LINED BUTTERFLY VALVES

INSTALLATION, OPERATION AND MAINTENANCE

INDEX:

1 - SAFETY INFORMATION

The following general safety information should be taken into account in addition to the specific warnings and cautions specified in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered in this I.O.M.

To avoid injury, never attempt disassembly while there are pressures either upstream or downstream. Even when replacing gaskets, caution is necessary to avoid possible injury. Disassemble with caution in the event all pressures are not relieved.

To prevent valve bending, damage, inefficient operation, or early maintenance problems, support piping on each side of the valve.

- A valve is a pressurized mechanism containing fluids under pressure and consequently should be handled with appropriate care.
- Valve surface temperature may be dangerously too hot or too cold for skin contact.
- Upon disassembly, attention should be paid to the possibility of releasing dangerous and or ignitable accumulated fluids.
- Ensure adequate ventilation is available for service.

This manual provides instructions for storing, general servicing, installation and removal of valves. Trust Valves refuses any liability for damage to people, property or plant as well as loss of production and loss of income under any circumstances but especially if caused by incorrect installation or utilization of the valve or if the valve installed is not fit for intended purpose. It is the sole responsibility of the user to ensure the valve type and materials are correctly specified.
DURING OPERATION, TAKE INTO ACCOUNT THE FOLLOWING WARNINGS:

- The valve's internal parts such as disc, stem, seat, shall be handled with care avoiding scratches or surface damage.
- All tools and equipment for handling internal critical sealing parts shall be soft coated.
- Seat & seals can include Viton, EPDM, Buna & Teflon hence high temperature will damage sealing components.
- Never part open or part close valve; valve must be full open or full closed to avoid seats damage. If valves are used to throttle, it must must be done at very low pressure and for very short periods.

For all operations, refer to position number on part list of the applicable drawing.

2 – INSTALLATION

The following procedure is required to be followed for correct installation:

- Before installation confirm the marking (rating, size and material) on the valve body and nameplate. Ensure the valve is suitable for the service which it is being used. The direction of installing the butterfly valve is normally bi-directional unless there is a marked arrow on the body.
- Body bolts and nuts on valve shall be checked and re-tightened if necessary in case loosened during installation.
- Remove valve end protectors and ensure gasket faces are free from damage. Tighten all bolts between mating flanges and valve equally paying careful attention to properly tighten bolts. Follow tightening procedure (opposing bolts sequentially) gradually increasing torque.
- Prior to installation of valve, ensure the line is completely flushed to remove any debris as soft seated butterfly valves are easily damageable.
- Valves will operate at any angle horizontally or vertically.
- The stem can be installed in any position, but if a choice of stem position exists, good practice dictates that the valve be installed with the stem horizontal. This will minimize liner wear by distributing stem and disc weight evenly.
- Before any flange bolt is tightened, valves should be centered (refer to Fig. 4 & 5) within the flanges and then carefully opened to assure free, unobstructed disc movement.
- After proper operation has been verified, tighten all bolts using the “crossover” method. Recommended tightening torques pattern is as shown in Fig. 7. Gradually increase tighten torque on each revolution, until recommended torque is reach.
- Prior to installing the valve, it is important to make sure the ID (Interior Diameter) of the pipe and the pipe flanges are large enough to allow the disc edge to swing into the opening without interferences. Damage to the disc edge can severely affect the performance of the valve.

Interference may also occur when butterfly valves are bolted directly to the outlet flange of a swing check or reducing flange. Check valve and butterfly valve combinations are very popular; normally a short spool piece may be required so the disc will not be obstructed by adjoining valve bores or mechanism.

Lined valves are not recommended for steam service or where a firesafe valve is required.

Do not install EPDM liner in compressed air lines or in lines containing any hydrocarbons. Viton liners are not recommended for hot water.

- Lever-lock handles are not recommended for use on DN 200 (8”) and larger valves unless where are very low pressures.

3 – GENERAL INSTALLATION

1. Make sure the pipeline and pipe flange faces are clean. Any foreign material such as pipe scale, metal chips, welding slag, welding rods, etc., can obstruct disc movement or damage the disc or seat.

2. Elastomer seats often have integral molded O-ring ribs on the face of the seat (where required in harder compounds). As a result, no gaskets are required as these O-ribs serve the function of a gasket. Softer rubber compounds do not have integral molded O-rings, but do not require them due to the pressure rating of valve.

3. Align the piping and then spread the pipe flanges a distance apart to permit the valve body to be easily dropped between the flanges without contacting the pipe flanges (see Fig. 4).

4. Check that the valve disc has been positioned to a partially open position with the disc edge about 6.3 mm to 9.5 mm from the face of the seat, approximately 10° open (see Fig. 4).

5. Insert the valve between the flanges as shown below, taking care not to damage the seat faces. Always pick the valve up by the locating holes or by using a nylon sling on the neck of the body. Never pick up the valve by the actuator or operator mounted on the top of the valve.

6. 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 ID. Now systematically remove jack bolts or other flange spreaders and hand tighten the flange bolts as shown in Fig. 7. Very slowly close the valve disc to ensure disc edge clearance from adjacent pipe flange ID. Now open the disc to full open and tighten all flange bolts per specification as shown in Fig. 6. Finally, repeat a full close to full open rotation of the disc to ensure proper functionality.

7. Wafer butterfly valves are designed to operate between two flanges. For 'dead end service', a lugged style valve is recommended. The valve should still be placed between two flanges, except the end flange should be an open flange not a blind. Otherwise a special dead end service design valve is required.

8. The valve disc can rotate 360° without damaging the valve or elastomer seat. The valve is designed to open with either clockwise or counter clockwise rotation of the shaft.

9. To prevent damage to the disc and seat during installation, the valve disc should be slightly open but not extending beyond the valve liner face. Positioning the disc in this 'almost closed' position will reduce seat interference and initial torque build-up during valve installation.

10. In general, it is preferable to install valves with the shaft in a horizontal orientation. In this position, shaft and disc weights are evenly distributed, minimizing seat wear. Additionally, any foreign matter which may accumulate at the bottom of the disc and shaft is effectively removed each time the valve is opened.

FIG. 3a – *Butterfly valves located down-stream near the discharge of a pump should be orientated as follows:*

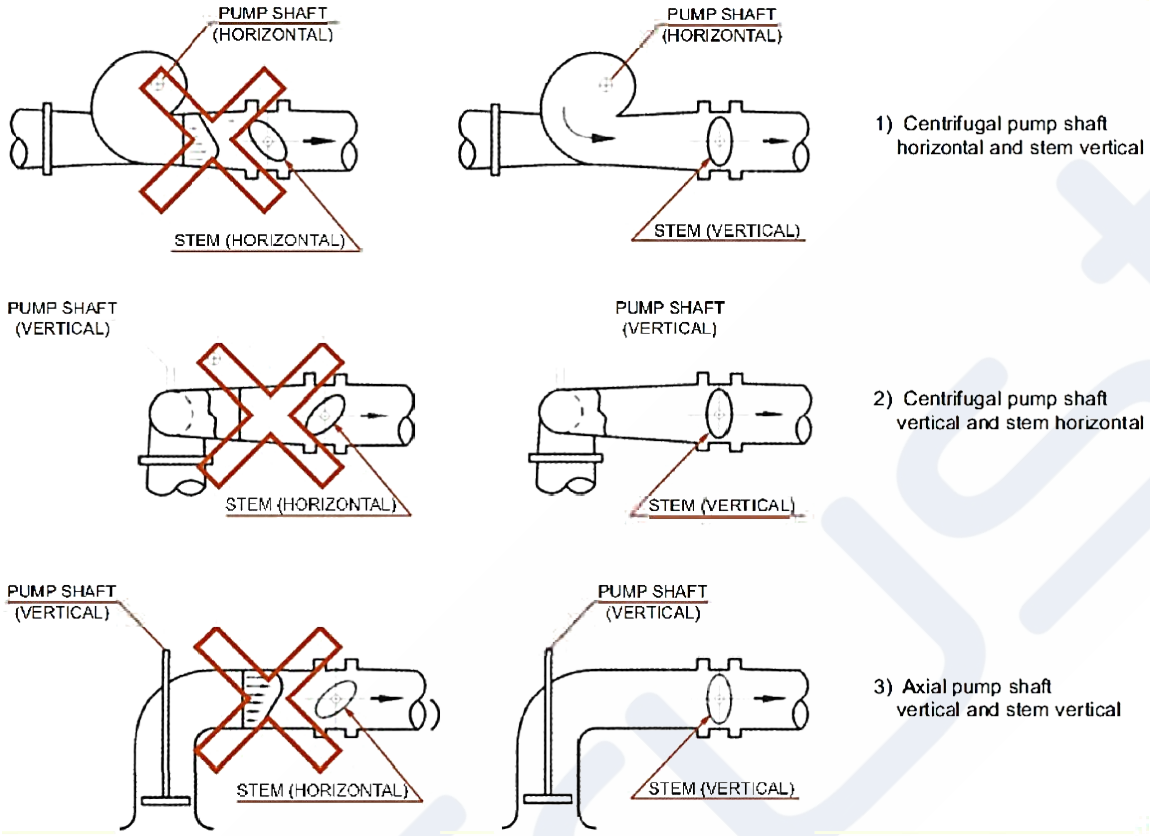


FIG. 3b – *Butterfly valves located down-stream near a bend, reducer or tee should be orientated as follows:*

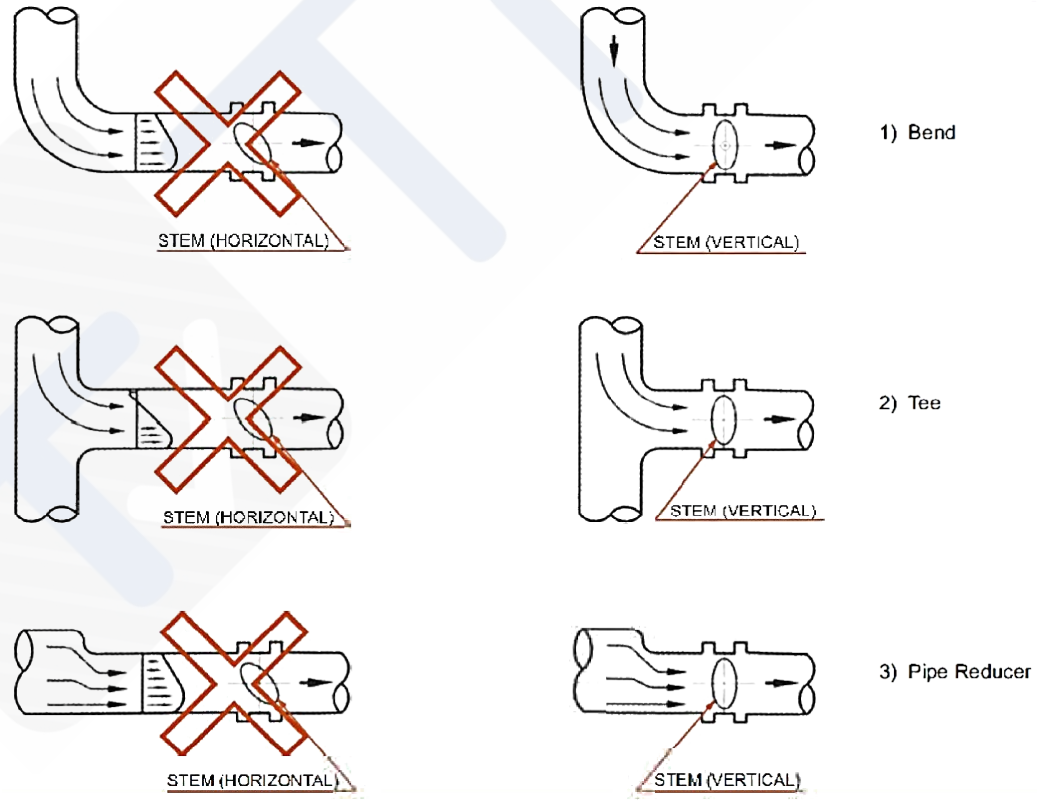
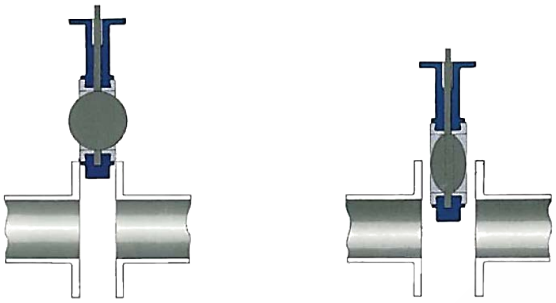


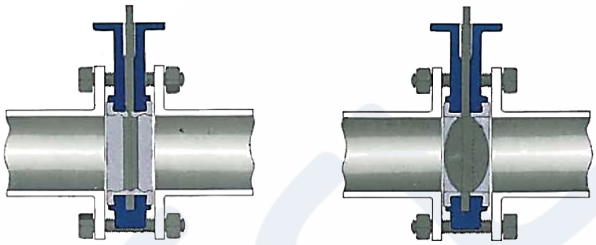
Fig. 4 – *Insert butterfly valve between flanges*



WRONG
Pipe not spread, disc opened beyond valve body face. Results: Disc edge damaged when it hits pipe flange.

RIGHT
Pipe spread & aligned, disc rotated. Results: No undesirable beginning seating/unseating torque, disc edge protected.

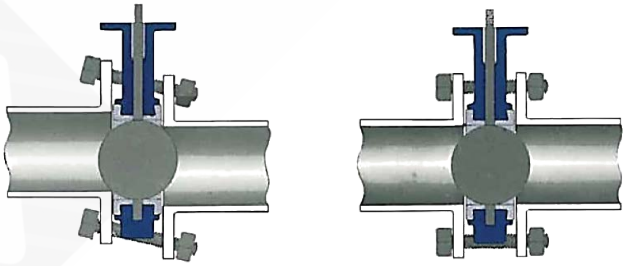
Fig. 5 – *Initial centering & flanging of valve*



WRONG
Disc in closed position, gaskets used. Results: Seal distorted and over compressed causing high initial unseating torque problems

RIGHT
Bolts spanned, disc edge within body face to face, no flange gaskets. Results: No disc damage, proper sealing allowed

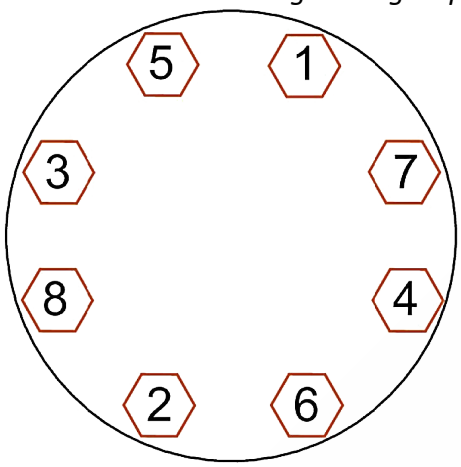
Fig. 6 – *Final aligning & tightening of flange bolts*



WRONG
Piping misaligned. Results: Disc O.D. strikes pipe I.D. causing disc edge damage, increased torque & leakage. Seat face O-rings seal improperly w/out engagement.

RIGHT
Piping aligned properly when bolts tightened, disc in full open position. Results: disc clears adjacent pipe I.D., seat face seals properly, no excessive initial torque.

Fig. 7 – *Recommended bolt tightening sequences*



Example only, same, criss-cross pattern applies for all bolting patterns.

Fig. 8 – *Minimum recommended bolting torque*

Flange Size	Recommended Min. Bolt Torque	Flange Size	Recommended Min. Bolt Torque
DN 50 – 100 (2” – 4”)	27.1 – 40.6 Nm (20 – 30 ft·lbs)	DN 350 – 400 (14” – 16”)	189.8 – 271.1 Nm (140 – 200 ft·lbs)
DN 150 – 200 (6” – 8”)	44.7 – 67.7 Nm (33 – 50 ft·lbs)	DN 450 – 500 (18” – 20”)	203.3 – 248.7 Nm (150 – 210 ft·lbs)
DN 250 (10”)	71.8 – 101.6 Nm (53 – 75 ft·lbs)	DN 600 – 750 (24” – 30”)	291.5 – 406.7 Nm (215 – 300 ft·lbs)
DN 300 (12”)	108.4 – 149.1 Nm (80 – 110 ft·lbs)	DN 900 (36”)	406.7 – 508.4 Nm (300 – 375 ft·lbs)

Do not exceed double the torques shown for DN 50 to DN 300. For DN 350 to DN 400 do not exceed more than torques shown by more than 50%. Bolting torques can vary. We recommend bolts are pre-greased to increase strength and life. The above torques are minimum torques. The profile and resilience of the liner will affect the torque. Only use high tensile bolts.

4 – INSTALLATION WITH FLANGE WELDING

When butterfly valves are to be installed between welding type flanges, care should be taken to abide by the following procedure to ensure no damage will occur to the soft seat. To ensure no damage to the seat, insert the valve between the flanges after welding.

1. Place the valve between the flanges with the flange bores and valve body aligned properly. The disc should be in the 10° open position.
2. Span the body with the bolts.
3. Take this assembly of the flange-body-flange and align it properly to the pipe.
4. Tack weld the cut off flanges to the pipe.
5. Weld the flanges.
6. Install the valve once flanges have cooled.

5 – OPERATION

5.1 – MANUAL OPERATION

Valve adjustments is by clockwise turning of the stem. Lever operated and gear operated valves have a position indicator to indicate open or closed (see Fig. 9 & 10). Butterfly valves are not designed to be used for throttling. Do not leave part open, or seats will be damaged. Valves must be full open or full closed. If valves are used to throttle, it must be done at very low pressures and for very short periods. Because of constant throttling, the life of the valve will be shortened. Even then, do not throttle unless clean fluids, less than 30% open or more than 70% closed, or Venturi action will still cause immediate seat damage.

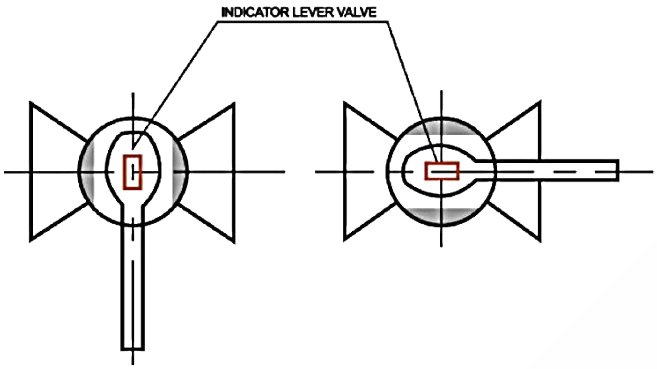


Fig. 9

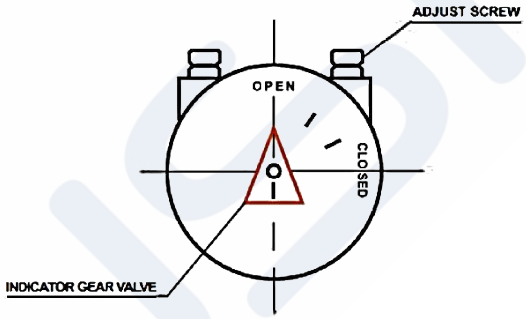


Fig. 10

5.2 – LOCK DEVICE

Where provided (optional) the valve has a locking hole that allows valve to be locked in full open or full closed position.

5.3 – ROUTINE OPERATION

It is recommended that the valve be periodically at least partially stroked to ensure the valve functions and will prevent seizure/galvanization of any mating stem chamber or seat surfaces or memory molding of the seat. This especially applies to automatic actuated valves which only have a limited amount of torque available to function the valve. Duration depends on service, criticality, etc. However, it also must be factored in that if there are impurities or particulates in the line each operation could reduce seat life proportionately.

Packing leakage could result in personal injury. Valve packing is tightened prior to shipping but may require adjustment to meet specific service conditions.

Personal injury may result from sudden release of any process pressure. Trust Valves recommends the use of protective clothing, gloves and eyewear when performing any installation or maintenance.
Isolate the valve from the system and relieve pressure prior to performing maintenance. Disconnect any operating lines providing air pressure, control signals or electrical power to actuators.

6 – OPERATION

Valves should be periodically checked. Frequently depends on service, critically and frequency of use.
The following periodic preventative maintenance practices are recommended for all butterfly valves.
1. Operate the valve from full open to full closed to assure operability.
2. Check flange bolting for evidence of loosening and correct as needed.
3. Inspect the valve and surrounding area for previous or existing leakage at flange faces or shaft connections.
4. Check piping and/or wiring to actuators and related equipment for looseness and correct as needed.

NO	DESCRIPTION	TYPICAL MATERIALS
1	Body	Cast iron, stainless ductile iron, aluminium, carbon steel, stainless steel, etc.
2	Disc	316SS, 304SS, AL-Bronze, hard epoxy coated, hard rubber coated, nickel plated, PTFE coated, 410SS, etc.
3	Stem	316SS, 304SS, PTFE coated, AL-Bronze, etc.
4	Seat	NBR (90 - 100°C), EPDM (90°C) Teflon, food grade rubber, Buna-N, Viton, etc.
5	Retaining Pin / Gland Ring	316SS, 304SS, 410SS
6	Bottom Bushing	Bronze, Nylon
7	O-rings	NBR, EPDM
8	Upper Bushing	Delrin, Nylon, Bronze

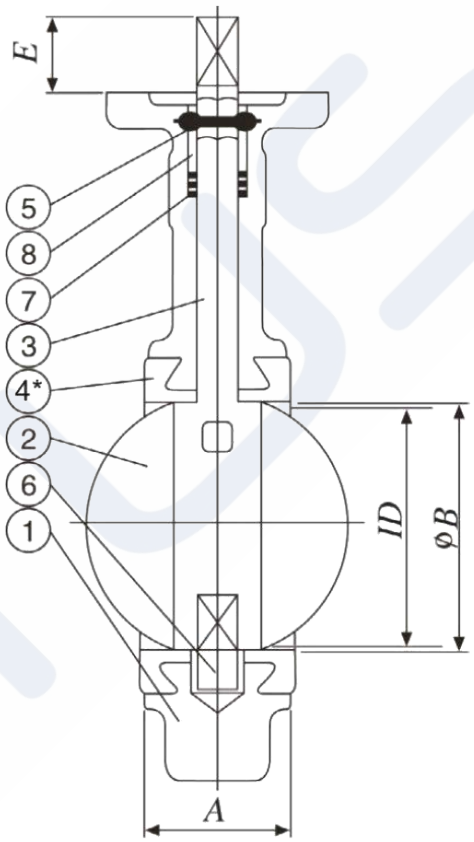


FIG. 11

This is a general drawing only; design will vary depending on size, class, trim, etc. Refer to as-built drawing.

Check the packing box for pressurized process fluids even after the valve has been removed from the pipeline, particularly when removing packing hardware or packing rings, or removing packing box pipe plug. Do not attempt to change the stem seals while the valve is in-line, it is not possible or allowable.

If a gasket seal is disturbed while removing a adjusting gasketed parts, Trust Valves recommends installing a new gasket while reassembling. A proper seal is required to ensure optimum operation.

6.1 – SPARE PARTS

All gear operators are lubricated for life at assembly and should not require service. In the event of a gear operator suffering damage or excessive wear, it is suggested that the complete gear operator be replaced. Only the handwheel, pin/cover, and some adaptor bushings are available for repair parts. If under DN 350 (14") it is usually just as cheap to replace the whole valve as it is to repair it unless the valve is a special specification like stainless body. See the sample bill of material shown above. Replacement rubber liners and stem seal kits are available.

6.2 – DIASSEMBLY

Single piece body design disassembly as follows:

1. Lay down the valve with the disc in the closed position.
2. Loosen the taper pin(s) from the valve disc using a punch. The punch should be same size or larger diameter as small end of taper pin to avoid flattening the taper pin.
3. Remove taper pin(s) from disc. Remove the valve shaft from the body (using a twisting motion will assist removal).
4. Remove the valve disc from body making sure not to damage the disc or seat sealing edge.
5. The seat can be removed from either direction by applying even pressure on one face to push the seat out of the body. If the valve is of dead end service design, remove set screws around periphery of body extending into seat prior to seat removal. Some liners also have an elastomer, monolithic or silicon seat backing ring.
6. Remove shaft bushings from body as required.

Note: Some valve designs use a pinless disc which requires the shaft is first pulled out before disc removal, consult as-built drawing.

2-Piece body design requires that the 2 body sections are first unbolted and then the procedure is similar to 6.2 above.

6.3 – REASSEMBLY

Reassemble the valve as follows:

1. Thoroughly clean all parts. Inspect components for any defects.
2. Apply small amount of silicon grease to the inside surfaces of the body, including the lower and upper shaft holes.
3. Insert the shaft bushings into the body being careful not to allow intrusion into the body seat bore.
4. Install the seat into the center of the body, making sure the shaft holes in the seat line up with the holes in the body.
5. Completely coat the inside surfaces of the seat with silicon grease. Carefully push the disc into the seat in the open position (90 degrees to the body). Line up the shaft holes of the disc as close as possible with the shaft holes in the seat body.
6. Insert the shaft through the body and disc; use a twisting motion to align the keyway parallel with the disc.
7. Insert taper pin(s) into the disc and set with two or three sharp blows. Wipe dust shield O-ring with silicon grease and place over the shaft into the top of the body.
8. If the valve is of dead end service design, insert set screws through the body into the seat.

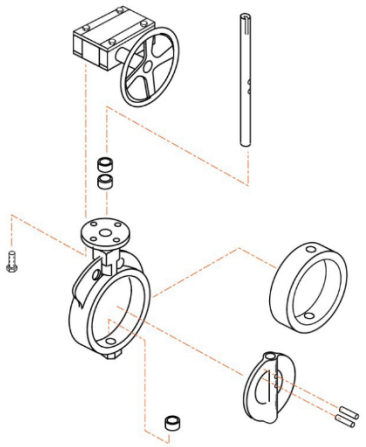


FIG. 12

Indicative explosion only. Pinned disc example shown. Refer to as-built drawing for actual parts list.

6.4 – RATCHET LEVER MOUNTING

1. Position the disc in the closed position.
2. Install the ratchet notch plate using machine bolts, nuts and lock washers, but do not tighten the fasteners.
3. Install the drive key in the shaft (where applicable). 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 setscrew 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.

6.5 – GEARBOX MOUNTING

1. Position the disc in the closed position.
2. Install the drive key in the shaft (where applicable). Tap the key into place to ensure it is fully seated.
3. 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.
4. Fasten the gearbox to the mounting bracket with the appropriate machine bolts and lock washers. It may be necessary to rotate the gear shaft slightly to align the mounting holes in the gear with the plate.
5. 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.

For any technical request or assistance, feel free to contact Trust Valves Quality Department at:
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