4. Never remove the Operator from the valve while the valve is in the pipeline under pressure. Flowseal's eccentric valve design may allow line pressure to open the valve if the handle/actuator is not in place while the valve is under pressure.
5. Always be sure that the disc is in the full-closed position before removing or installing the valve.
6. Take care in handling the valve. Personal injury or property damage may result if the valve is damaged or mishandled during maintenance operations.

### General Maintenance

Normal maintenance for a Flowseal HPBFV is limited to adjustment of the shaft packing by tightening down evenly on the gland flange using the gland flange studs and nuts. Overtightening of the gland should be avoided since this will shorten the life of the packing. During commissioning, it is common for dirt and foreign objects to be left in the pipeline during construction. This debris can damage the HPBV seat or disc edge which will prevent the valve from providing tight shut-off. In such cases seat replacement may be necessary.

### Packing Replacement

1. Remove the handle or actuator and the mounting hardware from the valve.
2. Remove the gland flange nuts and lockwashers.
3. Remove the gland flange and gland.
4. Replace the old packing with new packing. Correct packing selection is important. On larger valves it may be necessary to compress each stem seal into the stuffing box before adding the next one.
5. Reinstall gland, gland flange, lockwashers and nuts.
6. Tighten the gland flange nuts evenly to torque specified in Table 1.
7. Operate the disc several times.
8. Reinstall the handle or actuator and mounting hardware.
9. Set the actuator stops.

Table 1

Valve Size (in.)	Torque (in-lb)
2 to 8	25
10 to 12	35
14 to 20	50
24 to 30	75
36 to 48	100

### End Cap Seal Replacement

(where applicable)

1. Remove the end cap bolts and lockwashers.
2. Rotate the end cap to break the seal, then pull the cap out.
3. Remove the old seal.
4. Clean the body and end cap prior to installing the new seal.
5. Slide the new seal into place, then guide the end cap into the body.
6. Align the bolt holes and reinstall the lockwashers and bolts.
7. Tighten the bolts evenly to the torque specified in Table 2.

Table 2

Valve Size (in.)	Torque (in-lb)
2 to 8	50
10 to 12	80
14 to 30	100

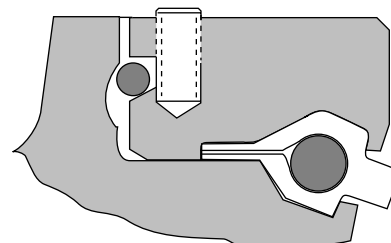
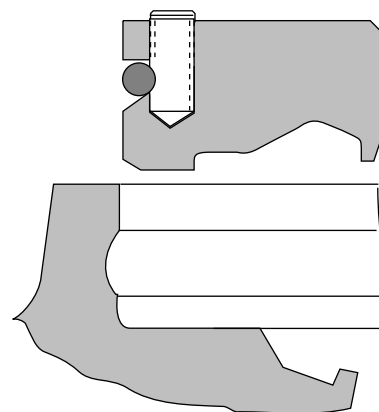
### Standard Soft Seat Replacement

1. Place the valve on a bench with the seat retainer facing up. Use blocks to elevate the valve above the work surface to provide enough clearance to prevent the disc from being damaged when the valve is opened.
2. (a) Cap Screw Retainer:  
Remove the cap screws and lift the seat retainer out of the valve.  
(b) Wedge Ring Retainer:  
Unlock the retainer by removing the set screws. If difficulty is experienced in removing the retainer, open the disc approximately 20 degrees and then tap the retainer with a non-metallic hammer. Lift the retainer from the body.
3. Remove the old seat from the seat retainer and discard.
4. Thoroughly clean the seat cavity in the body and the seat retainer prior to installing a new seat.

# MAINTENANCE INSTRUCTIONS

## Standard Soft Seat Replacement (cont.)

5. Carefully clean and polish the disc sealing surface with a soft cloth. The disc sealing surface should be free of all grooves and scratches.
6. Place the seat retainer on a flat surface with the seat locating area facing up.
7. Place the new preformed seat assembly (Seat and O-ring) on the seat retainer with the marked (tape) side facing down.
8. Using the balls of each thumb, press down on the seat engaging the shoulder of the seat behind the lip in the seat retainer. Stretch the seat into place by sliding each thumb around the circumference of the seat maintaining downward pressure and forcing the seat shoulder over the seat retainer lip.
9. With the disc in the closed position place the seat retainer with seat into the counterbore of the body.
  - (a) Cap Screw Retainer:  
Apply lubricant to the cap screw threads and tighten them down uniformly.
  - (b) Wedge Ring Retainer:  
Place the wedge ring in the groove on the outside edge of the retainer taking care to position the wedge ring gap away from any set screw. Using opposing C-clamps, pull the retainer into a position flush with body face. (The C-clamps should not block access to the set screw holes.)
10. Open the disc and relax the retainer pressure slightly to permit the seat to expand fully inward against the seat retaining lip machined in the retainer and body seat cavities. A positive “snap” action will be observed.
  - (a) Cap Screw Retainer:  
Leaving the valve disc open, retighten the cap screws to the torques specified in Table 3.
  - (b) Wedge Ring Retainer:  
Leaving the valve disc open, retighten the C-clamps and install the set screws. Remove the C-clamps after all screws have been tightened.
11. Operate the disc several times and inspect the seat for damage before reinstalling the valve in the pipeline.
12. Inspect the position of the disc in the closed position to determine whether the actuator stops are adjusted properly. The face of the disc should be parallel to the seat retainer face when the valve is in the fully closed position.



**Table 3**

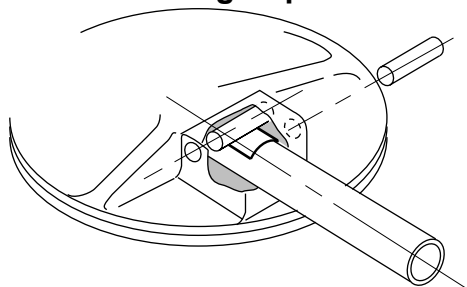
Valve Size (in.)	Torque (in-lb)
2 to 12	50
14 to 20	75
24 to 48	100

# MAINTENANCE INSTRUCTIONS

## Fire-Flow and Metal Seat Replacement

1. Follow Steps 1 and 2 of Soft Seat Replacement instructions.
2. Remove old soft seat and graphite gaskets and discard. Clean and inspect the metal seat.
3. If metal seat is scored, bent or otherwise damaged it will require replacement.
4. Thoroughly clean the seat cavity in the body and the seat retainer prior to installing the new seat.
5. Carefully clean and polish the disc edge sealing surface with a soft cloth. The disc sealing surface should be free of all grooves and scratches.
6. A graphite gasket is required on both sides of the metal seat. Gaskets can be made from self-adhesive graphite tape as follows:
  - (a) Suggested graphite tape size:  
2" - 12" valves – 1/2" wide  
14" - 48" valves – 1" wide
  - (b) To install the tape, peel off 6" of backing paper at a time. Apply the tape to the metal seat covering the flat outer edge area on both sides. Overlap the two ends of the tape a minimum of 1/8 inch.  
*Note: It is important that both sides have gaskets.*
  - (c) Smooth tape as much as possible by hand. Slight roughness is acceptable and will be pressed flat during final assembly. Avoid tearing tape. If a tear occurs, tape should be overlapped a minimum of 1/8 inch. Trim excess tape from outside diameter of the seat.
  - (d) If cap screw retainer design, bolt holes in metal seat should be opened by slitting an "X" in the hole. Do not attempt to cut round holes.
7. For Fire-Flow valves, place the preformed seat assembly in the body seat cavity with the marked (tape) side up. For metal seated valves, place the 316 SS back-up ring in the body seat cavity.
8. Place the metal seat with graphite gaskets on the TFE seat or 316 SS back-up ring already in the body. The metal seat should be installed with the rounded edge down against the TFE seat or the 316 SS back-up ring.
9. Follow steps 9 thru 12 of Soft Seat Replacement instructions.

## Disc, Shaft and Bearing Replacement



Flowseal uses a wedge pin method of disc/shaft pinning. This method permits the replacement of either a disc or a shaft since they are not required to be matched sets.

1. Remove any actuator and mounting bracket from top of valve.
2. Remove all top and bottom packing and/or end seals as required.
3. To prepare for removal of existing wedge pins, grind away any disc material that has been peened over pin heads.
4. (a) For Through Shaft Design:  
Using a punch approximately the same size as the wedge pins, drive each pin out of the disc hub from the non-peened side of the disc to the peened side of the disc.
- (b) For Split Shaft Design:  
Pull the wedge pins out of the disc hub using the threaded holes on top of each pin and a jack screw.
5. Support the valve body and disc on a flat surface in the horizontal position. Slowly remove shaft(s).
6. Remove the disc from the body.
7. To remove bearings, cut or grind a slot lengthwise in each bearing in order to be able to collapse bearing prior to removal. Be careful not to damage bearing seating bore within the body.
8. Clean all components thoroughly.
9. Inspect all parts for damage prior to reassembly. Damaged parts should be repaired or replaced with new parts.
10. Carefully clean and polish the disc sealing surface with a soft cloth. The disc sealing surface should be free of all grooves and scratches.  
Install the new bearings by gently tapping them into the body with a soft rod and hammer. The bearings should be
11. installed into the shaft bore firmly against the counterbore or bottom of shaft hole.
12. (a) Valves 2" thru 12":  
With the valve body on edge on the bench, shaft horizontal, and the body overtravel stop nearest to the bench, position the disc in the open position with the flat face upward. Present the disc to the valve body from the side opposite the seat retainer cavity.
- (b) Valves 14" and larger:  
Support the disc on a bench, flat side down and elevated above the bench top to a height of approximately 4 inches. Lower the valve body over the disc, seat retainer side facing upward, until the bearing bore and disc hole are aligned. Install the shaft into the body and disc.
13. The shaft keyway when viewed from the top of the valve should be to the right, which is also the direction from which the pins are installed.

# MAINTENANCE INSTRUCTIONS

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14. Line up the shaft flat to permit the insertion of the wedge pins. Install the first wedge pin in the disc hole closest to the top of the valve. Finger tight installation is appropriate.
15. Move the shaft fully into the valve and against this first installed pin. Insert the second pin. Tap both wedge pins in equal amounts until all play between shaft and disc is removed. Care should be taken not to attempt to over seat the wedge pins. If the pin is flush or protruding after tapping in, tack weld on the opposite side for security. Otherwise, peening of the installing side is recommended.
16. Install a new end seal if applicable with the end cap as described in Steps 4 through 7 of the End Cap Seal Replacement procedure.
17. Install new packing box components as described in Steps 4 through 10 of the Packing Replacement procedure.
18. Install new seat as described in the Seat Replacement procedure.
19. Cycle the valve several times to ensure the disc is pinned tightly to the shaft and there is no shaft binding or seat damage before reinstalling the valve in the pipeline.
20. Reinstall the actuator mounting hardware and actuator.
21. Set the actuator stops.

## Ratchet Handle Mounting Procedure

1. Position the disc in the closed position.
2. Install the ratchet plate using socket head cap screws and lockwashers, but do not tighten the fasteners.
3. Install the drive key in the shaft. Tap the key into place to ensure it is fully seated in the keyway.
4. Install the handle so that it is parallel with the disc face. The locking lever must be fully retracted before it will pass through the ratchet plate. Tighten the set screw in the handle against the key.
5. With the handle installed flush with the ratchet plate, engage the locking lever with the ratchet plate. Using the handle, adjust the position of the ratchet plate until the disc face is parallel with the valve face, then tighten the fasteners securely.

### Changing the Quadrant:

If it is necessary to relocate the handle 180° from its standard position, complete the following steps:

1. Remove the handle by disengaging the locking lever and lifting up. The locking lever will slide thru the ratchet plate only in the disengaged position.
2. Remove the ratchet plate fasteners and rotate the plate 180°. Reinstall the fasteners but do not tighten them.
3. Reinstall the handle 180° from the standard position so that it is parallel with the disc (Note: The locking lever must be disengaged). Tighten the handle set screw against the key.
4. Adjust the ratchet plate as described above.

## Manual Gear Mounting Procedure

1. Position the disc in the closed position.
2. Install the mounting bracket on the valve body. Fasten it tightly in place with the appropriate machine bolts and lockwashers.
3. Install the drive key in the shaft. Tap the key into place to ensure it is fully seated.
4. Rotate the gear shaft to the full clockwise position. Align the keyway in the gearbox bore with the key in the shaft and slide the gearbox onto the shaft.
5. Fasten the gearbox to the mounting bracket with the appropriate machine bolts and lockwashers. It may be necessary to rotate the gear shaft slightly to align the mounting holes in the gear with the plate.
6. Adjust the stops in the gearbox to position the face of the disc parallel with the face of the valve in the closed position and perpendicular to the face of the valve in the open position.

### Changing the Quadrant:

If it is necessary to relocate the manual gear handwheel 180° from its standard position, complete the following steps:

1. Close the valve.
2. Remove the bolts and lockwashers holding the gearbox to the mounting bracket. Lift the gearbox off the shaft.
3. Rotate the gearbox 180° around the shaft.
4. Align the key with the gearbox keyseat and slide the gearbox onto the shaft.
5. Reinstall the bolts and lockwashers to fasten the gearbox to the mounting bracket.
6. Adjust the gearbox stops as described previously.

## Remote Actuator (Male Drive) Mounting Procedure

1. Position the disc in the closed position.
2. Install the actuator mounting bracket on the valve body with the actuator mounting holes facing up-ward. Fasten the bracket securely in place with the appropriate machine bolts and lockwashers.
3. Install the drive key in the keyway of the shaft. Tap the key in place to insure it is fully seated.
4. Install the drive coupling on the shaft by lining up the proper keyway in the coupling with the key in the shaft.
5. Rotate the actuator shaft to the full clockwise position. Align the drive coupling with the actuator shaft and install the actuator on the mounting bracket.
6. Fasten the actuator to the mounting bracket with the appropriate machine bolts and lockwashers. It may be necessary to slightly rotate the actuator shaft to align the mounting holes in the actuator with the mounting bracket.

# MAINTENANCE INSTRUCTIONS

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## Remote Actuator (Male Drive) Mounting Procedure (cont.)

7. Adjust the stops in the actuator to position the face of the disc parallel with the face of the valve body in the closed position and perpendicular to the face of the valve body in the open position.

Caution: *The overtravel stop in the valve body is not to be used as an actuator stop.*

### Changing the Quadrant:

If it is necessary to rotate the actuator 90° from standard position, complete the following steps:

1. Close the valve.
2. Remove the bolts and lockwashers holding the actuator to the mounting bracket. Lift the actuator off the mounting bracket.
3. Remove the drive coupling from the valve shaft and rotate it 90° to the adjacent keyway.
4. Reinstall the drive coupling on the valve shaft.
5. Align the drive coupling with the actuator shaft and install the actuator on the mounting bracket.
6. Reinstall the bolts and lockwashers to fasten the actuator to the mounting bracket.
7. Adjust the actuator stops as described above.

If it is necessary to rotate the actuator 180° from standard position, complete the following steps.

1. Close the valve.
2. Remove the bolts and lockwashers holding the actuator to the mounting bracket.
3. Lift the actuator off the mounting bracket. Rotate the actuator 180°.
4. Align the drive coupling with the actuator shaft and install the actuator on the mounting bracket.
5. Reinstall the bolts and lockwashers to fasten the actuator to the mounting bracket.
6. Adjust the actuator stops as described previously.

## Remote Actuator (Female Drive) Mounting Procedure

1. Position the disc in the closed position.
2. Install the actuator mounting bracket on the valve body with the actuator mounting holes facing up. Fasten the bracket securely in place with the appropriate machine bolts and lockwashers.
3. Install the drive key in the shaft. Tap the key in place to insure it is fully seated.
4. Install the drive coupling on the shaft by lining up the proper coupling keyway with the key in the shaft.
5. Install the drive key in the drive coupling. Tap the key in place to insure it is properly seated.

6. Rotate the actuator to the full clockwise position. Align the keyway in the actuator bore with the key in the drive coupling and slide the actuator on the drive coupling.
7. Fasten the actuator to the mounting bracket with the appropriate machine bolts and lockwashers. It may be necessary to rotate the actuator slightly to align the actuator with the mounting bracket.
8. Adjust the stops in the actuator to position the face of the disc parallel with the face of the valve body in the closed position and perpendicular to the face of the valve body in the open position.

Caution: *The overtravel stop in the valve body is not to be used as an actuator stop.*

### Changing the Quadrant:

If it is necessary to rotate the actuator 90° from standard position complete the following steps:

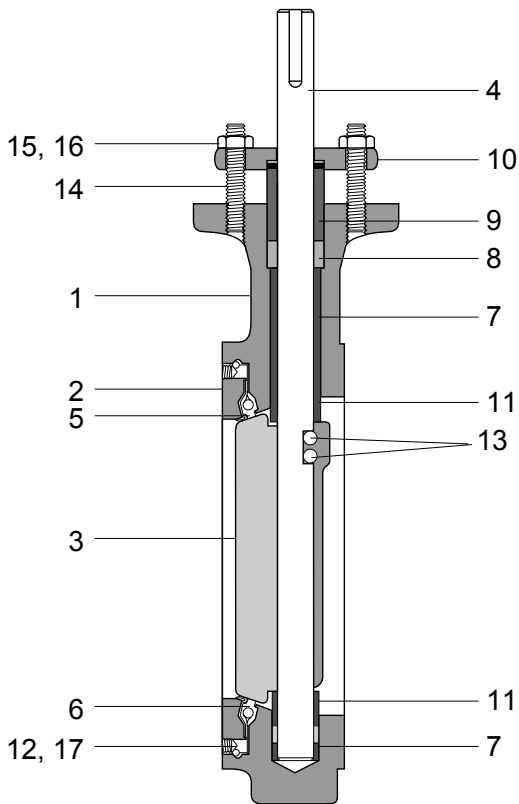
1. Close the valve.
2. Remove the bolts and lockwashers holding the actuator to the mounting bracket.
3. Lift the actuator off the mounting bracket.
4. Remove the key from the drive coupling and reinstall in the adjacent keyway 90° away. Tap the key in place to ensure it is fully seated.
5. Align the keyway in the actuator bore with the key in the drive coupling and slide the actuator onto the drive coupling.
6. Reinstall the bolts and lockwashers to fasten the actuator to the mounting bracket.
7. Adjust the actuator stops as described previously.

If it is necessary to rotate the actuator 180° from its standard position, complete the following steps:

1. Close the valve.
2. Remove the bolts and lockwashers holding the actuator to the mounting bracket.
3. Lift the actuator off the mounting bracket.
4. Remove the drive coupling from the valve shaft and rotate it 90°.
5. Reinstall the drive coupling on the valve shaft.
6. Remove the key from the drive coupling and reinstall the key in the adjacent keyway 90° away. Tap the key in place to ensure it is fully seated.
7. Align the keyway in the actuator bore with the key in the drive coupling and slide the actuator onto the drive coupling.
8. Reinstall the bolts and lockwashers to fasten the actuator to the mounting bracket.
9. Adjust the actuator stops as described previously.

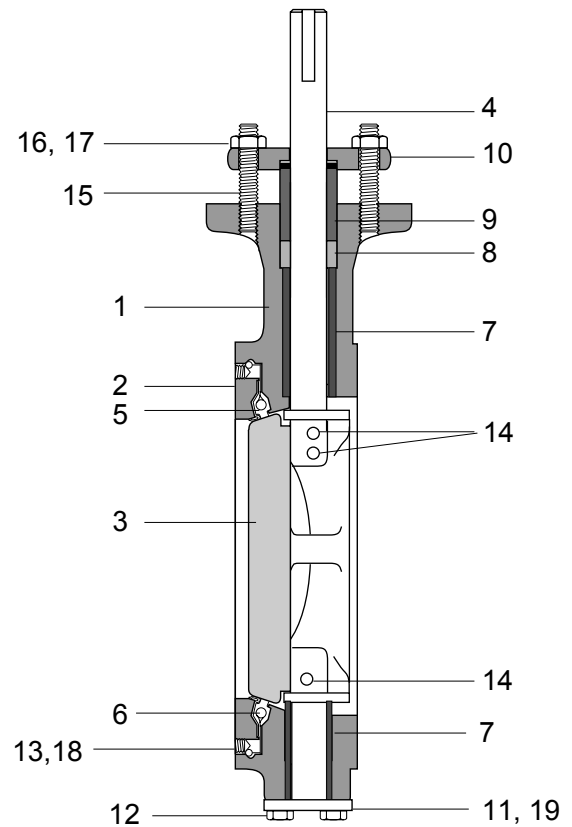
# MAINTENANCE INSTRUCTIONS

## Parts List



**Through Shaft Design**

Item	Description
1	Body
2	Seat Retainer
3	Disc
4	Shaft
5	Seat
6	Seat O-ring
7	Bearing
8	Packing
9	Gland
10	Gland Follower
11	Disc Thrust Spacer (2"-5")
12	Set Screws
13	Wedge Pins
14	Gland Flange Stud
15	Gland Flange Nut
16	Lockwasher
17	Wedge Ring



**Split Shaft Design**

Item	Description
1	Body
2	Seat Retainer
3	Disc
4	Shaft
5	Seat
6	Seat O-ring
7	Bearing
8	Packing
9	Gland
10	Gland Follower
11	End Cap
12	End Cap Bolts
13	Set Screws
14	Wedge Pins
15	Gland Flange Stud
16	Gland Flange Nut
17	Lockwasher
18	Wedge Ring
19	End Cap Seal

# MAINTENANCE INSTRUCTIONS

## BODY RATING

The charts below reflect the pressure/temperature ratings for carbon steel and stainless steel valves, in accordance with ASME B16.34. The hydrostatic shell test is performed on the body at 150% of the cold working pressure (C.W.P. is defined as the pressure rating between -20 to 100°F and the hydrostatic seat test is performed on the disc and seat at 110% of the cold working pressure.

°F	Maximum Non-Shock Working Pressure-PSI								
	Carbon Steel <sup>(1)</sup>			Carbon Steel <sup>(2)</sup>			316SS		
ASME Class	150	300	600	150	300	600	150	300	600
HYDROSTATIC SHELL TEST	450	1125	2225	450	1125	2225	425	1100	2175
HYDROSTATIC SEAT TEST	315	815	1630	315	815	1630	305	800	1585
-20 - 32	285	740	1480	-	-	-	275	720	1440
32-100	285	740	1480	285	740	1480	275	720	1440
200	260	675	1350	260	675	1350	240	620	1240
300	230	655	1315	230	655	1315	215	560	1120
400	200	635	1270	200	635	1270	195	515	1030
500	170	600	1200	170	600	1200	170	480	955
600	140	550	1095	140	550	1095	140	450	905
650	125	535	1075	125	535	1075	125	445	890
700	110	535	1065	110	535	1065	110	430	865
750	95	505	1010	95	505	1010	95	425	845
800	80	410	825	80	410	825	80	415	830
850							65	405	810
900							50	395	790
1000							20	365	725

<sup>(1)</sup> CE impact tested materials and standard non-impact tested materials.

<sup>(2)</sup> CE non-impact tested materials.

°C	Maximum Non-Shock Working Pressure-Bars								
	Carbon Steel <sup>(1)</sup>			Carbon Steel <sup>(2)</sup>			316SS		
ASME Class	150	300	600	150	300	600	150	300	600
HYDROSTATIC SHELL TEST	30	77	153	30	77	153	29	75	150
HYDROSTATIC SEAT TEST	22	56.9	112.4	22	56.9	112.4	20.9	54.6	109.3
-29 to 0	19.6	51.1	102.1	-	-	-	19.0	49.6	99.3
0 to 38	19.6	51.1	102.1	19.6	51.1	102.1	19.0	49.6	99.3
50	19.2	50.1	100.2	19.2	50.1	100.2	18.4	48.1	96.3
100	17.7	46.4	92.8	17.7	46.4	92.8	16.2	42.2	84.4
150	15.8	45.2	90.5	15.8	45.2	90.5	14.8	38.5	77.0
200	14.0	43.8	87.6	14.0	43.8	87.6	13.7	35.7	71.3
250	12.1	41.7	83.4	12.1	41.7	83.4	12.1	33.4	66.8
300	10.2	38.7	77.5	10.2	38.7	77.5	10.2	31.6	63.3
350	8.4	37.0	73.9	8.4	37.0	73.9	8.4	30.4	60.8
400	6.5	34.5	69.0	6.5	34.5	69.0	6.5	29.1	58.2
425	5.6	28.8	57.5	5.6	28.8	57.5	5.6	28.7	57.3
450							4.7	28.1	56.2
500							2.8	26.8	53.7
525							1.9	25.8	51.6

<sup>(1)</sup> CE impact tested materials and standard non-impact tested materials.

<sup>(2)</sup> CE non-impact tested materials.

## COMPONENTS RATING

The chart at right reflects the maximum temperature ratings for individual components of the Flowseal HPBFV.

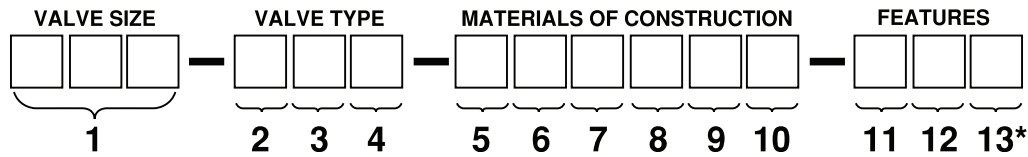
Special care should be taken when specifying component materials for valves at elevated temperatures, especially metal seat valves.

Consult factory if additional information is required re-garding the suitability of components for specific pressure/temperature applications.

Description & Material	Temperature	
	°F	°C
Seat Seal (Soft Seated)		
TFE	-100 to 400	-73 to 204
RTFE	-100 to 500	-73 to 260
UHMWPE	-100 to 200	-73 to 93
Seat Seal (Fire-Flow)		
TFE/Inconel	-100 to 400	-73 to 204
RTFE/Inconel	-100 to 500	-73 to 260
Seat Seal (Metal Seats)		
Inconel 718	-100 to 1150	-73 to 621
316 Stainless Steel	-100 to 1000	-73 to 538
Seat O-Ring		
Silicone (Standard with RTFE)	-100 to 500	-73 to 260
Viton (Standard with TFE)	-50 to 400	-46 to 204
Stem Packing		
TFE	-100 to 500	-73 to 260
Graphite	-100 to 1150	-73 to 621
Shaft		
17-4PH H1150	-100 to 800	-73 to 427
17-4PH H1150M	-100 to 800	-73 to 427
316 Stainless Steel	-100 to 1150	-73 to 621
K-Monel 500	-100 to 1150	-73 to 621
Inconel 718	-100 to 1150	-73 to 621
Bearings		
TFE/Fiberglass Composite	-100 to 500	-73 to 260
RTFE/316 Stainless Steel	-100 to 500	-73 to 260
Bronze	-100 to 750	-73 to 339
Steel	-100 to 1150	-73 to 621
316 Stainless Steel	-100 to 1000	-73 to 538
Disc Treatment		
Electroless Nickel Plating	-100 to 750	-73 to 399
Stellite	-100 to 1150	-73 to 621
Malcomizing	-100 to 900	-73 to 482



# FLOWSEAL FIGURE NUMBER SYSTEM



1. Size	Code
2"	02
2 1/2"	025
3"	03
3 1/2"	035
4"	04
to	
48"	48
2. Body Class	Code
150 PSI Max. Diff. Pressure	0
ASME 150	1
ASME 300	3
ASME 600	6
3. Body Type	Code
Wafer	W
Lugged	L
Lugged DDES	D
4. Shaft Design	Code
Straight	A
Class 150 2" - 12"	
Class 150 36" - 48"	
Class 300 2" - 12" & 30"	
Class 600 2" - 8"	
Balanced	C
Class 150 14" - 30"	
Derated 36" - 48" (150 psig max.)	
Class 300 14" - 24"	
Class 600 10" - 16"	
5. Body Material	Code
Carbon Steel	1
316 SS	2
Monel	3
Alloy 20	4
Alum Bronze B148 ASTM C958	8
ASTM A744 CN-3MN	A
2205 Duplex ASTM A890 Gr 4A	B
254 SMO	C
Hastelloy C	H
Special	X

Note 1: Shaft materials other than 17-4 PH or Monel will affect working pressure ratings. Please consult factory.  
 Note 2: DDES = Double Dead End Service.  
 Note 3: For CE marked valves, see Body Rating chart on page 16, as temp ranges can vary per material.

Example: 12 - 1WA - 171MTG - 3

12" Wafer Style Class 150 Carbon body, Straight 17-4 Ph SS Stem, 316 SS Nitrided Disc, Inconel Seat, TFE Pkg, Garfil Bearings, Gear Operated

## FLOWSEAL ACTUATOR OPTIONS:

Lever:	Not recommended for Metal Seat High Performance Butterfly Valve	
Worm Gear Operators:	Five types available:	Optional:
	• High temperature service	• Chain wheel
	• Buried service	• Output shaft extension
	• Submersible service	• Input shaft extension
	• Marine service	
	• Standard aluminum handwheel	• AWWA special operator
Hydraulic Actuator:	Customer specified hydraulic actuator	
Pneumatic Actuators:	• Crane Revo® spring return pneumatic actuator	
	• Crane Revo® double acting pneumatic actuator	
	• Customer specified pneumatic actuator	
Electric Actuators:	• Series 44000 electric actuator	
	• Customer specified electric actuator	

6. Disc Material	Code
Alum Bronze/ENP B148 C958	0
316 SS	2
Monel	3
Alloy 20	4
Alum Bronze MIL-B-24480	5
316 SS Nitrided	7
Alum Bronze B148 ASTM C958	8
316 SS/ENP	9
ASTM A744 CN-3MN	A
2205 Duplex ASTM A890 Gr 4A	B
254 SMO	C
Hastelloy C	H
Hastelloy C/ENP	J
Special	X
7. Shaft Material	Code
17-4PH SS (See Note 1)	1
316 SS	2
Monel (See Note 1)	3
Alloy 20	4
Inconel 718/750	6
Ferrallium A479	7
Nitronic 50	0
ASTM A744 CN-3MN	A
2205 Duplex ASTM A890 Gr 4A	B
254 SMO	C
Hastelloy C	H
Special	X
8. Seat Material / O-Ring	Code
TFE / Viton	T
TFE/Neoprene	N
RTFE / **	R
RTFE / AFLAS	O
Polyethylene (UHMWPE) / Viton	L
Fire-Flow (TFE & Metal) / Viton	F
Fire-Flow (RTFE & Metal)/Viton	A
Fire-Flow (RTFE & Metal) /	B
Silicone	
Inconel	M
300 SS	S
Fire-Flow (TFE & Monel) / Viton	C
Fire-Flow (RTFE & Monel) /	J
Silicone	
Fire-Flow (TFE & Hastelloy C) /	H
Viton	
Fire-Flow (R TFE & Hastelloy C) /	K
Silicone	
Special	X

\*\* Original may be Silicone or Viton.

9. Packing Material	Code
TFE	T
Graphite	G
Fire-Flow	F
Special	X
Live-Load Packing/TFE	A
Live-Load Packing/Graphite	B
Live-Load Packing/Fire-Flow	C
FF Seal (Viton O-Rings)/TFE	D
10. Bearing Material	Code
Garfil (Glass Backed TFE)	G
316 SS Backed TFE	H
Fire-Flow (Garfil & 316 SS)	F
Stainless Steel Nitrided	S
Bronze	B
Monel	K
Hastelloy C Backed TFE	J
Special	X
11. Actuator Type	Code
Bare Shaft	B
Ratchet Handle	H
Ratchet Handle w/Lock	L
Throttle	T
Worm Gear	3
Worm Gear (4-Way keyed)	9
Pneumatic Double Acting	4
Pneumatic SR Fail Close	5
Pneumatic SR Fail Open	6
Hydraulic	7
Electric	8
Other	X
12. Special Feature	Code
None	O
Level 2 Commercial Oxygen Cleaning	A
Bi-directional	B
Chlorine Service	C
Dead-end Service (DDES)	D
CE Marked (impact tested)	PI
CE Marked (non-impact tested)	PN
Flat Face	F
Silicone Free	G
Epoxy Coated Body	H
Chainwheel	J
Stem Extension	K
Lockable Gear	L
Mil-V-24624	M
NACE Construction	N
60 to 125 AARH Facing	S
Vacuum Service	V
Further Description Required	X
13. Series	
*Factory Assigned	J