



Instructions for Installation, Operation & Maintenance:

Butterfly Valves



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Section 1: Background

R&D Multiples was established in early 1980's and we were one of the pioneering manufacturers to develop butterfly valves in India. Butterfly valves are quarter turn rotational movement valves and are an important part of any pumping / distribution system. It possesses many advantages over other conventional valve types such as savings in weight, space as well as maintenance costs. The number of moving parts is low and there are also no pockets to trap fluids.

Our butterfly valves have been very commonly used in various applications all over the globe for the past 3 decades. We are one of the few manufacturers in the world to have >200,000 installations of butterfly valves. This product type needs to be installed, operated & maintained by qualified & trained technicians as per the instructions & precautions given in this manual, using proper tools & tackles. Unauthorised / unskilled persons should not be allowed near the equipment unless under proper supervision. Alterations to the product or any of its components are also not permitted. In case if the same are not followed, we reserve the right to decline warranty responsibilities.



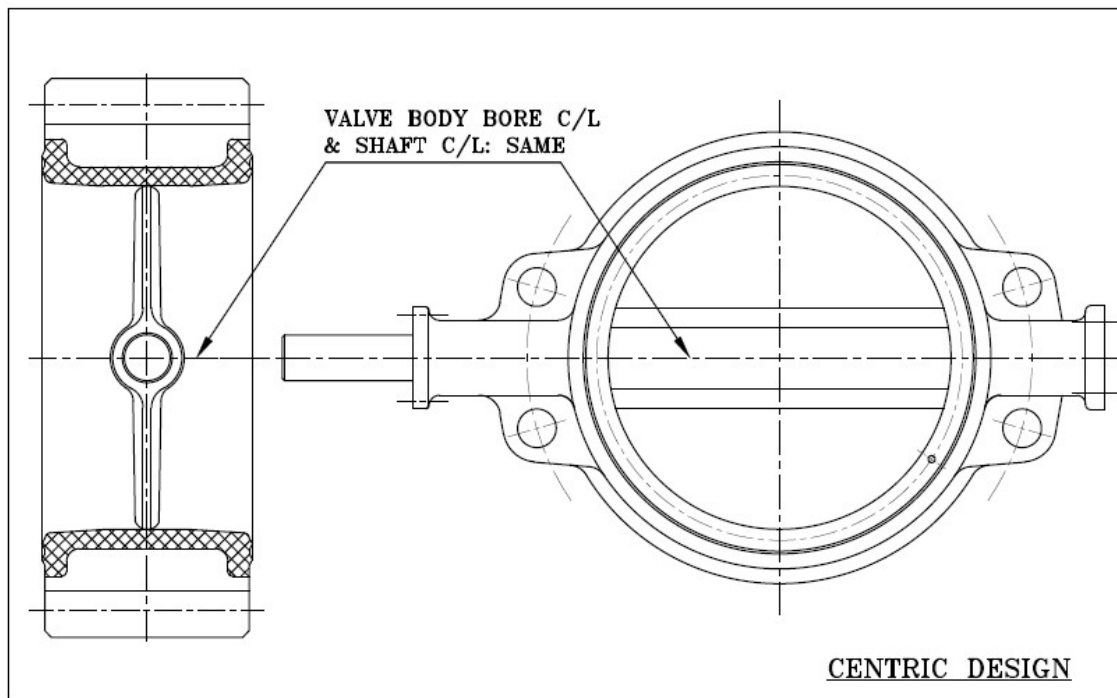
Section 2: Introduction

We welcome you to a family of quality conscious & discerning customers of R&D Multiples' products. We thank you for the trust in our company & products & we assure you that we will spare no effort in establishing a rewarding long-term mutual relationship.

This manual covers the butterfly valves of following types:

- Centric design: 50 to 600mm, PN 10 & PN 16 ratings (wafer, lug wafer and double flanged type)
- Eccentric design: 80 to 3600mm, PN 10, PN 16, PN 25, Class 75, Class 150 & Class 250 (double flanged type)
- Manufacturing standard specifications: BS EN 593, IS 13095, AWWA C504 (50 to 1800mm) & AWWA C516 (>1800 mm)
- Operators: Hand-lever: 50 to 150mm; QT worm gear-box: for sizes larger than 200mm; electrical actuators; pneumatic actuators, hydraulic actuators

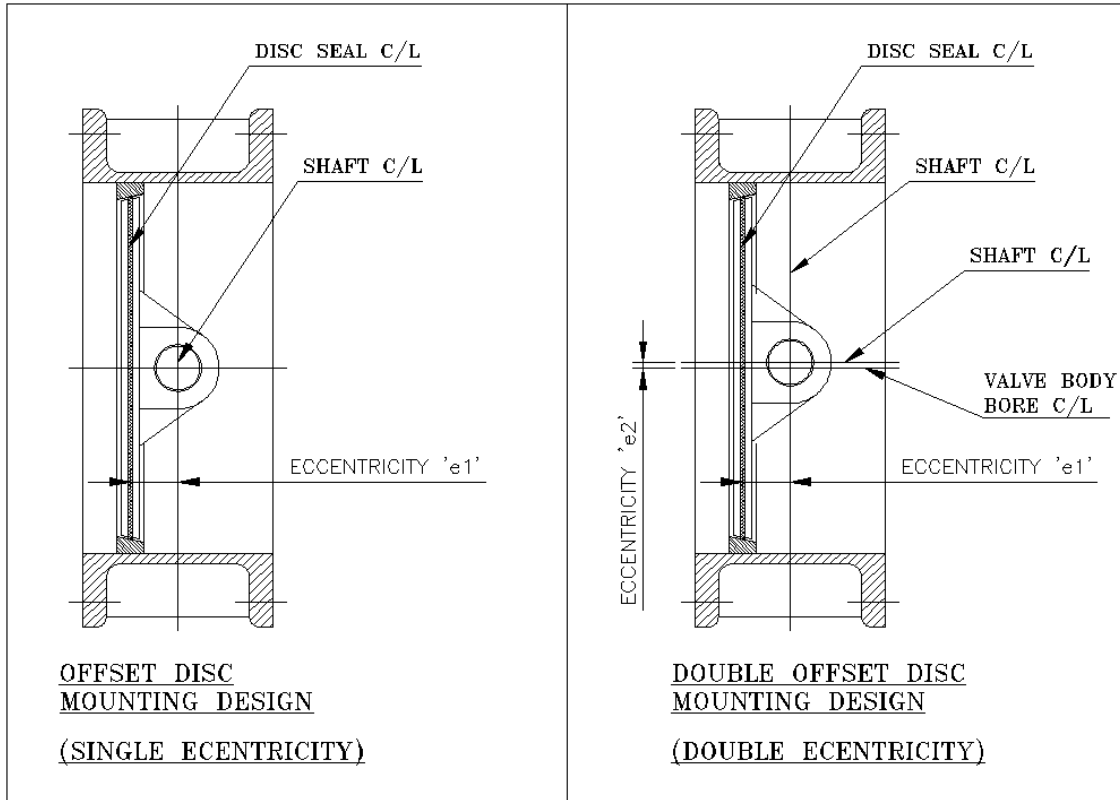
For a detailed explanation on eccentricities, please refer to the following schematic drawings:



In centric design, the shaft centreline is concentric with the valve body centreline. The sealing is caused by the dimensional interference between the rubber seal & metal seating surface. This design is applicable to the wafer type valves in which a rubber sleeve liner is used in valve body.

In the single eccentric (offset) design, the shaft centreline is offset from the plane of the disc seal. Due to this, the disc sealing surface is an un-interrupted & continuous sealing surface. This is used in double flanged designs due to longer face to face dimensions (compared to wafer designs).

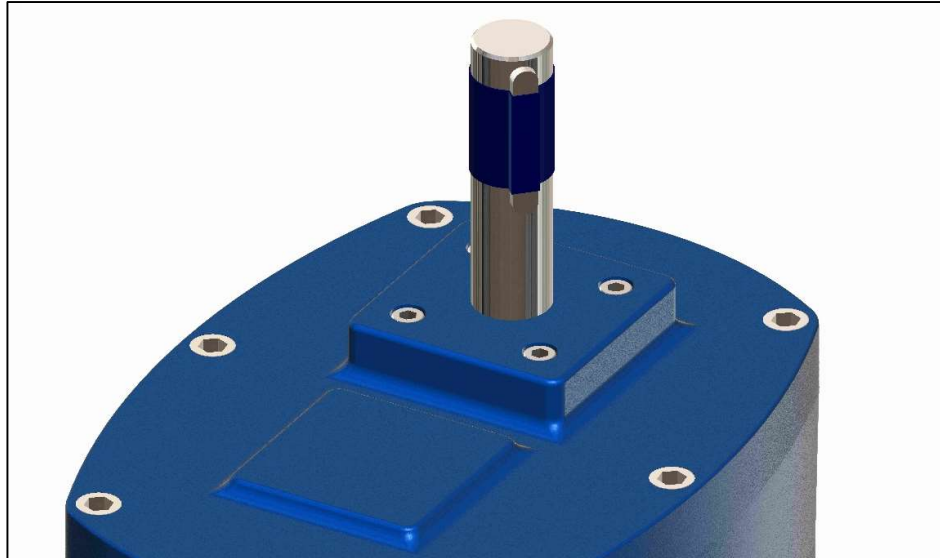
In duo-eccentric (double offset) designs, the shaft centre-line is offset from the disc seal plane as in case of single offset designs. Additionally, the shaft centre-line is also offset in relation with the valve body bore in a direction transverse to the flow axis. Due to this, we get better camming action & better sealing & also reduced wearing action on the seal.



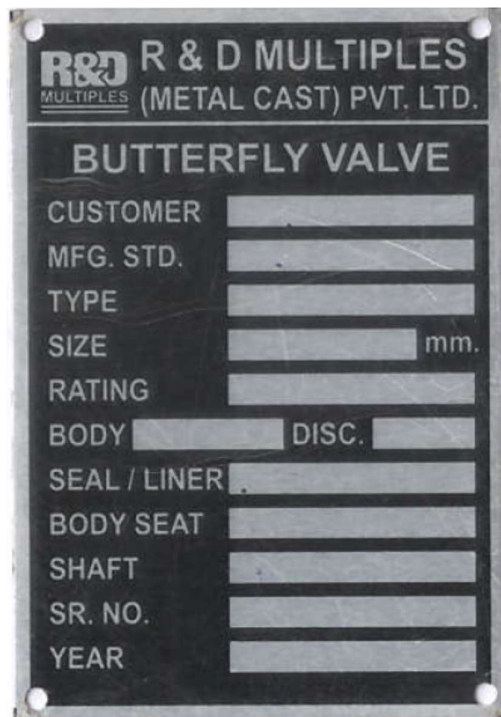
Section 3: Site activities prior to installation

Inspection after material receipt:

- Transit damages: Inspect the valve visually for any transit damages on receipt at the site. Please check the flange surfaces, rubber gaskets / liners, actuator, gearbox components etc. If you observe any such damages, please get a report signed by the transporter
- Completeness: Please check the receipt of the components / sub-assemblies as per the packing list. If you find any shortages, please record the same & get a report signed by the transporter
- The hand-wheel for the gear-box / actuator is packed separately & the keys are fixed on the shaft by tape. Check the bolting attaching to the actuator / gearbox to the valve for loosening in transit, and if loose, tighten firmly



- In case of companion flanges supplied with the valve, please check the correctness & quantity of the fasteners & gaskets as well
- Use the general arrangement drawing to check the overall dimensions of the valve: F-F dimension, flange dimensions, overall width, use the drawing to also identify the various components of the valve which are visually accessible. You may also cross-check basic data like valve size, pressure rating, material etc with the corresponding name plate affixed on every valve along with its as-cast markings. The markings and the nameplate would typically look like the following:



- Operate the valve for open & close to make sure it operates properly & also check the end stops / limit switches are correctly set so that the valve seats fully. If needed, the end stops / limit switches are to be adjusted. Please note that the full closed position cannot be correctly ensured once the valve is installed in pipe line with no access to clamping ring side of the disc

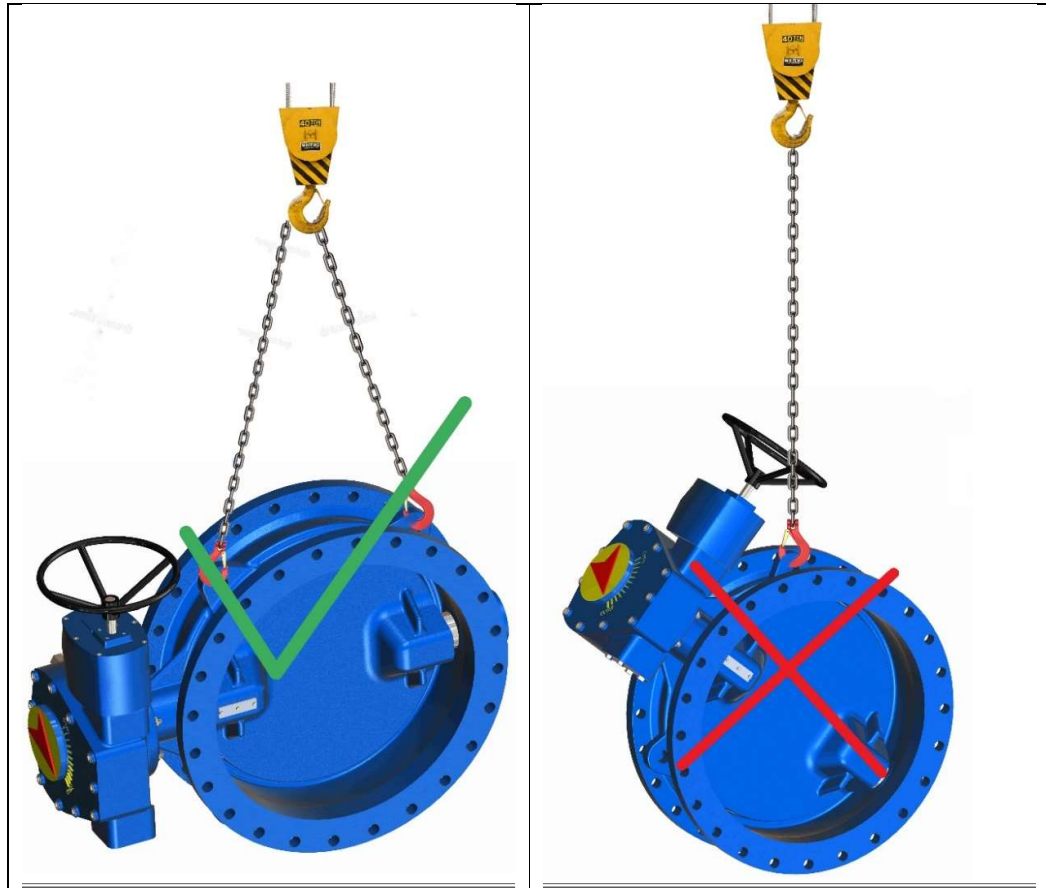
Storage:

- If the valves have to be stored at site for some duration, ensure that the same are kept on raised platforms / pallets so that ground rain water does not wet the same. Store the valves in the shade & not exposed to direct sun-light / ozone

- Keep the valves covered by tarpaulin so that atmospheric dust does not accumulate on the valve components
- The valves are despatched with the disc in slightly open position so that the rubber seal on disc does not rub / stick onto the metallic body seat ring
- As far as possible, do not store the valve in a humid atmosphere
- If the valves are supposed to be stored for a long period, they should be manually cycled once in 1 month from closed position (as despatched from our plant) to open & back to original position manually
- Wherever valves with power actuators are stored, ensure to protect electrical control equipment to prevent corrosion of electrical contacts caused by condensation due to temperature variations

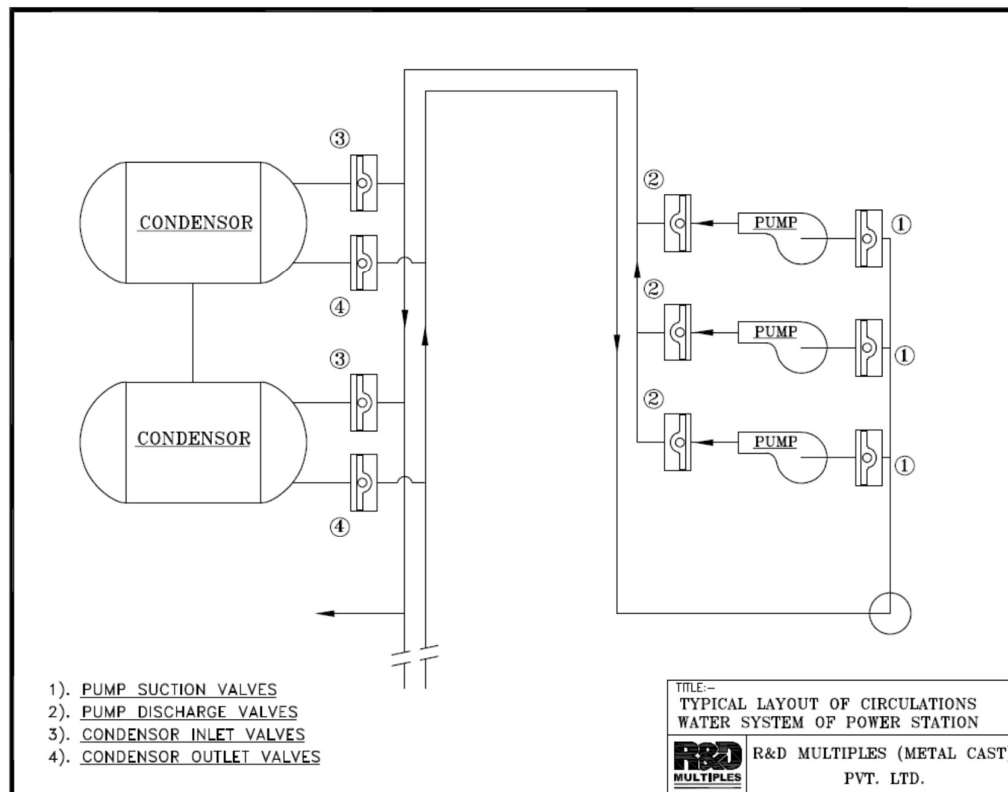
Handling procedures:

- On receipt from our plant, please unload the valves from vehicle carefully without allowing it to drop / impact etc. Please use non-metallic slings to avoid damage to painted surfaces. Rig the load before lifting so that it does not move / slide / turn / topple / sway during unloading & carrying to the storage location
- Take the valves to the location of installation only at the time it has to be installed. While lowering the same into the trench / vault please ensure that the valve does not impact on the trench / vault wall or on the adjoining equipment
- Always ensure that the equipment for lifting the valves has sufficient capacity to lift & carry the valve comfortably
- Never drag the valve along the ground. Do not carry the same hanging over when workmen are working below
- Lift the valve by hanging / slinging at the lifting lugs / eye-bolts / D-shackles / rods passed in flange holes only. Give due consideration to the centre of gravity of the assembly
- Never pass the slings through the valve body bore. Do not lift the valve by hanging from actuators/ gearboxes etc. This may result in damages to the valve assembly

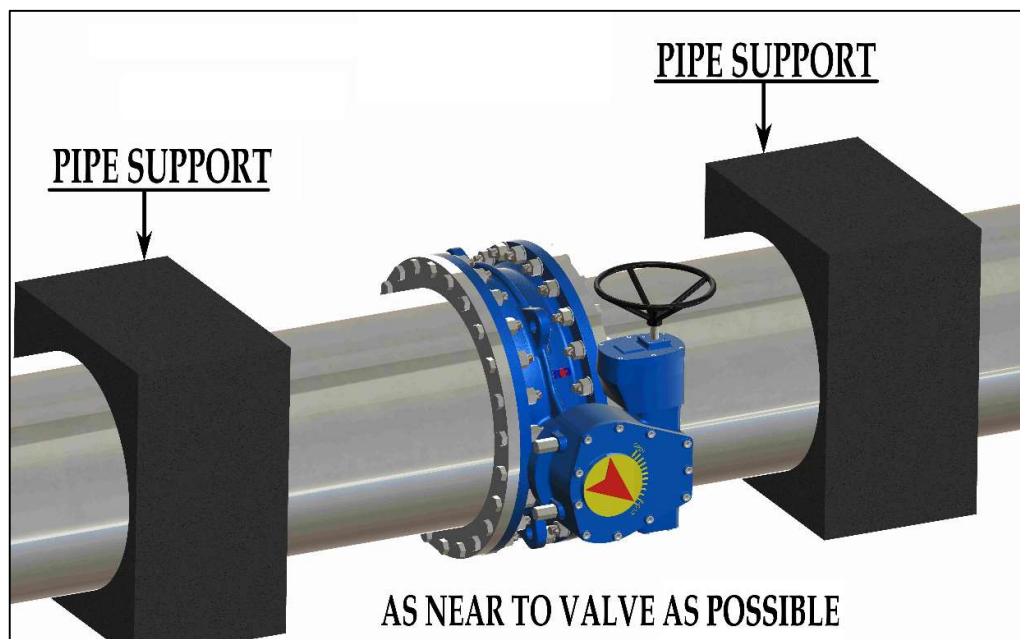


Section 4: Procedures for Installation

- Ensure that the pipeline bore is fully cleaned & there are no foreign material / debris / particles / welding residue in the pipeline. Such matter, if present, can create serious damage to valve components. The flange faces also have to be perfectly clean & devoid of any foreign particles / oil / grease or rust preventer
- Also ensure that the duty parameters of the valve & the application requirements are matching; such as: fluid handled, temperature, pressure & velocity of flow. Confirm the suitability of the materials of construction of the valve components for the duty parameters
- There is a chance that the fasteners might have got loosened during transportation & handling. Check the same & re-tighten as required
- Check & ensure that the rubber seal on the periphery of the disc / in the liner is fully intact & there are no dents / cracks / swells / bulges etc. on them
- The valve disc should be in fully closed position while installing the valve. The valve faces (flanges / liners) & interiors also have to be very clean. Ensure that any rust preventive, if applied, is thoroughly removed
- In horizontal pipelines, the valve should be installed preferably with shaft in horizontal position
- Install the valve so that the preferred flow direction as indicated by an embossed as cast arrow on the valve body matches with the predominantly pressurised direction in closed position of the valve in as installed condition. Please note that the flow direction in a fully open condition may or may not be the actual pressure direction in the fully closed position (see diagram below for an illustration)

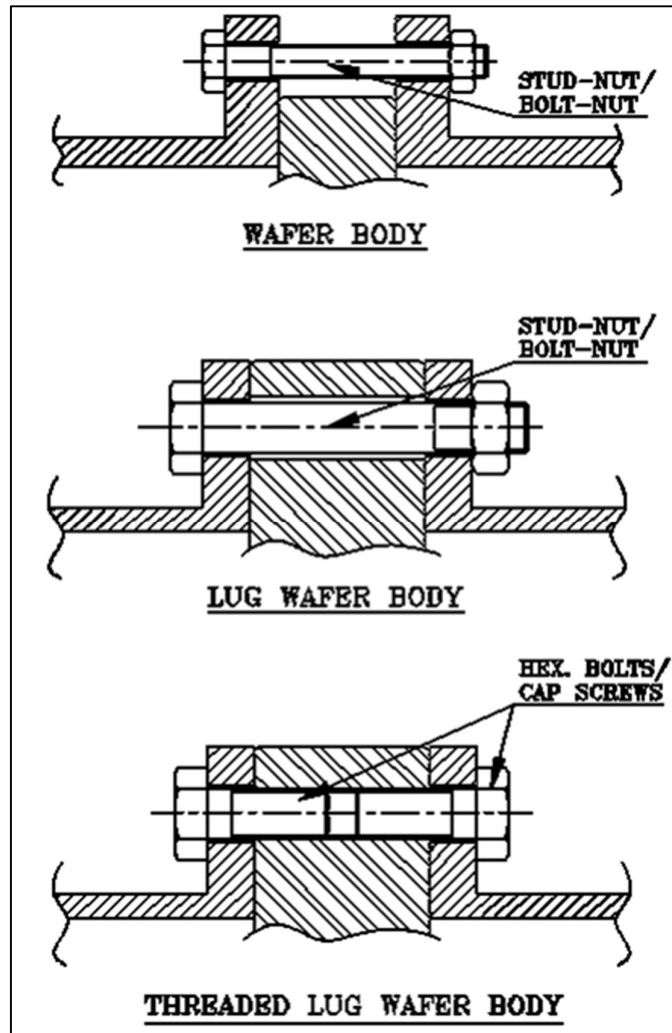


- The pipeline on either side of the valve has to be independently supported. Ensure that no pipeline load due to any of the following parameters gets transmitted to the valve:
 - Pipeline weight
 - Weight of water in the pipeline
 - Loads / forces & moments due to thermal expansion & contraction of the pipeline
 - Loads due to settlement / wash-out of the soil-bed below the pipeline
 - Loads due to hydrodynamic reaction forces / thrusts of the flow due to grade & direction changes
 - Weight of the landfill above the pipeline in a trench after installation
 - Loads due to the traffic over the buried pipeline
- The valve should be isolated from all these forces / moments by providing flexible joints immediately in the vicinity of the valve on either side if required. The valve weight should be supported by a suitable foundation in case of large valves. If the valve is supported directly below & the adjoining pipes on either side are not supported, the valve may end-up as a fulcrum for all the unsupported pipeline lengths. The valve body gets subjected to severe tensile & bending loads & may fail. Hence, avoid this situation



- Any worker entering a trench / pit for valve installation has to be properly protected by sloping / shoring of the banks as per OSHA CFR 1926: Sub-part 'P': Excavation
- Ensure that there are good measures to release/ admit air into the pipeline system. Entrapped air can cause catastrophe for the system & valves also
- Ensure that the surge alleviation measures as envisaged in pipeline system design are provided & are effectively available
- Wafer Valves: According to whether the valves are wafer type, lug wafer type or wafer with threaded lugs, the valve is to be initially positioned between the pipeline flanges. These types of valves do NOT need gaskets on the flanges

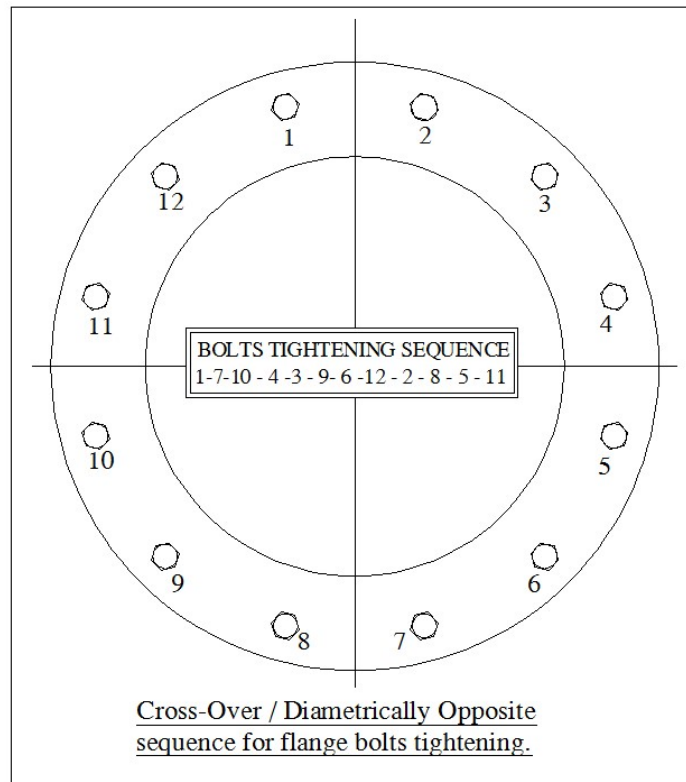
- Ensure that the valve is perfectly centred along the pipeline centre-line. The valve & pipes on either side must be concentric. Run the bolts / studs through the lugs & ensure the concentricity
- Never apply grease to the rubber liners / gaskets which may lead to swelling of the rubber parts
- Gradually tighten the nuts / screws so that the integral liner /gasket gets evenly & equally compressed
- Follow cross-over sequence (diametrically opposite) of tightening of the bolts / screws. While tightening the mounting bolts / studs & nuts, ensure that either the valve is vertically supported from below or it is freely hanging vertically
- Before full tightening, ensure that the valve disc can be freely turned to full-open position without being obstructed by the adjoining pipeline inner diameter. If the adjoining pipeline ID is smaller & it obstructs the disc from reaching the full-open position, then use spool pieces on either side of the valve with suitable ID to avoid the obstruction & to ensure free & full opening of the valve disc



- Tighten the bolts / nuts securely. Refer the table below for tightening torque values

Thread Size (mm)	Tightening torque (Nm)	
	Class 4.6	Class 8.8
M6	4	11
M8	10	26
M10	19	51
M12	33	89
M16	80	215
M20	156	420
M24	270	725
M27	398	1070
M30	540	1450
M33	740	1970
M36	950	2530
M39	1230	3290

- Use a thread lubricant while tightening the bolts & nuts
- For double flanged valves, assemble the valve so that the valve flanges & pipeline flanges are perfectly parallel. Do not use force on the fasteners to accommodate any misalignments / non-parallelism / non-concentricity
- In case if the pipeline flanges are yet to be welded onto the pipes, then first engage the bolts between the flanges with those of the valve so that the flanges are perfectly concentric with the valve bore. Then insert the pipes into the flange bores & apply tack welds. Ensure also that the disc opens fully without any obstruction at the flanges. Remove the valve & weld the pipes fully. This will ensure that the welding heat will not damage the elastomeric components in the valve assembly
- The installation precautions & guidelines as outlined in AWWA C-504, AWWA C-516 & AWWA M11 are to be strictly followed
- The actuators should not be powered / charged before installation of the valve in the pipeline
- In case of double flanged valves, the gasket between the valve & pipeline flanges as provided by us (if ordered in our scope) or as per AWWA C-207 should be provided
- It should be ensured that the flange bolts are tightened evenly & by following the cross-over sequence so that the gap between the valve flange & companion flange is always constant.
- While installing valves in particular & any other flanged assembly as well, it is a good engineering practice & a highly recommended one that the bolts be tightened in a diametrically opposite & cross-over sequence. This ensures that the gasket / seal gets uniformly compressed. Also, the flanges move together parallel to each other. This avoids any stresses in the flanges also due to bolts tightening. A sample illustration with 12 flange bolts is shown in the schematic drawing below. Same principle applies to other sizes having different number of flange bolts.



- This will ensure that the gasket will be evenly compressed all along the perimeter. Ensure that the gasket fits centrally between the flanges. Apply only the recommended tightening torque
- Effectiveness of the performance of the valve depends on the nature of the pipeline flow. If the flow is turbulent, the performance & longevity of the valve get affected. Moreover, turbulent flow can lead to undesired hydro-mechanical forces on the valve. Hence, it is advisable to provide 6-8D straight length of the pipeline on the upstream side & 4-6D straight length of the pipeline on the downstream side without any flow disturbances like bends, T's, flowmeters etc. (D = nominal size of the valve)
- Never install a valve without the operator assembled / with operator removed
- In case of pipeline pressure tests, never subject the valve to pressure beyond its recommended pressure in the respective valve position
- As a part of installation process, manually operate the valve from the given position to full-open position gradually. The movement should be smooth & without any jerks / locking-braking effects
- Check that the stopper on the full open side stops the disc movement when the disc face is at 90 degrees to the flange faces. If not, adjust the stopper by loosening the lock-nut & nut & stud by 1- 2 rotations. Set the disc position at FO & fix the stopper bolt & lock-nut again. Ensure that the indicator arrow points the FO position on the indicator plate
- Close the valve fully. Ensure by a feeler gauge of 0.05 mm thickness that the rubber seal on the disc is in uniform & tight contact with the finished body seat ring surface. If not, adjust the stopper on the close side & tighten the valve again. Fix the stopper at this position. This should indicate full closed position on the indicator arrangement also

Section 5: Commissioning

- Once the valve installation is done, install the actuator (electrical / pneumatic / hydraulic) on the provided mounting arrangement. Ensure that the valve is in full closed position & also that the position indicator on the actuator shows the position accordingly. Ensure that the valve / gearbox input shaft engages smoothly into the actuator bore
- Provide an earthing connection to the electrical actuator
- Connect the pneumatic / hydraulic piping to the actuator (as required)
- If the actuator is provided with a manual-override, then operate the valve through the MOR for one complete cycle & ensure that the movement is smooth & true
- Operate the valve by power / medium (air / oil) for once complete cycle: C-O-C
- Follow all the installation, commissioning & maintenance instructions as given by the actuator manufacturer thoroughly

Operation:

- Start the flow inside the pipeline only after the operating mechanism (gearbox / actuator) are duly installed & set
- Start the flow in the pipeline & open the valve as desired. An attempt at a quick opening / closing of the valve may result in pressure transients & surges. Hence this should be avoided. Please refer to our technical team if you require recommended opening / closing times for each valve size
- If you encounter air in the flow, keep the valve at a steady state & allow the air to be purged through the system
- Forcing the hand-wheel once the valve disc has reached its extremity does not help to incrementally close / open further. It only puts extra forces on the gearbox components
- Improperly set stoppers / limit switches (torque / travel) can lead to malfunction of the valve & operating mechanism. Hence set the switches properly
- Do not use any extra leverage / bar / pulley / large hand-wheel to forcefully close / open the valve. This may damage the operator and the valve components

Section 6: Maintenance

R&D Multiple's butterfly valves are designed & manufactured so as not to need regular maintenance. However, it is advisable to:

- Periodically check visually for any signs of damage on the components
- Look for any increased friction in the opening / closing operations
- Watch out for any abnormal noise and vibrations on the valve. Any leakage past disc in full closed position can also cause abnormal noise
- In large size valves, if inspection / access openings / doors are provided, the condition of the disc seal can be checked periodically or as required. The scaling / encrustation on the body seat ring if any, should be cleaned
- If any debris are accumulated in the body bore, the same should be removed.

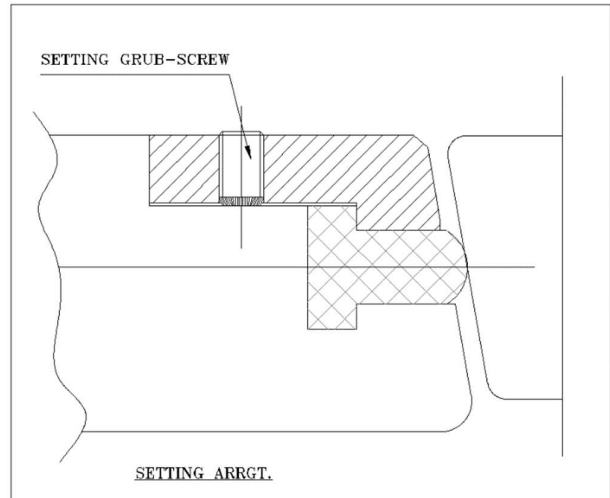
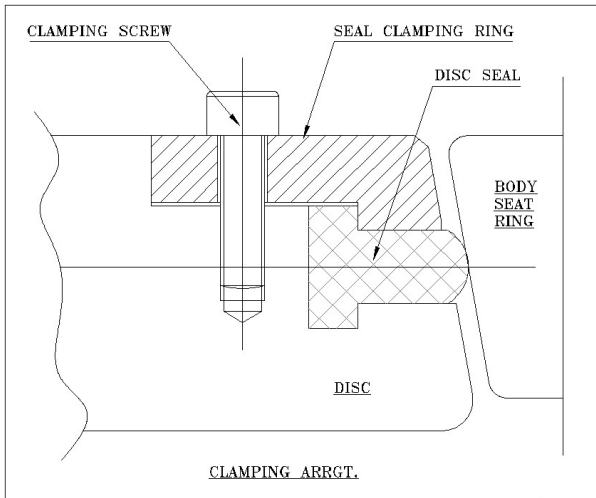
Dismantling & Re-assembly:

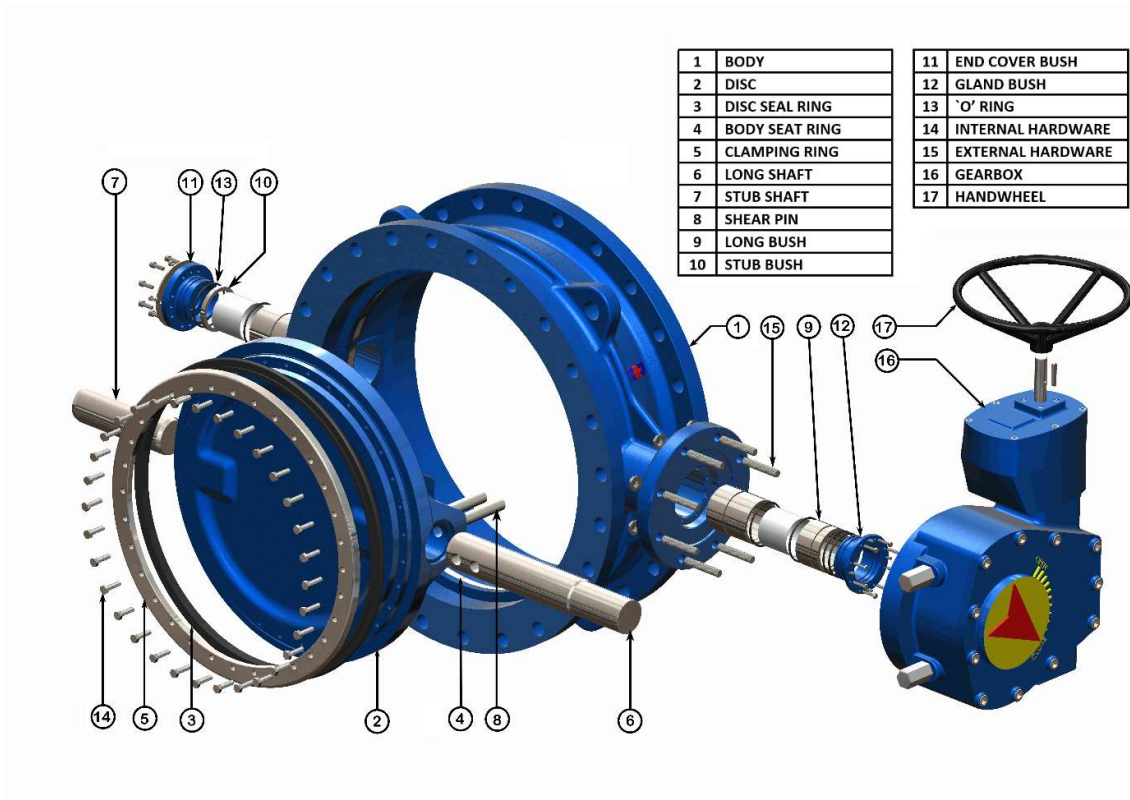
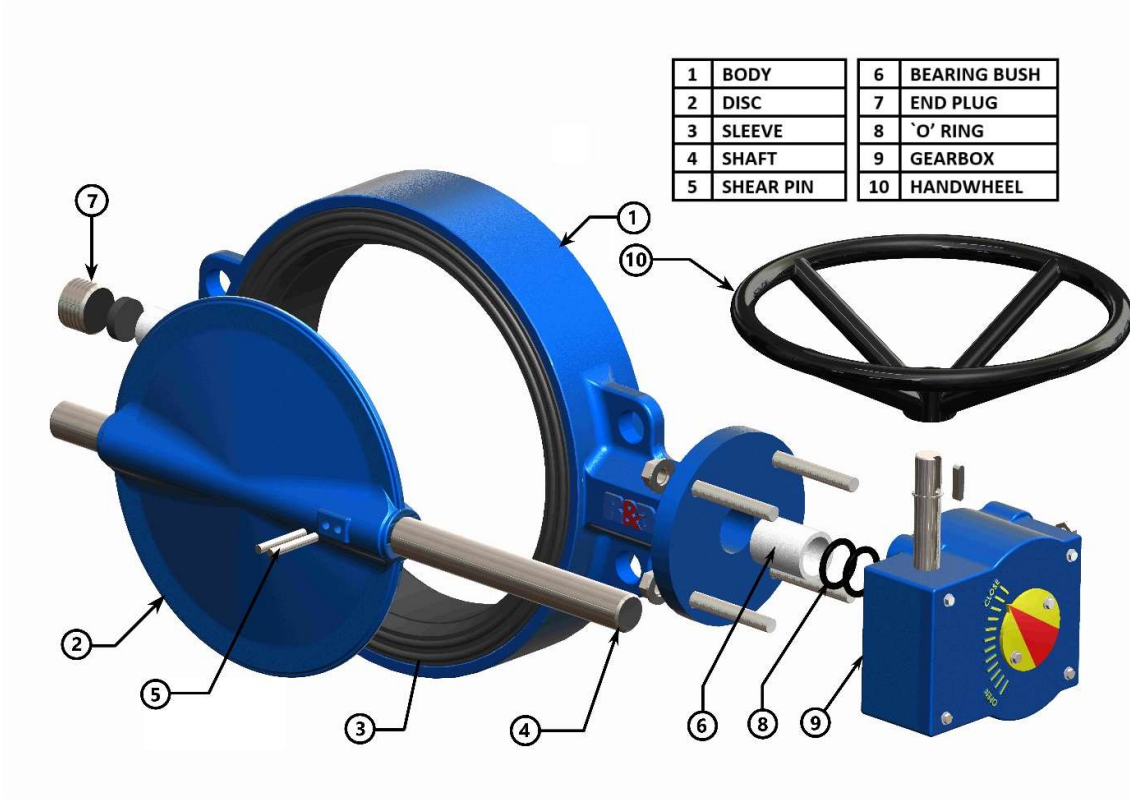
- The pipeline should be de-pressurised & drained before loosening the valve mounting fasteners
- Valve disc should be in full closed position before dismantling
- The actuator electrical supply / high pressure air / oil supply should be disconnected
- The dismantling joint / mechanism if provided should be used to relieve the lateral pressure on the valve flange faces for easy removal from the pipeline
- The valve should be carefully removed from the pipeline using appropriate handling & lifting equipment
- The valve is to be kept with flanges horizontal on a clean, flat platform. Wooden rafters can be used to keep the valve at an elevated position & for accessibility. The actuator & gearbox assemblies are to be removed by loosening & removing the mounting bolts. The actuator & gearbox should be independently supported before removal. Handle them carefully & keep their respective fasteners engaged to the respective flanges / holes
- Support the disc weight from below. Remove the drive shear pins between the shaft & disc bosses. Remove the gland plate, end cover, spacers & bearings. Pull the shaft out. Clean the spacers & bearing bushes as required. Also clean the valve body bore housing the bearings, spacers & Seals. Fit new bearings, seals etc. & re-assemble. Refit the shafts & pins
- Repeat the same procedure for ND End shaft. Remove the end cap & thrust bearing. Clean the mating surfaces. Polish the TB end face if required
- In case of a disc seal replacement, the seal can be replaced in-situ provided there is access from the clamping ring side of the valve. The clamping ring is to be removed by first loosening the locking grub screws & then removing the fastening screws. The seal groove in the disc periphery is to be fully cleaned. The body seat ring mating surface is also to be fully cleaned & polished. Fit the new seal ring and then fit the clamping ring and the clamping bolts. Ensure that the seal fits snugly on the body seat ring surface all around. Check this by a feeler gauge of 0.05 mm. Tighten the locking grub screws & fix the clamping screws. Ensure that the old seal ring pieces are fully removed from the valve body bore for disposal

Disc Seal Fine Setting:

The disc seal has to have a measured dimensional interference with the body seating surface. This can be set either in a valve after some usage & resultant wear or when the seal is replaced with a new one. The machined grooves on the disc & clamping ring peripheries & conical machined & finished body seating surface do take care of the seal fitment automatically, however, the variations due to tolerances & wear of rubber seal can be finely tuned as explained below:

- Setting grub screws are provided in-between the seal clamping screws on the clamping ring
- For fine setting of the rubber seal, loosen the setting grub screws by 2-3 turns. Tighten the clamping screws evenly & equally in cross-over sequence. This will put some more pressure on the seal & push it out. This can be done preferentially also
- Check the seal fitness by the feeler gauge 0.05 mm thick. Finally fix all the grub screws





Section 7: Quick reference guide

Troubleshooting

Observations	Possible root cause	Remedies / suggestions
Excessively high torque required to operate the valve / valve jammed	Wafer valve: pinched seat <ul style="list-style-type: none"> • Flange bolts are not evenly torqued • Over torqued bolts • Flanges not parallel when bolted 	Loosen the flange bolts around the valve. Manually spin the disc through butterfly valve a couple of times to attempt to reshape the seat. Tighten the flange bolts in the crossover & diametrically opposite sequence. Ensure flange parallelism. Re-weld if required.
	Valve installed too close to an elbow strainer, pipe reduction or other obstruction	Either change piping, change the location of the valve or upgrade the torque of the actuator
	Obstruction in the pipeline due to which the valve does not close fully	Remove the valve from pipeline and remove the obstruction
Valve stem or disc bent	Build-up of scale / deposits on stem or seat / bearings / shaft or valve sitting in one position for a long period of time. Wearing-out of bearings	Check the valve seat/ bearings for deterioration. Open and close the valve several times. Operate the valve at least once a week. Ensure proper chemical wash of the system periodically
Disc not closing fully	Closed position stop is not adjusted properly	Set the stopper in its correct position
	Line pressure exceeds valve's rated pressure	Reduce the line pressure or change the valve as required for the actual pressure
	Seal / seat is worn or damaged	Replace the seal / seat
Leakage from the flange face	Flange bolts not evenly tightened or non-parallel flanges	Loosen the flange bolts and retighten the same. Check & ensure parallelism of flanges
	Improper flanges / gaskets	Check for the correctness of flanges / gaskets and replace as required
Valve open only partially & stops	The valve is improperly aligned	Correct the valve alignment with the pipeline bore
	Pipeline ID is small	Use correct ID pipe / spool pieces
	The actuator torque has been exceeded	Check the actuator torque setting & free passage for valve opening
	Gearbox stopper is not set properly	Check gearbox open side stopper setting
Water hammer or vibration	The valve is closing too quickly	Adjust the actuator speed if possible, or change control signal rate of speed
Leakage along valve stem	Valve shaft seals worn out	Replace the shaft seals

 DO'S	 DON'TS
<ul style="list-style-type: none"> • Always refer to the GA drawing, data sheets & name plate details & ensure that the correct valve is being installed at the correct location with correct orientation 	<ul style="list-style-type: none"> • Allow any pipeline loads & forces to get imposed on the valve
<ul style="list-style-type: none"> • Before installation, ensure that the valve movements from closed to open & reverse are smooth & free 	<ul style="list-style-type: none"> • Installation of the valve in pipeline without the primary drive mechanism
<ul style="list-style-type: none"> • Clean the valve from inside & outside thoroughly before installation 	<ul style="list-style-type: none"> • Force the actuator on the valve / gearbox input shaft
<ul style="list-style-type: none"> • Install the actuator on the valve in full closed position 	<ul style="list-style-type: none"> • Try to align oblique / crossed flanges by tightening the bolts
<ul style="list-style-type: none"> • Ensure that the utilities available at site: Electricity & compressed air etc. are as per the recommendations of the valve manufacturer 	<ul style="list-style-type: none"> • Usage of gearbox / actuators / hand-wheels for lifting & handling the valves
<ul style="list-style-type: none"> • Keep visual check on the valve performance. Keep a routine log of operation 	<ul style="list-style-type: none"> • Use of force multipliers to operate the valves
<ul style="list-style-type: none"> • Flush the line after installation to remove cut pieces of pipeline fabrication 	<ul style="list-style-type: none"> • Subject the valve to pressure higher than its rated pressure

Still need help? Write to us with the valve details (serial no) and a brief description of the issue on the contact details given below:

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