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1 Introduction

1.1 Scope of the Manual.

The purpose of this manual is to ensure that the valves supplied are properly installed and maintained to give trouble free performance .

This manual covers FNW single piece body butterfly valves from 2" to 72" in both wafer, lug and double flanged designs.

1.2 General Design.

The FNW Butterfly valves are tight shut off, with wafer or lugged body construction. The valves are design & manufacture generally conforms to the requirements of API 609 / EN 593 / MSS SP-68 standards . The valves are bi-directional. The valve seat enveloping the entire wetted surface and the flange contact face of the body.

1.3 Flange and Pipe compatibility :-

Butterfly valves are designed to fit between schedule 40 (for class 150) & schedule 80 (for class 300) & above 100 (for class 600) pipe, and the following pipe flanges.

1.4 Marking.

Specifications of the valve are marked on the body or on name plate or both, prior to shipment. The identification marking generally consists of size of valve, pressure rating body material, trim material, serial number and the manufacturing date.

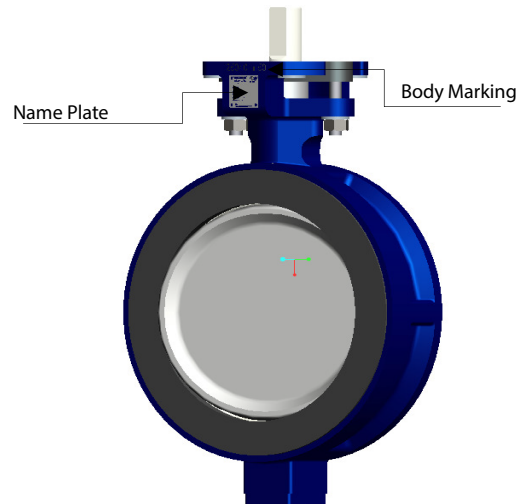


Fig 1.1 Valve Marking

Standard Materials

Item	Component	Carbon Steel	Stainless Steel	Item	Component	Carbon Steel	Stainless Steel
1	Body	A216WCB	A351 CF8/CF8M	10	Packing Support	SS TYPE 316	
2	Disc	A351 CF8/CF8M		11	Stem Packing	PTFE (CHEVRON)/GRAPHITE	
3	Seat	MRTFE (2" TO 24") FIRESAFE - SS316 (2" TO 24") METAL-SS316/INCONEL 625 (2" TO 24")		12	Gland	SS TYPE 316	
				13	Snap Ring	STAINLESS STEEL	
				14	Gland Flange	CARBON STEEL	SS TYPE 304
				15	Gland Flange Stud	GR. B8	
4	Stem	A564 17-4PH / A479 TYPE 316 A479 XM-19		16	Belleville Spring	STAINLESS STEEL	
				17	Nyloc Nut	A2-70 (SS304)	
5	Seat Retainer	CARBON STEEL	SS TYPE 304/SS TYPE 316	18	Gasket	PTFE / GRAPHITE	
6	Disc Spacer	SS TYPE 316		19	Bottom Flange	CARBON STEEL	SS TYPE 304
7	Bearing	BEAR - X/SS 316 + PTFE / HT 316		20	Washer	SS TYPE 304	
8	Wedge Pin	17-4 PH		21	Stud	GR. B8	
9	Retainer Screw	A4-70 (SS316)		22	Hex Nut	GR. 8	

3 Safety Precautions.

3.1 Do not exceed the valve pressure / temperature rating limitations!

- Exceeding the pressure/temperature rating limitations marked on the valve may result in major damage or Personal injury. Users of these valves should ensure that the valve pressure / temperature is less than or equal to the rated pressure/temperatures. If required, end user should incorporate appropriate limiting/monitoring devices in the system for the safe operation of the valve.

3.2 Use the valve for specified application only!

- User to ensure that the valve is used only for the specified application as agreed between the manufacturer and the purchaser.

3.3 Follow the safety rules and regulations!

- User of the valve must be aware of all the safety rules and regulations related to a particular environment in which the valve is to be used.

3.4 Do not disassemble the valve or remove it from the pipeline while the valve is pressurized!

- Disassembling or removing a pressurized valve will result in uncontrolled pressure release. Always isolate the relevant part of the pipeline, release the pressure from the valve and remove the media before dismantling the valve.
- Be aware of the type of media involved. Protect people and the environment from any harmful or poisonous substances.
- Make sure that no dust, dirt can enter the pipeline during the valve maintenance .

3.5 When handling the valve or the valve package, bear in mind its weight!

- Never lift the valve or valve package by the handle gear operator, actuator or hand wheel. Place the rope securely around the valve body while handling the valve. Refer to Fig No. 1.2

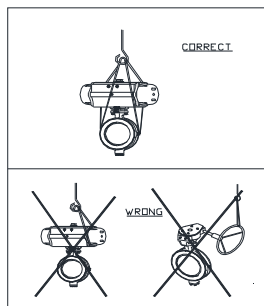


Fig 1.2 Lifting of the Valve

3.6 Only use properly qualified personnel for Installation & maintenance .

4 Transportation, Receiving and Storage.

- 4.1 Valves are being packed in cartons, boxes or pallets while shipping to the customer. Care should be taken to store them in a suitable place. We recommend storing the valves indoors in a dry and dust free atmosphere (Refer to figure 2.1). While unpacking the valves, check that the valves and any other accessories have not been damaged during transportation. Avoid mechanical damage to the valve seat during storage. Rubber lined valve must not be stored for more than 2 years without installation, unless specified otherwise.

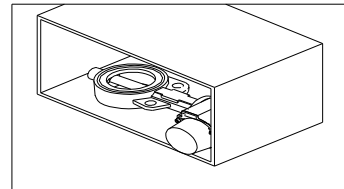


Fig 2.1 Storing the Valve.

• **Caution:**

Placing the valves directly on the ground or on a concrete floor should be avoided!

- 4.2 All wrapping and protection on the valves should not be removed until the valve is ready for installation.

- 4.3 If the valves are stored for a long time, then all the valves should be cleaned and hydro / pneumatic tested before installation. Refer to General Arrangement drawing, which lists the appropriate testing standards, or consult the nearest branch office / factory for more information

- 4.4 Valves are bi-directional and can be installed in either direction.

- 4.5 Lever or hand wheel of gear operator for respective valves are packed loosely and kept in the same box, in which the valve is packed (wherever applicable). When handling the valve either by hand or by mechanical means, special care should be taken not to damage the lever or gear operator. Lift the valve only as shown in fig. 1.2. Lifting the valve from any other location may damage the valve components.

5.0 Installation

- 5.1 When removing the valve from storage a careful check should be made to ensure that the valve has not been damaged during the storage period.
- 5.2 Valve open or close position is indicated on the notch plate for lever operated valves or on the top of the gear operator for gear operator operated valves
- 5.3 Center valve, span body with bolts, but do not tighten. Slowly open disc to ensure that it clears adjacent pipe ID and leave at full open position. Tighten bolts in a criss cross pattern refer fig 3.5.

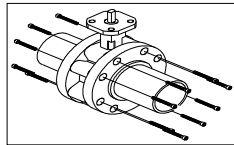


Fig 3.1 Lug Valve Installation

- 5.4 For flange welding center valve, span bolts, align this assembly in pipe and tack weld flanges to pipe. After tack welding, remove valve and finish welding.

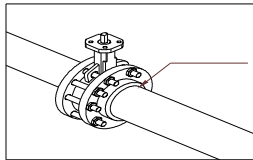


Fig 3.2

- Note:**
- a) Do not attempt to correct the line misalignment by means of flange bolting Ref to fig 3.3.
 - b) Use flange gaskets Ref to fig 3.4.
 - c) Valves shall never be mounted with the operator vertically downwards.

- 5.5 Valve should be checked for identification purpose and ensure that characteristics of valve matches to those specified for piping specifications, for the line where that is to be mounted. Nameplate instructions will give the necessary information.

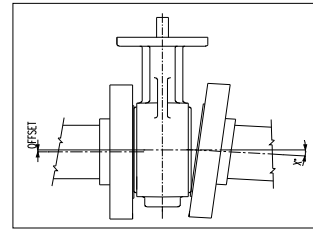


Fig 3.3 Valve Alignment

- 5.6 Use flange gasket & Install valve between flanges in closed condition.

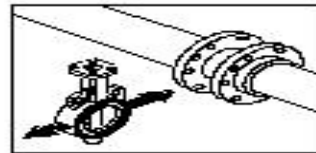


Fig 3.4 : Installation of valve into pipe line

5.7 Recommended Bolt Tightening Sequence:

Place the valve between the flanges, center it and then span the valve body with all flange bolts, but do not tighten the bolts. Carefully open the disc to the full open position, making sure the disc does not hit the adjacent pipe I.D. Now systematically remove jack bolts or other flange spreaders, and hand-tighten the flange bolts as shown in fig.3.5 Very slowly close the valve disc to ensure disc edge clearance from adjacent pipe flange I.D. Now open the disc to full open and tighten all flanges bolts as per specification as shown in fig. Finally, repeat a full close to full open rotation of the disc to ensure proper clearance.

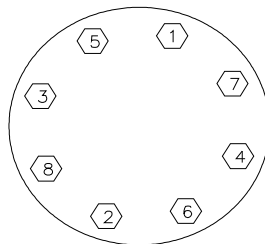


Fig 3.5: Initial Centering & Flanging of Valve

- 5.8 Insulation / lagging of the valve and pipeline outside diameter is recommended, where fluid temperatures are going to be higher than 150°C.

Note: It is recommended to use ASTM A193 Gr.B7 fasteners for flange bolting.

6. Operation of the Valve.

- 6.1 For lever operated valves, the hand lever is either assembled with the valve or shipped loose depending upon the size of valve / hand lever.
- 6.2 For gear operated valves, THE GEAR OPERATOR OPEN / CLOSE ADJUSTMENT HAS BEEN DONE PRIOR TO SHIPMENT AND MUST NOT BE CHANGED. Rotation of hand wheel in the clockwise direction closes the valve and counter clockwise rotation opens it. (Looking from hand wheel end) The details of gear operator are shown in the fig. 4.1. The internal details/construction of gear operator may vary as per manufacturer's standard.

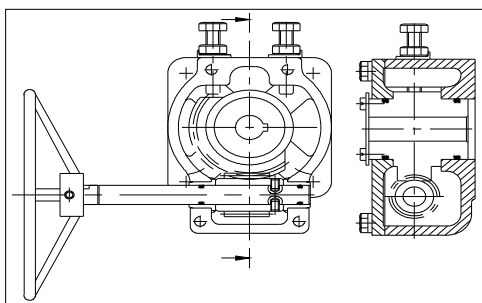


Fig 4.1: Details of gear operator.

- 6.3 Butterfly valves always close in a clockwise direction. Valve should always be rotated through 90° to the fully opened or fully closed position.
- 6.4 Valve should be opened and closed slowly to avoid hammering effect on the valve and pipeline.
- 6.5 Once the flushing is complete, valve should be operated 3-4 times and then kept in the fully open position.
- 6.6 If the valve is not operating to fully open or fully closed position, and/or leaking, do not apply excessive force to operate the valve. This can damage the seats or stem.
- 6.7 The hand wheel provided on the gear boxes is capable of generating the required output torque with a pull of 36Kg (356N) on hand wheel. No extra lever / crowbar shall be used with the hand wheel.

Caution:

- Apply gradual force on the hand wheel of the gear operator and do not give impacts.
- Do not apply extra leverage (using pipe/bar), when the end stops of the gear operator are reached.

7 Maintenance.

Note:

Observe the safety precautions as outlined in section 3 before performing maintenance.

7.1 Preventive Maintenance.

- 7.1.1 In order to avoid valve failure during operation, all valves in a process plant should be periodically inspected thoroughly to detect the wear of disc, seats, seals and even body. It is recommended that on such occasions seats, seals and bushings should be replaced.
- 7.1.2 The type of process, fluids involved, working conditions and location of the valves in the process plants, will determine the frequency of periodic inspection / maintenance which in fact will be made at the time of partial or total shutdown of the plant. Preventive maintenance is absolutely essential as the failure due to lack of the same may cause an emergency shutdown of the plant.
- 7.1.3 Section 8 describes the procedure for disassembly, repair and assembly of the valve. The procedure will be the same for a valve failing during operation due to lack of preventive maintenance.
- 7.1.4 Once a valve is repaired, it should undergo a complete set of tests to make sure that the valve is adequate for the original working conditions. Hydro/Pneumatic tests should be carried out as per the specifications relevant to the valve (Refer General Arrangement Drawing).
- 7.2 Lubrication of Worm Gear operator.
- 7.2.1 Worm gear operators are packed with grease. Normally the grease is suitable for -20 °C (-4 °F) to 80°C (176 °F). For other applications, consult the nearest branch office / factory.
- 7.2.2 Grease should be changed as following. If operated frequently, after approx. 3 years. If operated rarely, after approx. 5 years.
- 7.2.3 Recommended Greases-

Servogem EP2 (Extreme Pressure),
Mobilux EP2,
Valvoline EP2,
Chevron EP2.

WARNING

Pipeline pressure can propel the loose flange bolts flanges, and can cause personal injury or equipment damage. Relieve pipeline pressure before removing flange bolts and flanges.

WARNING

Moving Parts from accidental operation of powered (Pneumatically / Electrically) actuator can cause personal injury or equipment damage. Disconnect and lock power to actuator before servicing.

8. Disassembly and Assembly Instructions :

Note: If complete disassembly becomes necessary, replacement of seats and all seals is recommended.

8.1 Disassembly Instructions:

(Refer to exploded view No. 10.1 and 10.2)

Before disassembling, please ensure that all spare parts as detailed in Table 1 of Section 9, are available. For below mentioned procedure, the numbers in the bracket refer to the part numbers of the components as indicated in exploded view (fig no 10.).

- In case the valve is in operation, release the pressure from the line.
- Rotate the valve stem (03) manually to keep the Valve in the half-open position. This will remove pressure in the pipeline.
- Always fully close valve before removing from line to avoid damage to disc
- Valve can be repaired by removing the entire valve from pipeline. Use mounting holes to lift the valve (Wherever applicable).

- 8.1.1 Unscrew the lever lock bolt. Lift the lever by pressing the latch of the lever out of the stem in case of hand lever operated valve.
- 8.1.2 Lift the gear operator out of the stem by removing the bolts in case of gear operated valve.
- 8.1.3 Place the valve on a bench or other suitable working space. Now follow the following method for bolted seat retainer and snap fit retainer kind of valves.

8.1.4A Bolted seat retainer:(fig.no.10.1)

Remove all cap screws (06) and remove the seat Retainer .

8.1.4B Snap fit seat retainer:(fig. no. 10.2)

Using a wooden or plastic rod and hammer, drive the seat ring out of the body from the shaft side. Do not strike the valve directly with a hammer.

- 8.1.4 Remove the seat (04) and replace it.
- 8.1.5 Remove the nuts from gland flange (18) and remove the flange. The studs (17) do not have to be removed.
- 8.1.6 Remove the disc pin welds by grinding or machining off the welds and remove the disc pin (09).
- 8.1.7 Remove the snap ring (14) (fig 10.1) and pull the stem (03) out and remove the stem seal.**NOTE:** When removing the stem and freeing the disc, be careful not to scratch the sealing surface of the disc.
- 8.1.8 Gently pull the disc (02) from the body (01).
- 8.1.9 Remove the bottom flange nuts (21) and remove the bottom cap (20).

- 8.1.10 Remove the bottom gasket (19) and thrust bearing (19).
- 8.1.11 Remove top bearing either from top of the valve or the waterway.
- 8.1.12 Remove the bottom bearing.

Note: Points 8.1.10 and 8.1.11, is only applicable for case 2 condition .

8.2 Repair of Components.

- 8.2.1 The metallic parts should be cleaned.
- 8.2.2 After cleaning components examine for damaged parts. Ensure that there are no scoring marks on the metallic sealing surfaces. Check the seals for scratches / wear.
- 8.2.3 Replace the damaged parts. The parts such as seats, stem packing, bearings are recommended to be replaced with new ones whenever the valve is disassembled.



Fig 5.1:Way to remove seat retainer



Fig 5.2:Installing seat and seat retainer assembly



Fig 5.3:Fixing the seat and seat retainer assembly in to the body

8.3 Assembly Instructions:

(Ref exploded view 10.1 and 10.2)

1. Clean all the components and remove burr and sharp edges if any.
2. Before assembly visual inspect all the valve components for damage. Look for damage to the seating areas on the disc and check quantity as per bill of material.
3. Apply rust preventative oil wherever applicable. (i.e. Body & disc stem bore in case of DI/CS material).
4. Place the body (01) on a clean work surface.
5. Install the bearing (08) with the help of mandrill in to the upper stem bore (2 Nos.) and lower stem bore (2No.) of the body.
6. Place the bottom gasket (19) from bottom side.
7. Assemble bottom cap (20) and fasten the bolts (21) of bottom flange.
8. To easy assembly of the shaft into the disc, it may be necessary to coat the shaft and disc bore lightly with a lubricant compatible with the media to be handled by the valve.
Slide the stem through the top bearing and engage the top disc spacer (07) toward the bonnet when applicable, place the disc and slide the stem through disc stem bore. Place the lower disc spacer (07) and push the stem through lower bearing in to the body.
9. Insert the disc pins (09) as shown in figure-02. Take care that pin flat surface matches to stem flat surface and drive them into place. When pines are correctly installed (refer figure-03 for correct installation) the drive shaft will be as shown in figure-01. Cycle the disc 4 to 5 times.

Note:- Ensure difference between both pins top surface from disc face within $\pm 1\text{mm}$ & there is no play between disc and stem while cyclic.

Note: When the gear operator or hand lever or actuator is re-assembled on the valve, it may be necessary to adjust gear operator or hand lever or actuator travel stops to ensure proper setting of the butterfly in the open and closed position

10. Place the support ring in to the upper stem bore and Install the stem packing (12) with pair of male and female (3 set) above the support ring.
11. Install packing gland (13) in to the upper stem bore.
12. install the snap ring (14) on the stem.
13. Install the gland flange assembly (18) through body hole and stem, insert the spring washer and install nut, tighten the nut (15) slowly till to the ISO top flange.
14. Install the seat (04) in to the seat retainer ring (05)
- 16A. **Bolted seat retainer:**
Insert the seat and seat retainer assembly in to the body main bore with disc is in closed position .
Apply anti seize grease for threading area. Insert the socket headed cap screw (06) through seat retainer ring and tighten slowly in an alternating sequence.
- 16B. **Snap seat retainer :**
Insert the seat and seat retainer ring assembly in to the body main bore with disc is in close position.
Press the seat retainer so that ball will be fixed in to the groove provided in to the body.
17. Cycle the disc and set disc horizontal (closed) position.
18. Disc pins to be Tig spot welded after leakage Testing.

Note: - Point no. 6 and 7 is only used in case 2 condition.

FIG.5.4: SNAP FIT RETAINER

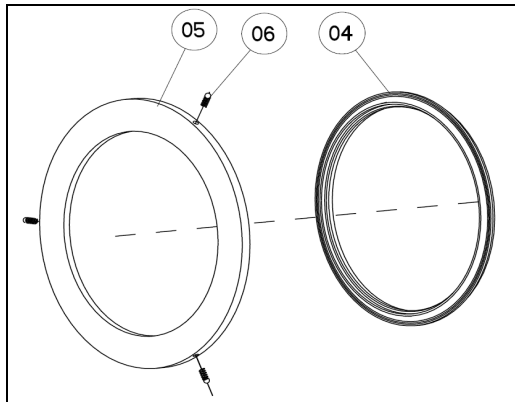
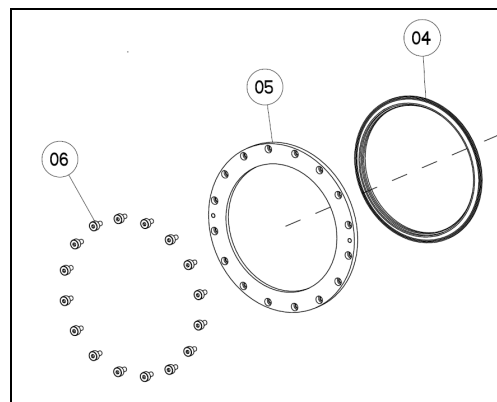
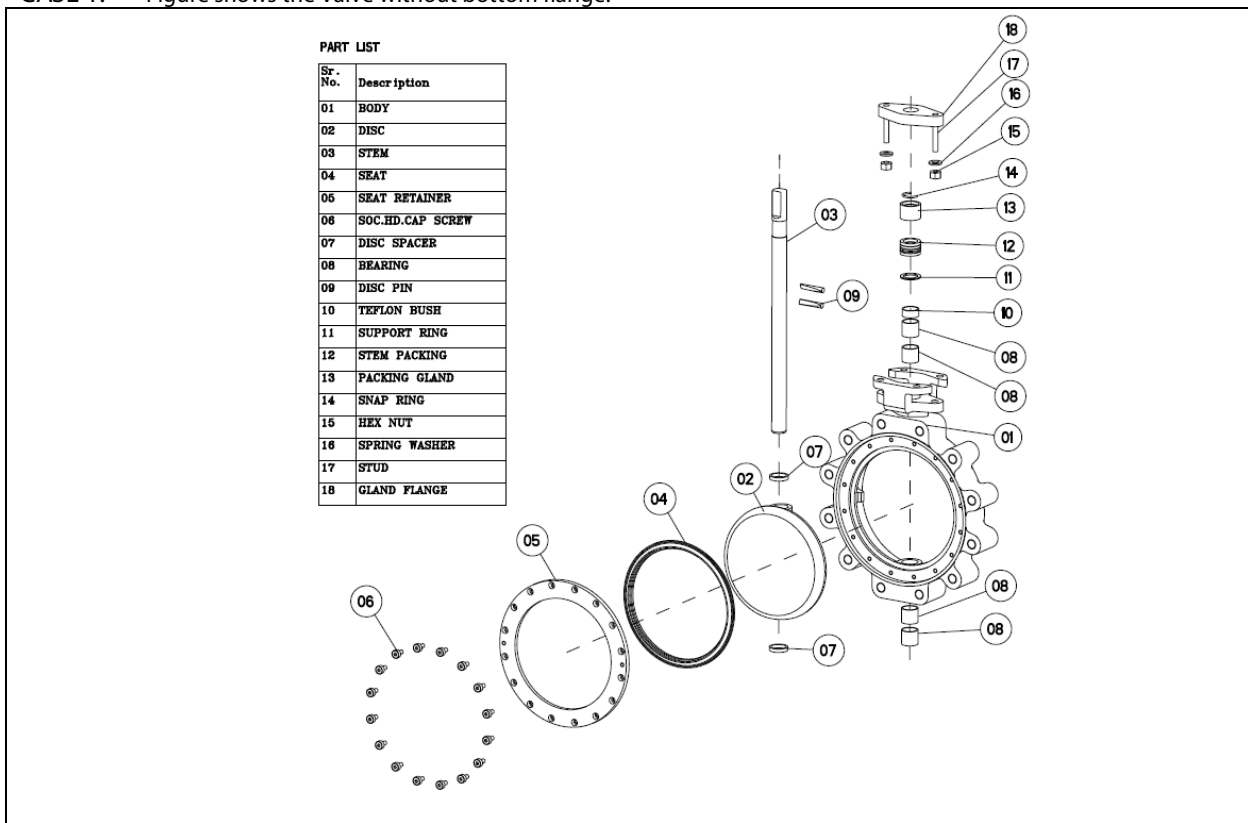


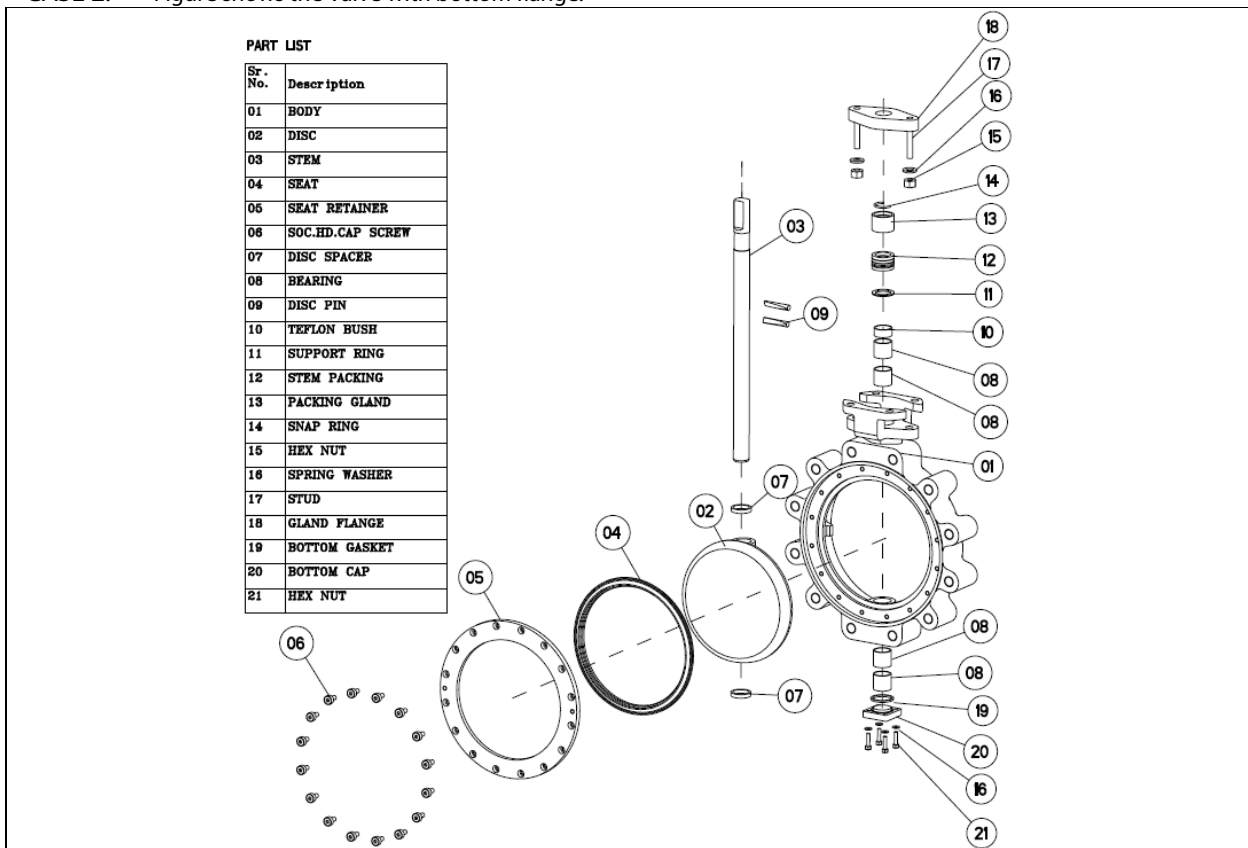
FIG.5.5 BOLTED SIT RETAINER

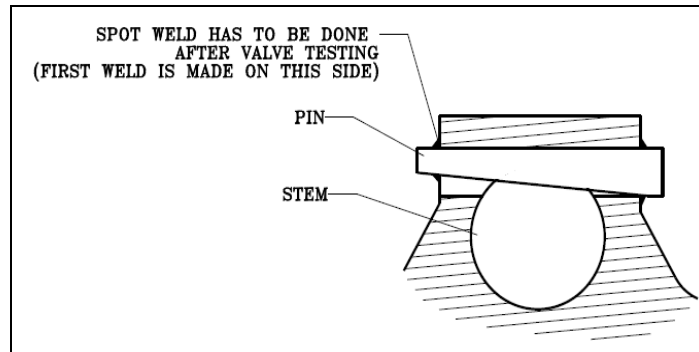


CASE 1: - Figure shows the Valve without bottom flange.



CASE 2: - Figure shows the Valve with bottom flange.





9 Recommended Spares Kit.

Before the start of the repair operations, we commend that one set of spares as given in the table below should be available. For normal operation (2 years), we recommend one set of spares be available at site.

9.1 List of Recommended Spare Parts

Part Name
Seat
Bearing
Stem packing
Snap ring
Bottom gasket

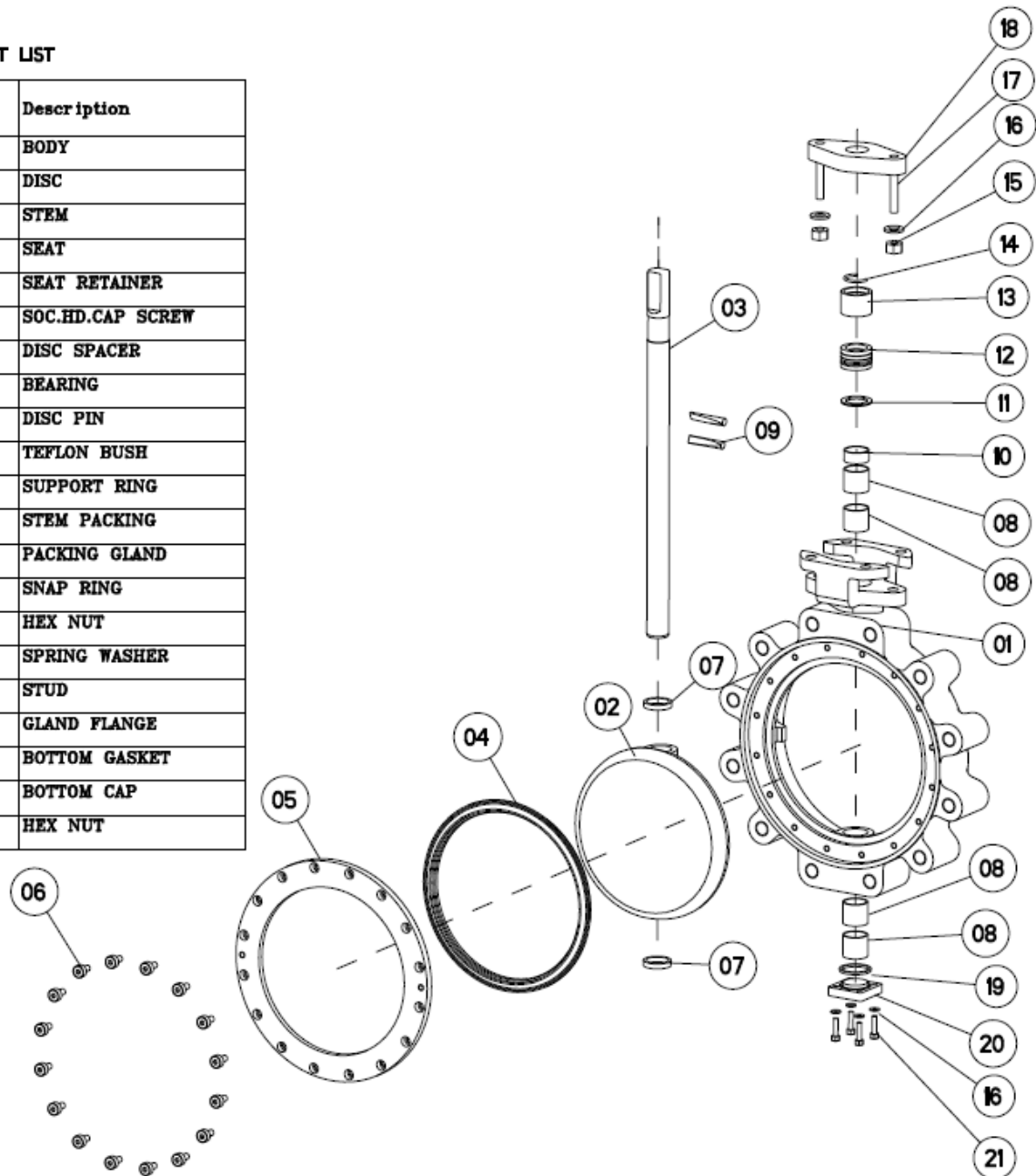
Note:- All equipment must only be fitted with manufacturer's original spare parts. When ordering for spareparts always convey the information i.e. size of valve, Sr.No, Mfg date whi ch is available in the name plate tag.

10. Exploded View

Exploded View Fig No: 10.1

PART LIST

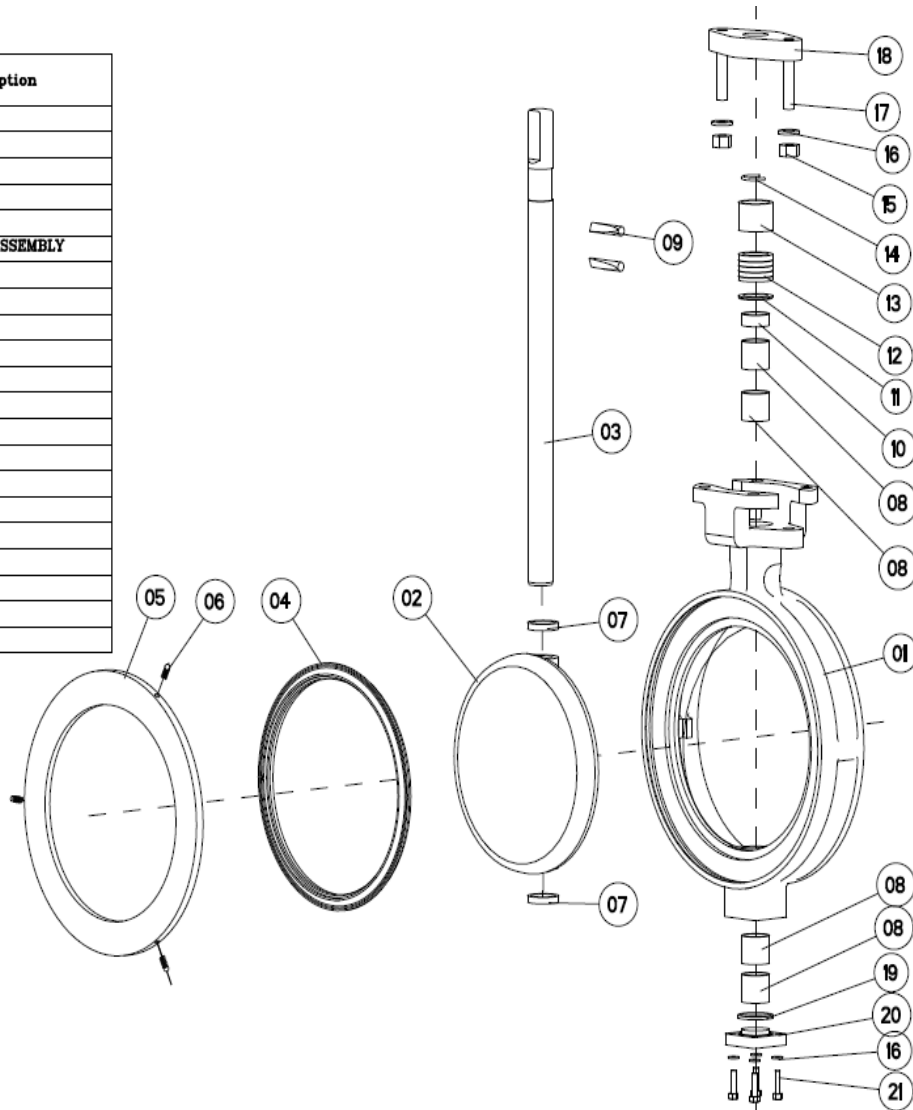
Sr. No.	Description
01	BODY
02	DISC
03	STEM
04	SEAT
05	SEAT RETAINER
06	SOC.HD.CAP SCREW
07	DISC SPACER
08	BEARING
09	DISC PIN </td
10	TEFLON BUSH
11	SUPPORT RING
12	STEM PACKING
13	PACKING GLAND
14	SNAP RING
15	HEX NUT
16	SPRING WASHER
17	STUD
18	GLAND FLANGE
19	BOTTOM GASKET
20	BOTTOM CAP
21	HEX NUT



Exploded View Fig No: 10.2

PART LIST

Sr. No.	Description
01	BODY
02	DISC
03	STEM
04	SEAT
05	SEAT RETAINER
06	BALL LOCKING ASSEMBLY
07	DISC SPACER
08	BEARING
09	DISC PIN
10	TEFLON BUSH
11	SUPPORT RING
12	STEM PACKING
13	PACKING GLAND
14	SANP RING
15	HEX NUT
16	SPRING WASHER
17	STUD
18	GLAND FLANGE
19	BOTTOM GASKET
20	BOTTOM CAP
21	HEX BOLT



11. Trouble shooting :-

Symptom	Possible Cause	Corrective Action
Stem packaging leaks from top	<ol style="list-style-type: none"> 1. Gland bolts loose 2. Packaging damaged or missing 3. Seal misaligned 	<ol style="list-style-type: none"> 1. Tighten the bolts 2. Replace packaging (shutdown first) 3. Replace and aligned it correctly
Body gasket leaking	<ol style="list-style-type: none"> 1. Body bolts loose 2. Body gasket damaged 	<ol style="list-style-type: none"> 1. Tighten the body bolts 2. Remove Gasket
Valve leaks at closed position	<ol style="list-style-type: none"> 1. Seat is worn or damaged 2. Disc edge is worn or damaged 	<ol style="list-style-type: none"> 1. Replace seat as described in disassembly & assembly 2. Replace the disc. <p>Consult factory for potential application problem.</p>

12. Atex Instructions for use in potentially explosive environment.

- Prevent any kind of ignition during installation, adjustment, putting into service & use.
- Assembly, disassembly & maintenance must be done outside potentially explosive areas.
- Installation, adjustment, putting into service, use, assembly, disassembly, and maintenance of is strictly reserved to qualified persons.
- Valve should be insulated if the maximum operating temperature of process fluid flowing is greater than 150°C
- Dust deposited on the exterior parts of the valve must be removed regularly. Dust deposition layer should not be more than 5mm.

Note:

Special condition for temperature class X: - Maximum surface temperature of the valve depends upon the temperature of fluid flowing through the valve.



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