

# Installation, Operation and Maintenance Manual of Floating Ball Valves



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**Note**

This manual shall be read in conjunction with manual LTV-DEP-566, "Instruction, Operation and Maintenance Manual - Important Points".

## L&T Valves

L&T Valves Limited (formerly Audco India Limited) is a wholly-owned subsidiary of L&T and one of the largest valve manufacturers in the world.

The company has three modern manufacturing facilities, in Chennai (Manapakkam), Coimbatore and Kancheepuram, in Tamil Nadu, India. The company leverages its world-class capabilities in design, quality assurance and manufacturing to ensure that their products consistently meet customer expectations.

### Product Range:

- Gate, Globe & Check Valves
- Valves for Power
- Pipeline & Process Ball Valves
- Triple-offset Butterfly Valves
- Rubber lined Butterfly Valves
- Valves for Water Service
- Double Block & Bleed Valves
- Control Valves
- Customized Solutions

Designs for the valves are created by an experienced team of valve experts who have a deep understanding of user-industry processes. An extensive manufacturing and quality assurance infrastructure ensure that world-class designs are transformed into high performance products. Every phase of manufacture is governed by an institutionalized environment, health and safety policy.

L&T Valves distribution network spans across the globe, partnering some of the largest valve distribution companies in the world. In India, L&T Valves has a presence in every industrial center through a network of offices, stockists, automation centers and service franchisees.

## Ball Valves

The Ball valves are bi-directional valves that allow flow in either direction. In these valves, line pressure forces the floating ball towards the downstream seat to effect bubble-tight sealing.

Ball valves are offered in cast/forged construction. Valves has end connections like flanged (Flat face/Raised face) Socket weld, Threaded (BSPT/NPT) ends. The single piece, two piece & three piece body constructions are of fire safe design. Three piece ball valves is also offered with non-fire safe design.

## Range

Valve Type			End Connection & Pressure Rating	Size													
				8	10	15	20	25	32	40	50	65	80	100	150	200	
Regular Bore	Three-Piece	Non Fire-Safe	Screwed / SW				✓	✓	✓	✓	✓		✓	✓			
			Flanged CI 150 / 300 / 600				✓	✓		✓	✓						
		Fire-Safe	Screwed / SW				✓	✓		✓	✓		✓	✓			
			Flanged CI 150 / 300 / 600				✓	✓		✓	✓						
	Two-Piece	Fire-Safe	Flanged CI 150 / 300									✓	✓	✓	✓	✓	
	Single-Piece	Fire-Safe	Flanged CI 150 / 300			✓	✓	✓		✓	✓	✓	✓	✓	✓		
Full Bore	Three-Piece	Non Fire-Safe	Screwed / SW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
			Flanged CI 150 / 300 / 600			✓	✓	✓		✓	✓						
		Fire-Safe	Screwed / SW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
			Flanged CI 150 / 300 / 600			✓	✓	✓		✓	✓						
	Two-Piece	Fire-Safe	Flanged CI 150 / 300			✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	

### Limitations

As the extent of application these valves can be used is large, it does not make it possible to cover all installation and maintenance instructions to service the valve. It is the owner's responsibility to use the valves as recommended and in accordance with the pressure and temperature limits as stated in this manual. Where in doubt, please consult with L&T Valves. Any unstable fluid or gas should be identified by its manufacturer and must not be used with L&T valves.

## Exploded View

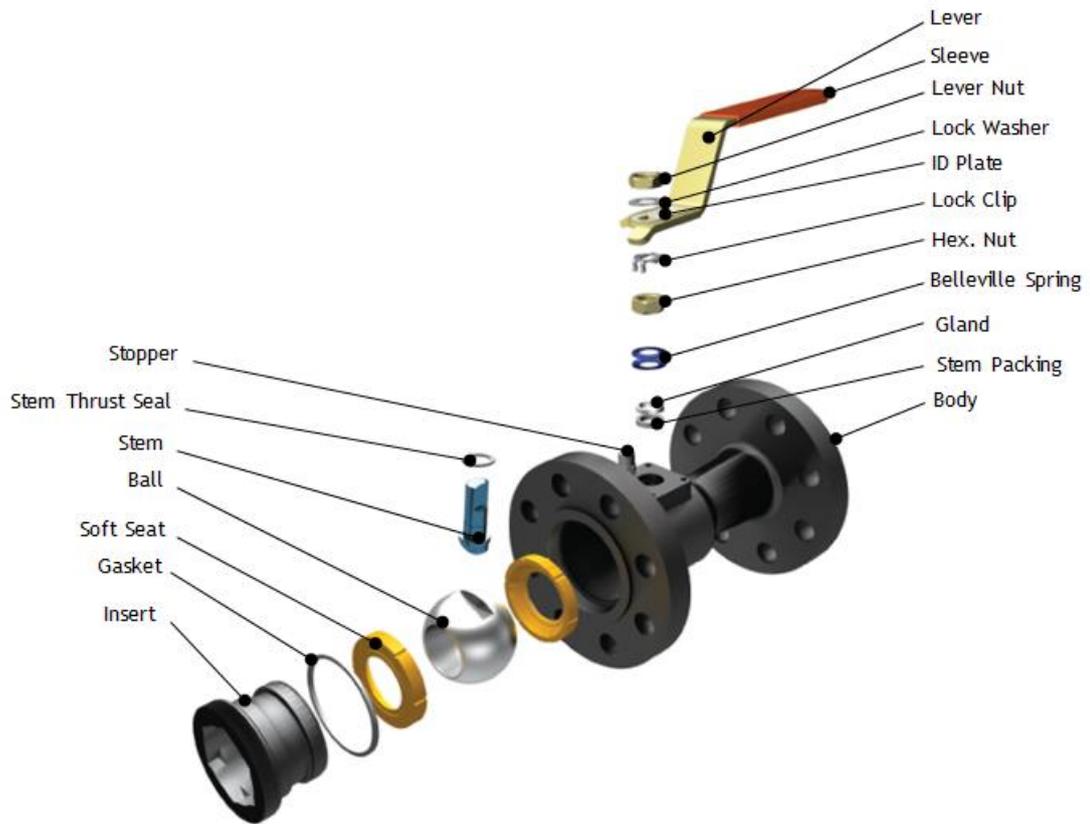


Fig. 1 Single Piece Ball Valves - Lever Operated

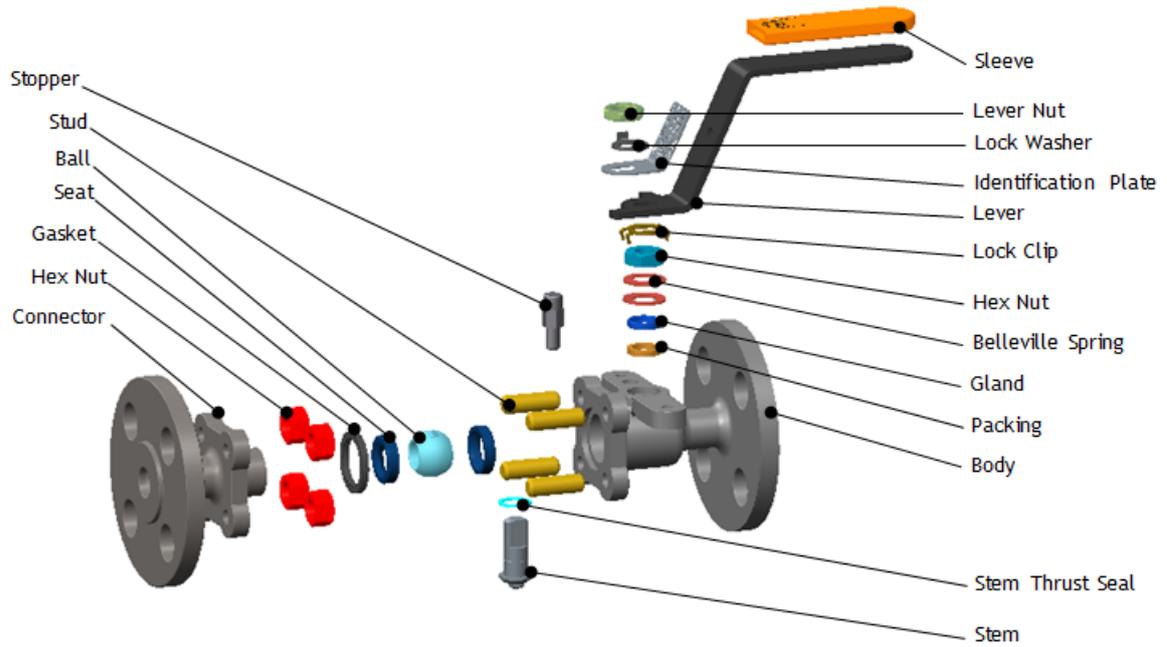


Fig. 2a Two Piece Ball Valves - Lever Operated (DN15 FB - DN50 FB)

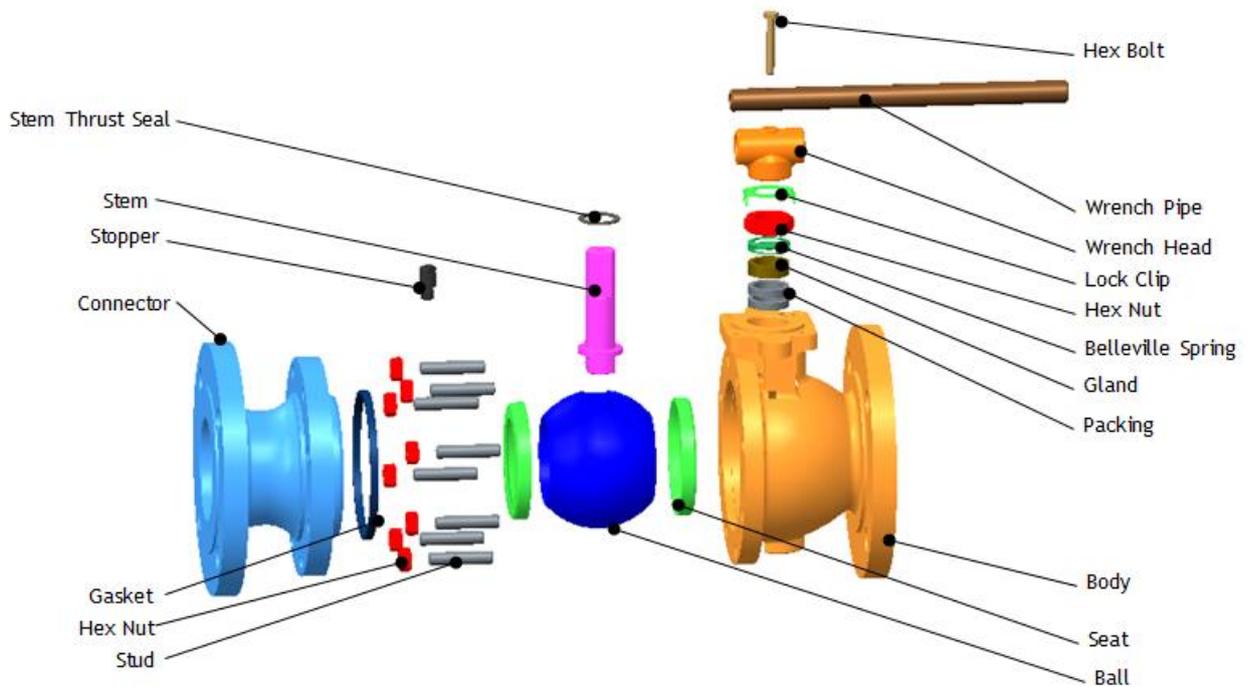


Fig. 2b Two Piece Ball Valves - Wrench Operated (DN65 FB - DN150 FB)

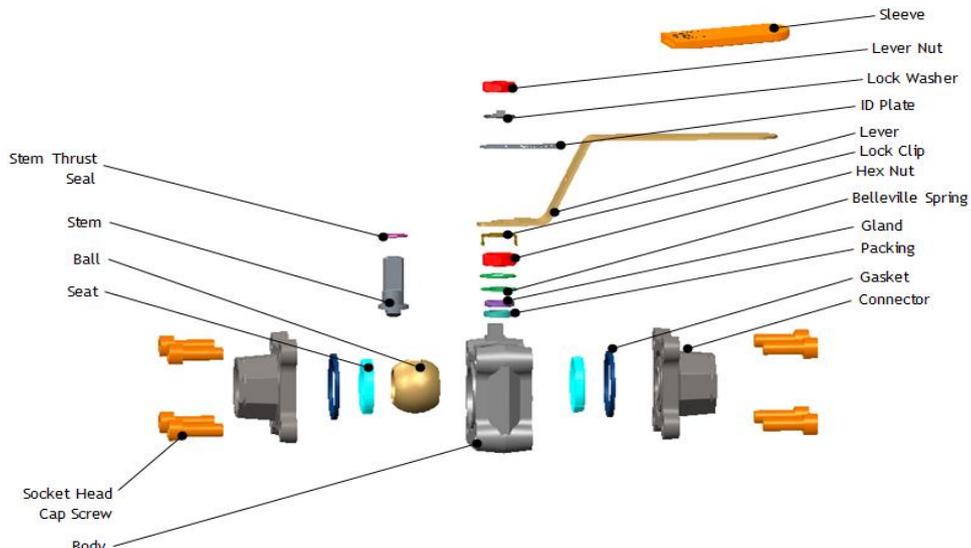


Fig. 3a Three Piece Ball Valves - Lever Operated (DN15 FB - DN50 FB)

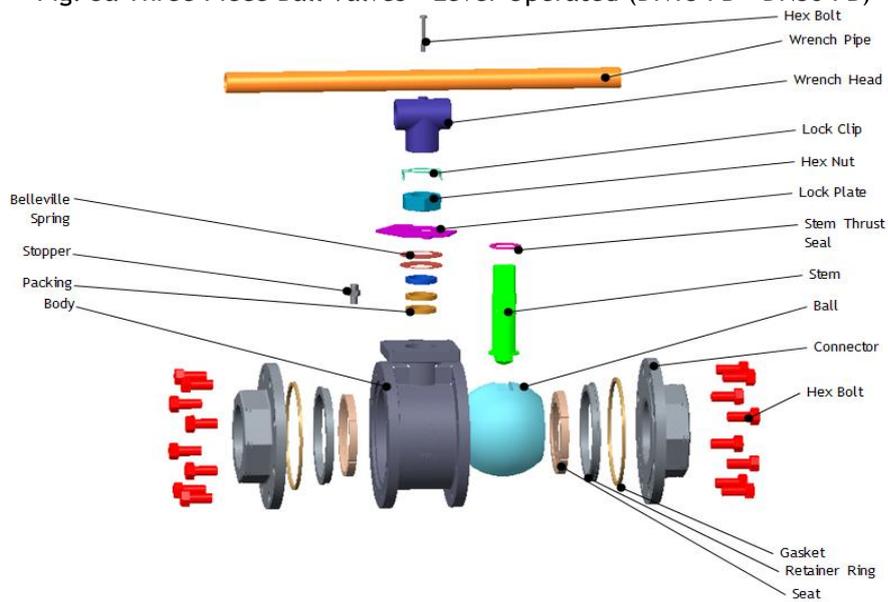


Fig. 3b Three Piece Ball Valves - Wrench Operated (DN65 FB - DN100 FB)

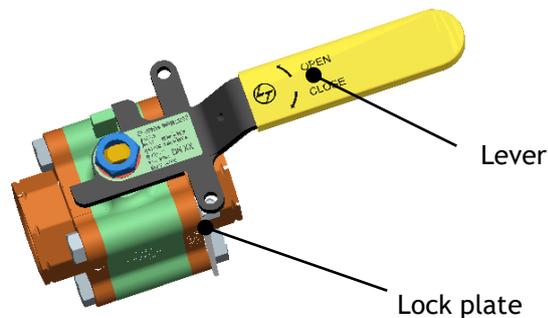


Fig. 3c Typical Locking plate arrangement



## Handling and Storage

### Handling

Valve shall be properly supported and secured before moving, to prevent possible damage to valve, property or harm to personnel.

Do not drag the valve on the ground while transporting. A minimum of one foot height from the ground is to be maintained while moving the valve.

Valve shall not be slung around the valve port for transportation.

The crane wire should not be slung around the actuator/gear unit to avoid any load acting on it. Also, ensure that the while handling the valve, no external load acts on the actuator/gear unit.

Valves shall not be handled with the hand wheel keyed/ fixed to the gear unit. The hand wheel shall be dismantled before handling and transporting the valve.

### Storage

Valves shall be stored in covered area which is dust free, least humid and well ventilated. Ensure that the end protectors are in place before the valve is stored, as dry contaminants like dust, sand, grit etc. can scratch metal seating surfaces and the soft parts, leading to leakage during operation.

The valve shall always be maintained in an ambience with temperature higher than the dew point temperature at the storage location, so as to avoid collection of water droplets on the valve surface.

Do not keep the valve directly on the floor. Valve shall be placed on wooden pallet such that it is at least at a height of 6 inch from the floor.

Care shall be exercised not to damage the extended portion of the adaptor, gear unit/ actuator while storage.

Do not apply tar, grease or any other material inside the valve, as it could impair the performance of the valve.

All valves are to be despatched in fully open position, in order to protect the sphere surface and soft valve seats and it is recommended that they are left in this position. Carbon steel valves are coated with nontoxic “Manganese Phosphating”. This retards rust during storage. Stainless Steel valves have their natural finish and may not require additional protection once installed.

Improper storage and /or handling may cause ball/seat damage or deformation of stem or seat, which will affect sealing and operational performance of the valve.

## Planning & Responsibilities

When installing or maintaining valves

- Conduct a risk assessment and eliminate or reduce hazards to an acceptable level.
- Work in accordance with safe systems of work site.
- Observe all site health and safety rules.
- Wear all necessary personal protective equipment.
- Never use a valve on a duty which exceeds its prescribed operating parameters. Refer to L&T Valves for further information.
- The valve shall not be subjected to frequently occurring disturbances.
- End user to ensure there are no external disturbances (e.g. Shocks, vibrations, electromagnetic fields etc.).
- Misuse of valves / valve components shall be avoided.
- Maximum surface temperature of the valves will be same as the line media temperature. The end user must take account of the line media temperature.
- If the processes or environments that the valves are used in are likely to cause temperature (high or low) that may cause injury to personnel if touched, then adequate insulation / protection must be fitted.
- Adequate safety measures shall be made for valves similar to pipe lines.
- Due to variety of duties in which these valves can be employed, it is the end user's responsibility to ensure the compatibility of media with the material of construction of the product for each specific application (i.e. corrosion and erosion which may affect integrity of the pressure containing envelope).
- Before valves are installed in areas which may be subject to seismic activity or extreme climatic conditions, consult L&T Valves with data.
- All exposed parts shall be cleaned to prevent dust deposit or insulation is needed similar to pipeline.
- Valves shall be protected by other devices to prevent over-pressurisation. (i.e., caused by temperature, fire etc.).
- It is recommended to use ring spanners to tighten and support the bolts and nuts.

### WARNINGS & SAFETY INSTRUCTIONS

- L&T cannot anticipate all of the situation a user may encounter while installing and using L&T Valves. The user **MUST** know and follow all applicable industry specifications on the safe installation and use of these valves. Misapplication of the product may result in injuries or property damage. Refer to L&T valves product catalogue, brochures for additional product safety information or contact L&T Valves.
- Keep hands and objects away from the valve ports at all times. Actuated valves could be accidentally operated, resulting in serious injury or valve damage.
- Before removing the valve from the line always make sure the line has been depressurized and drained. Cycle the valve a few times to relieve any pressure that could be trapped in the body cavity.

For additional product safety information details refer to DO's and Don'ts (Page 17)

- Utmost caution must be taken when handling a valve that has toxic, corrosive, flammable or a contaminant nature medium flowing through its pipeline. The following safety precautions are recommended when dismantling valve with hazardous media:
  - a. Wear eye shield, protective headgear, clothing, gloves and safety shoes.
  - b. Have available running water.
  - c. Have a suitable fire extinguisher when medium is flammable.
- Do not try to operate a valve that exhibits any sign of leakage. Isolate the valve and either repair or replace it.
- Do not use or substitute non L&T components or parts in L&T Valves and assemblies.
- Never look into the valve bore while the valve is in a flow line. Pressure and fluids could escape from the valve causing bodily injury.
- A Silicone-based lubricant is applied to assist valve break in. The lubricant, if unacceptable, may be removed by a solvent wash.
- To prevent leakage malfunction resulting from internal wear or seal degradation, the user must establish a preventive maintenance and inspection program.
- When dispatched, valves contain a mineral oil which aids the bedding in of the valve. This may be removed if found unstable. Special variants may contain other lubricants or be dry built.
- Some valves contain a Silica gel bag inside the ball cavity to absorb humidity during storage. These must be removed before installation, as must all other protective packaging.

## Valve Installation

### General

Carefully unpack the valve and check for tags or identification plates, etc.

- The performance of the valves will be better if the flow is smooth. It is suggested to avoid installation of valves where turbulence is expected (Example: Immediate after elbows, bends, pumps etc.)
- If the identification plate / arrow plate / tag is lost or destroyed during the shipment or while in storage or if it is not legible, contact your distributor or L&T Valves.
- Look for any special warning tags or plate attached to or accompanying the valve and if any, take appropriate action.
- It is recommended to remove all foreign particles from the pipe line by flushing it with a suitable fluid. Corrosion inhibitors shall be added to the flushing medium to prevent any corrosion due to trapped fluids.
- Remove the end protectors and protective sheath within the flow bore valve, wherever provided.
- Gasket contact faces of the valve and pipe flanges shall be inspected thoroughly for scratches / defects. Scratches, if any, shall be corrected by grinding the surfaces or by rubbing with emery sheet.
- After cleaning, operate the valve for at least two complete cycles before installing.
- Ensure that the valve is in fully open position during installation.

- The pipes must be properly aligned and provisions made to minimize stresses from external load/thermal expansion. Always review pipe manufacturer's recommendation.
- In case of pipes with long overhangs, adequate support/jacks shall be provided at the flange ends of the pipe so as to avoid bending of pipes due to weight of the valve.
- The fasteners on the valves might have loosened or relaxed during transportation or long storage. It is highly recommended that all fasteners (Body-connector joint, Stem Nut, lever nut, gear unit/actuator) shall be retightened to the required torque provided in appendix.
- The standard valve shall be mounted in any convenient position, preferably with easy access to the packing gland nut, actuator, and positioner.
- The valve may be installed with flow in either direction. It may be positioned horizontally, vertically or at a gradient without impairing the operation of the valve.
- For actuated valves, please refer to the actuator manufacturer's recommendations for the valve's orientation to ensure optimal performance.
- Do not allow dust layers to build up on the equipment. The process fluid temperature shall not exceed the ignition temperature of the dust.
- Valves should be placed in a partially open position prior to working on a valve or removing it from service to vent pressure or drain product that may be trapped in the body cavity.
- When removing threaded end valves from the line, apply wrenches in the same manner used for installation and NOT to the valve body section or opposite side tailpiece as this may result in breaking loose the thread tailpiece to body joint.
- Standard valves may be installed in either direction. Valve with a upstream relief hole are unidirectional and must be fitted with the flow arrow pointing downstream.

The improper alignment of the pipe and the valve during installation can lead to unbalanced tightening of the flanges which may cause excessive stress on the bolts and lead to leakage

## Flanged Ends

- Refer [Appendix A1](#) for applicable standards
- Clean valve flanges and companion flanges and remove protective grease from the valve flanges. Clean the valve interiors adjacent piping prior to mounting of the valve pipe joint.
- Align the bolt holes of the valve end flange and pipe flange.
- Fasteners shall be lubricated for ease of installation.
- Insert the gasket (not supplied with valve) and tighten the bolts. Flange bolts shall be tightened evenly. Using suitable device, in cross rotation to prevent damage to the flange.
- For sequence of tightening bolts, refer [Appendix A2](#).
- For larger flanged valves, which are provided with foot support supporting base/pedestal shall be placed beneath the valve after the alignment and bolting of the pipe.
- For handling refer relevant section on [Handling and Storage](#)
- Ensure that the valve is in fully open position during installation

- When gasketing always ensure multiple ground paths across gaskets. i.e.  $<1\Omega$  across total gasket.

If valve is not cleaned or if cleaning is done after valve installation, cavities may form a natural trap in the piping system. Any impurity not dissolved or washed out by the flushing fluid/line fluid may settle in such cavities and adversely affect valve performance.

## Screwed Ends

- Valves with screwed ends shall be treated as a single unit and shall not be dismantled when installing in pipeline.
- Before installing, make sure that the threads on the mating pipe are free from grit, dirt or burrs.
- Ensure correct thread size on the pipe ends.
- Clean both the mating parts before assembly.
- Use an anti-seize thread sealant to seal and prevent galling.
- When tightening the valve apply a pipe wrench or spanner with flat jaws on octagon ends to the connector closest to the pipe being worked, using standard piping practices
- Sealant shall be applied only to the pipe or male threads.

## Socket Weld Ends

### Disassembly

- Because of the heat input during welding and the soft material used in the valve, it is required to dismantle the body and connectors before welding the connector onto the pipe.
- The working area around the valve shall be kept clean and free from dust, dirt, debris etc. Keep the valve in OPEN position.
- Unscrew the bolting joining the body and the connectors. Remove the body - subassembly from the connectors.
- Turn the valve to part Close position, and remove Seats and gasket. In vertical pipeline, keep the valve in closed position.
- Holding the ball carefully so that it does not fall out of the body, turn the valve to CLOSED position.
- Remove the ball & keep all removed components in clean surface and protect them from dust and weld spatter.
- Assemble the body (along with stem & lever/wrench) and connectors using two bolts diagonally.

## Welding & Re-assembly

- Assemble dummy valve on to the pipe and ensure proper alignment. There shall be a gap of 0.5 to 1.0 mm between the pipe end and socket weld depth so the weld contraction does not create stress in the weld or component.
- Tack weld the connectors on the pipe.
- Dismantle the two bolts and remove the body from the connectors and keep all components in clean area free from debris and weld spatter.
- Complete the weld, using qualified welder with respect to WPS, correct material and size of electrode. Protect the connector's face from weld spatter. Clean the welds thoroughly.
- Allow the end connectors to cool to Atmospheric temperature. Wherever the system calls, carry out NDE on the welds.
- Remove the two gasket used in the valve from the body and scrap them. Assemble the Ball, Seats and gasket on to the body. (Use the two new gasket sent along with the valve).

Note: Ball valves with graphite gasket shall not be removed from the body. They can be reused.

- Keep the valve in OPEN Position and fit body between the two end connectors in correct orientation and assemble the four bolts.

During locking plate assembly and disassembly, use appropriate bolt length on either side of body - connector joints as shown in Fig 5a

- Apply Chemilube copper gel or equivalent on the threads (SS fasteners only) to avoid galling.
- Tighten the nuts uniformly with a torque as given in the Table 3 & 4 and in the sequence shown in Fig 5.

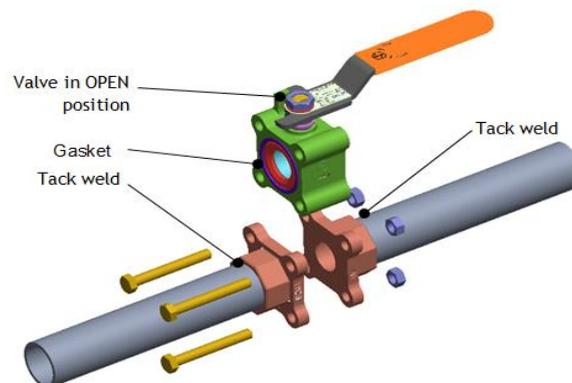


Fig. 5 Three-piece ball valves Welding

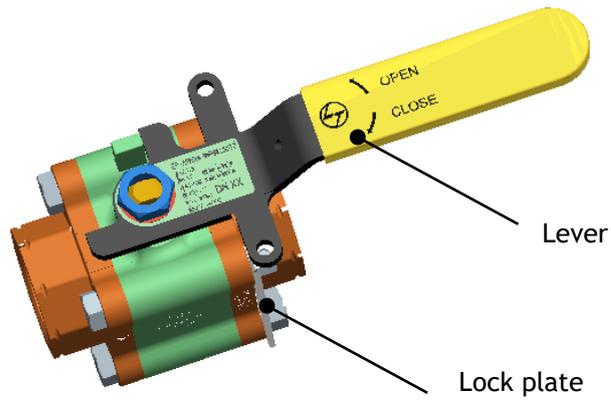


Fig. 5a Typical Locking plate arrangement

## Valve Operation

### General

- Operational life of the valve can be maximized if the valve is used within the rated range, in accordance with design parameters.
- For understanding the internal construction refer to the general assembly drawing of the valve.
- It is not good practice to leave a standard ball valve in the partially (throttled) position as this may cause damage and seat life may be reduced.
- Any media which may solidify, crystallise or polymerise should not be allowed to stand in the ball cavity since this is detrimental to valve performance and life.
- L&T valve have  $\frac{1}{4}$  turn operation, closing in a clockwise direction.

### Operation Mechanism

Quarter turn motion of the valve is achieved using Lever/Wrench/Gear unit/Hydraulic/Pneumatic/Electric Actuator.

#### Gear Unit

Gear units are provided on valves for easier operation. Usually clockwise operation is for closing and anti-clockwise for opening of the valve (Fig. 6). The position of the valve can be noted using the position indicator provided on side of the gear unit.

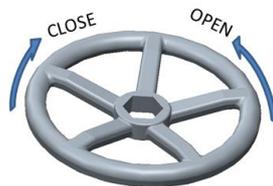


Fig. 6 Close Open Direction

Forcing the hand wheel, Chain wheel or nut against the stops will not provide tighter shutoff of the valve and may damage the gear unit.

#### Electric Actuator

It gives multi-turn output and is fitted on the gear unit or directly mounted on valve. The actuator drives the gear unit which in turn rotates the shaft. Electrically actuated valves are provided with declutching mechanism for manual operation of the valve. For electric actuators, L&T Valves recommends to strictly adhere to the instructions as per actuator's manual. Actuator settings are done at factory and normally resetting at site will not be repaired

## Pneumatic / Hydraulic Actuator

Pneumatic/hydraulic actuators are fitted directly on the valve, without gear unit. It is recommended to strictly adhere to the instructions as per actuator manual.

In case, valves are supplied as bare stem, as per customer requirement, ensure that connecting devices for actuators does not exert any axial or radial loads on the shaft, as it may lead to bending of the shaft and excessive loading on the ball. This in turn can cause the torque to increase and may lead to problem in valve operation.

## Do's and Don'ts

Do's	Don'ts
Before taking valve for erection, make sure that is cleaned properly from inside and outside and there are no foreign particles or metallic chips sticking on to sealing element.	DO NOT lift the valve by the hand wheel, gear box, actuator, adaptor, or bracket.
While installing the operating mechanism make sure that the ball valves in fully open position (the operating mechanism to be in similar position).	DO NOT use the lifting points located on the Gear unit / actuator, if any, to lift the valve. These lifting points are for the Gear unit / actuator only.
Make sure to remove the entire rust preventive on the machined surface in the flow area before a valve is put in the pipe line.	DO NOT over-tighten Stem nut. Over-tightening will increase the torque required to operate the valve.
Carefully read the identification plate details and install the valve in the right place and for the correct duty conditions for which it is designed and manufactured.	DO NOT use impacting devices to tighten up the bolting on the body/connector. Use mechanical devices for tightening.
Make sure to supply rated voltage and frequency to the electrical actuator.	DO NOT tighten the body connector bolting's when the ball is in fully closed position.
Refer the general assembly drawing for recommended valve installation. Valves should be installed in the line after visually checking.	DO NOT use force multiplying devices like levers or pulleys. In case a valve demands excessive operating torque, make sure there is no artificial obstruction in the pipe line or in the operating mechanism
Ball valve needs care and maintenance in its use. Always make routine checks once in three months for the working condition of operating mechanism.	DO NOT remove operating mechanism from the valve when the ball is partially open.
In case of Single piece ball valves use proper tools for opening the insert.	DO NOT weld the 3P Socket weld end valves in the pipe line before dismantling the same.

## Maintenance

### Introduction

For enhanced life of the valve and better operability, it is recommended to do a periodic inspection and maintenance of the valves as per the procedure explained below:

The frequency of observation depends on its application. L&T Valves recommends that valve shall be inspected every 1000 cycles or three months (whichever earlier) for smooth operation and leak free performance. This is recommended even for stored valves also.

It is advisable to maintain a record of the performance of the valve.

Replacement of all seats, seals and gaskets is recommended using the appropriate L&T Repair kit.

In case of Infrequent operation, the valve should not be left standing without operation for more than 1 month. After this period the valve should be operated through three full cycles.

### Safety Procedure

Always depressurize the pipeline when taking up any maintenance activity on the valve/ actuator.

Always disconnect the electrical supply to the electrical actuator before carrying out any maintenance activity on the valve/actuator.

Study carefully and understand the instructions outlined in the installation, operation & maintenance manual of the valve & actuator before taking up any maintenance.

### Routine Maintenance

Soft seated valve products may wear over time resulting in loosening at component boundaries. If leakage is detected, tighten according to the steps and torque values outlined below. If tightening does not correct the problem, it is time to replace your seats, seals and gaskets.

The following activities can be carried out during the routine maintenance of the valves.

- Check for any leak through the Stem seals
- Check for any leak through the Seat
- Check for any leak through the Gasket
- Check Operators for smooth and complete operation

#### 1. Stem Seal Leakage

Stem seal leakage shall be stopped as soon as it is detected. On actuated valves, most mounting hardware allows access to the packing adjustment screws. If this is not the case, it

may be necessary to remove the actuator to gain adequate access to make the packing adjustment. Leakage in the stem packing area may be eliminated by adjusting the lower stem (gland) nut.

Remove lever and other parts. Packing adjustment shall be accomplished by turning the stem packing adjustment screws clockwise to the maximum torque shown in Table 1. Ensure stem does not rotate while tightening stem nut. If leakage persists, replace stem packing.

**Caution:** Do not over tighten the adjustment screws. Over-tightening will result in excessive operating torque and shorten the packing's service life. If stem leakage continues, or operating torque becomes excessive, de-pressurize the valve and replace the stem seals.

If the seal has been damaged replace it with new seal (refer relevant section on [Dismantling & Assembly Procedure](#))

## 2. Seat Leakage

Check whether the valve is in fully closed position. If leakage persists, the valve shall be disassembled and seats shall be replaced.

If the seal has been damaged replace it with new seal (refer relevant section on [Dismantling & Assembly Procedure](#))

## 3. Gasket Leakage

### Between Single Piece Body & Gasket

Check the torque of the insert according to Table 2. Replace gasket if leakage persists.

### Between Two Piece\Three Piece Body & Gasket

Check the torque of the body connector bolting according to Table 3 & 4. Replace gasket if leakage persists.

Use Copper Gel when retightening the insert / boltings.

If the seal has been damaged replace it with new seal (refer relevant section on [Dismantling & Assembly Procedure](#))

## 4. Gear Unit & Actuators

Generally the gear units are filled with grease (Shell Alvania EP2/equivalent 3). They do not require any additional maintenance.

However in case extreme difficulty of operation, remove the top cover and refill the grease. Assemble the top cover; ensure that the mechanical stoppers inside the gear unit are not disturbed.

Setting of Mechanical Stoppers:

Close the valve manually till movement of disc is stopped by mechanical stopper in the gear unit. Check whether the disc seal engages uniformly with body seat ring. If not, loosen the close position mechanical stopper of the gear unit, move the disc till the contact line of the seal and body seat ring is parallel to face of the body seat ring. Set the close position

mechanical stopper bolt, so that it touches the worm sector. Lock the mechanical stopper bolt in this position with the help of lock nut provided.

Open the valve manually till disc movement is stopped by open position mechanical stopper of the gear unit. Measure the angular movement of the position indicator, which should be 90 degrees. If not, move the disc so that the indicator shows 90 degrees angular movement from “shut” position. Set the open position mechanical stopper, so that it touches the worm sector. Lock the mechanical stopper bolt in this position with the help of lock nut provided. This completes the setting of mechanical stopper bolts.

#### Actuators

For maintenance of electrical /pneumatic/hydraulic actuator refer the instruction manual of the electric actuator

*Note: After Maintenance of the Ball Valve, and before commissioning the same, please observe all the installation guidelines as mentioned in Valve Installation section.*

## Dismantling and Assembly Procedure

### 1. Single Piece Ball Valves

#### Dismantling Procedure

- Depressurize the line and open the valve to drain the line.
- Valves shall be slung properly and supported before loosening companion flange bolts.
- Place the valve in platform or base and transport to the repair shop. Refer GA drawings / Exploded view for component identification.
- Remove all add-on components (if used) such as actuators/gear unit, Limit switch and set aside.
- Remove the insert from the side by loosening it (special tool may be required to loosen the insert) and also the insert seal.
- Loosen the Lever nut and remove the lock washer, id plate, lever (for lever operated valves) or remove the wrench head, wrench pipe and bolt (for wrench operated valves) .
- Remove the Lock Clip and loosen the hex. Nut.
- Remove the stop plate (for wrench operated valves).
- Remove the Belleville spring, gland and packing from the stem.
- Keep the valve in closed position and remove seat and then the ball in the insert size.
- Remove the stem along with the thrust seal.
- Finally remove the other seat from the body.
- Disassemble valve. Remove old seats, seals, gasket and discard them. Clean and dry metal components in preparation for reassembly.

Maintenance consists of replacing packing, seats, seals, gasket, and ball or stem if worn or damaged, and requires partial or full disassembly by trained personnel following the instructions in this manual.

Carry out the required replacement of the parts and reassemble the valve with new parts

#### Assembly Procedure

- Check for cleanliness of all components i.e. body, Insert, ball, stem, seat etc.
- Ball valves do not normally need internal lubrication or routine maintenance during service.
- Insert the seat from the side and make sure that the seat is properly seated on the body face.
- Insert the Stem with Thrust seal on it from the side.

- Place the packing, gland followed by Belleville spring on the stem.
- Insert the stop plate in correct orientation (for wrench operated valves)
- Insert the hex nut and tighten the nut.
- Packing may be adjusted if the valve is leaking around the stem, or the stem feels loose. See - Stem seal leakage maintenance.
- Place the lock clip on the hex nut such that it seats properly on the hex nut.
- Keep the stem in the closed position.
- Insert the Ball from the side followed by the seat.
- Place the insert seal and tighten the insert from the side.
- Place the lever, lock washer, ID plate, Lever (in the sequence specified for lever operated valves) or place the wrench head and tighten the bolt (for wrench operated valves).
- Tighten the lever nut and bend the lock washer to lock the Lever nut (for lever operated valves).
- Assemble all add-on components (if used) such as actuators/gear unit, Limit switch.
- Valves with high operating torque not resulting from stem seal over-tightening or valves, which have leakage by the seats, may have damaged seats or ball surfaces. These valves shall be de-pressurized, disassembled, and inspected for damage.
- For necessary tightening torque values refer Table 1, 2.
- Before installing the valve in pipeline do conduct pressure test.

## 2. Two Piece Ball Valves

### Dismantling Procedure

- Depressurize the line and open the valve to drain the line
- Valves shall be slung properly and supported before loosening companion flange bolts.
- Place the valve in platform or base and transport to the repair shop. Refer GA drawings / Exploded view for component identification
- Remove all add-on components (if used) such as actuators/gear unit, Limit switch and set aside.
- Remove the connector by loosening body bolting's and also the gasket, seat.
- Loosen the Lever nut and remove the lock washer, id plate, lever (for lever operated valves) or remove the wrench head, wrench pipe and bolt (for wrench operated valves) .
- Remove the Lock Clip and loosen the hex. Nut.
- Remove the stop plate (for wrench operated valves).
- Remove the Belleville spring, gland and packing from the stem.

- Keep the valve in closed position and remove seat and then the ball in the insert size.
- Remove the stem along with the thrust seal.
- Finally remove the other seat from the body.
- Disassemble valve. Remove old seats, seals, gasket and discard them. Clean and dry metal components in preparation for reassembly.

Maintenance consists of replacing packing, seats, seals, gasket, and ball or stem if worn or damaged, and requires partial or full disassembly by trained personnel following the instructions in this manual.

Carry out the required replacement of the parts and reassemble the valve with new parts.

## Assembly Procedure

- Check for cleanliness of all components i.e. body, ball, stem, seat, gasket etc.
- Ball valves do not normally need internal lubrication or routine maintenance during service.
- Insert the seat from the side and make sure that the seat is properly seated on the body face.
- Insert the Stem with Thrust seal on it from the side.
- Place the packing, gland followed by Belleville spring on the stem.
- Insert the stop plate in correct orientation (for wrench operated valves)
- Packing may be adjusted if the valve is leaking around the stem, or the stem feels loose. See - Stem seal leakage maintenance.
- Place the lock clip on the hex nut such that it seats properly on the hex nut.
- Keep the stem in the closed position.
- Insert the Ball from the side followed by the seat
- Place the gasket and seat from the side.
- Place the connector and tighten the body bolting's.
- Place the lever, lock washer, ID plate, Lever (in the sequence specified for lever operated valves) or place the wrench head and tighten the bolt (for wrench operated valves).
- Tighten the lever nut and bend the lock washer to lock the Lever nut (for lever operated valves).
- Assemble all add-on components (if used) such as actuators/gear unit, Limit switch.
- Valves with high operating torque not resulting from stem seal over-tightening or valves, which have leakage by the seats, may have damaged seats or ball surfaces. These valves shall be de-pressurized, disassembled, and inspected for damage.
- For necessary tightening torque values refer Table 1, 3 & 4.
- Before installing the valve in pipeline do conduct pressure test.

### 3. Three Piece Ball Valves

#### Dismantling Procedure

- Depressurize the line and open the valve to drain the line
- Valves shall be slung properly and supported before loosening body connector bolting's.
- Place the valve in platform or base and transport to the repair shop. Refer GA drawings / Exploded view for component identification
- Remove all add-on components (if used) such as actuators/gear unit, Limit switch and set aside.
- Remove the body by loosening body bolting's.
- Remove the gasket, seat from either side of the body.
- Keep the valve in closed position and remove the ball from the side.
- Loosen the Lever nut and remove the lock washer, id plate, lever.
- Remove the Lock Clip and loosen the hex. nut.
- Remove the Belleville spring, gland and packing from the stem.
- Remove the stem along with the thrust seal from the side.
- Disassemble valve. Remove old seats and seals and discard them. Clean and dry metal components in preparation for reassembly.

Maintenance consists of replacing packing, seats, seals, gasket and ball or stem if worn or damaged, and requires partial or full disassembly by trained personnel following the instructions in this manual.

Carry out the required replacement of the parts and reassemble the valve with new parts.

#### Assembly Procedure

- Check for cleanliness of all components i.e. body, ball, stem, seat, gasket etc.
- Ball valves do not normally need internal lubrication or routine maintenance during service.
- Insert the Stem with Thrust seal on it from the side.
- Place the packing, gland followed by Belleville spring on the stem.
- Insert the stop plate in correct orientation (for wrench operated valves)
- Packing may be adjusted if the valve is leaking around the stem, or the stem feels loose. See - Stem seal leakage maintenance.
- Place the lock clip on the hex nut such that it seats properly on the hex nut.
- Keep the stem in the closed position.

- Insert the Ball from the side followed by the seat
- Place the gasket and seat from either side.
- Place the connector and tighten the body bolting's.
- Place the lever, lock washer, ID plate, Lever (in the sequence specified for lever operated valves) or place the wrench head and tighten the bolt (for wrench operated valves).
- Tighten the lever nut and bend the lock washer to lock the Lever nut (for lever operated valves).
- Assemble all add-on components (if used) such as actuators/gear unit, Limit switch.
- Valves with high operating torque not resulting from stem seal over-tightening or valves, which have leakage by the seats, may have damaged seats or ball surfaces. These valves shall be de-pressurized, disassembled, and inspected for damage.
- For necessary tightening torque values refer Table 1, 3 & 4.
- Before installing the valve in pipeline do conduct pressure test.

## Troubleshooting

### 1. Single Piece Ball Valves

Problem	Reason	Action
Leakage through the valve Fully Closed Condition	Deformed or Damaged Seat	Replace the Seat ( <a href="#">Refer Maintenance Chapter</a> )
	Disturbed Setting of limiting stoppers in gear unit For Open/Close Position not allowing the disc to close fully	Set the gear unit mechanical stoppers ( <a href="#">Refer Maintenance Chapter</a> )
	Loose Insert	Tighten Insert( <a href="#">Refer Appendix-A2</a> )
Leakage through stem packing	Maximum compression of the packing has been attained.	Replace the packing ( <a href="#">Refer Maintenance Chapter</a> )
	Leak through Thrust seal	Replace the Stem Thrust seal ( <a href="#">Refer Maintenance Chapter</a> )
Leakage through end flange facings	Inadequate tightening of flanged joint	Re tighten the Flanged joint
	Gasket damage	Replace the gasket
	Loose Insert	Tighten Insert( <a href="#">Refer Appendix-A2</a> )
Noise /Vibrations while opening or closing of the valve	Inadequately supported / fixed valve and its assembly	Support / fix upstream / downstream piping and Valve foundation bolts (wherever applicable)
Hard to operate	Accumulation or solidification of material in the body of valve.	Flush valve to get material out of body.
	Swelling Seats.	Install correct trim.
	Corrosion between stem and valve body.	Apply penetrating oil around stem. If still won't operate, disassemble valve and polish stem.
	Operator not installed properly.	Check operator.

### 2. Two Piece Ball Valves

Problem	Reason	Action
Leakage through the valve Fully Closed Condition	Deformed or Damaged Seat	Replace the Seat ( <a href="#">Refer Maintenance Chapter</a> )
	Disturbed Setting of limiting stoppers in gear unit For Open/Close Position not allowing the disc to close fully	Set the gear unit mechanical stoppers ( <a href="#">Refer Maintenance Chapter</a> )
	Maximum compression of the packing has been attained.	Replace the packing ( <a href="#">Refer Maintenance Chapter</a> )
Leakage through stem packing	Leak through Thrust seal	Replace the Stem Thrust seal ( <a href="#">Refer Maintenance Chapter</a> )

Leakage through end flange facings	Inadequate tightening of flanged joint	Re tighten the Flanged joint
	Gasket damage	Replace the gasket
Noise /Vibrations while opening or closing of the valve	Inadequately supported / fixed valve and its assembly	Support / fix upstream / downstream piping and Valve foundation bolts (wherever applicable)
Leak through Body Connector Joint	Deformed or damaged gasket	Replace the gasket ( <a href="#">Refer Maintenance Chapter</a> )
	Accumulation or solidification of material in the body of valve.	Flush valve to get material out of body.
	Swelling Seats.	Install correct trim.
	Corrosion between stem and valve body.	Apply penetrating oil around stem. If still won't operate, disassemble valve and polish stem.
	Operator not installed properly.	Check operator.
Hard to operate		

### 3. Three Piece Ball Valves

Problem	Reason	Action
Leakage through the valve Fully Closed Condition	Deformed or Damaged Seat	Replace the Seat ( <a href="#">Refer Maintenance Chapter</a> )
	Disturbed Setting of limiting stoppers in gear unit For Open/Close Position not allowing the disc to close fully	Set the gear unit mechanical stoppers ( <a href="#">Refer Maintenance Chapter</a> )
	Maximum compression of the packing has been attained.	Replace the packing ( <a href="#">Refer Maintenance Chapter</a> )
Leakage through stem packing	Leak through Thrust seal	Replace the Stem Thrust seal ( <a href="#">Refer Maintenance Chapter</a> )
Leakage through end flange facings	Inadequate tightening of flanged joint	Re tighten the Flanged joint
	Gasket damage	Replace the gasket
Noise /Vibrations while opening or closing of the valve	Inadequately supported / fixed valve and its assembly	Support / fix upstream / downstream piping and Valve foundation bolts (wherever applicable)
Leak through Body Connector Joint	Deformed or damaged gasket	Replace the gasket ( <a href="#">Refer Maintenance Chapter</a> )
	Accumulation or solidification of material in the body of valve.	Flush valve to get material out of body.
	Swelling Seats.	Install correct trim.
	Corrosion between stem and valve body.	Apply penetrating oil around stem. If still won't operate, disassemble valve and polish stem.
	Operator not installed properly.	Check operator.
Hard to operate		

**IMPORTANT:**

All these procedures require emptying the upstream and downstream piping and removal of valve from the pipe line.

## Appendix

### A1 - References

#### Face to Face Dimensions

ASME B16.10 Face to face and End to end dimensions of valves

#### End Connections

ASME B16.5 Pipe Flanges and Flange Fittings (NPS ½ through NPS 24)

ASME B16.11 Forged Fittings, Socket-Welding and Threaded

ASME B1.20.1 Pipe Threads, General Purpose (Inch)

ISO 7-1 Pipe threads where pressure-tight joints are made on the threads

#### Testing Standard

API Standard 598 Valve Inspection and testing

ISO 5208 Industrial valves - Pressure testing of metallic valves

ISO 17292 Metal ball valves for petroleum, petrochemical and allied industries

ISO 10497 Testing of valves – Fire type-testing requirements

API STANDARD 607 Fire Test for Quarter-turn Valves and Valves Equipped with Non-metallic Seats

API Spec. 6D Pipeline Valves

### A2 - Tightening Sequence & Torque

The tightening sequence for all possible number of bolting is beyond the scope of this manual. However, the logic to be followed is explained below

- Tighten the first four nuts in the sequence shown Fig.7. This helps in correct location of the mating parts.
- Tighten the other bolts in the sequence shown Fig.7 the same way.
- The sequence goes clockwise around the bolt
- Ensure that the recommended torque (refer Table 3 & 4) is maintained in all bolting.

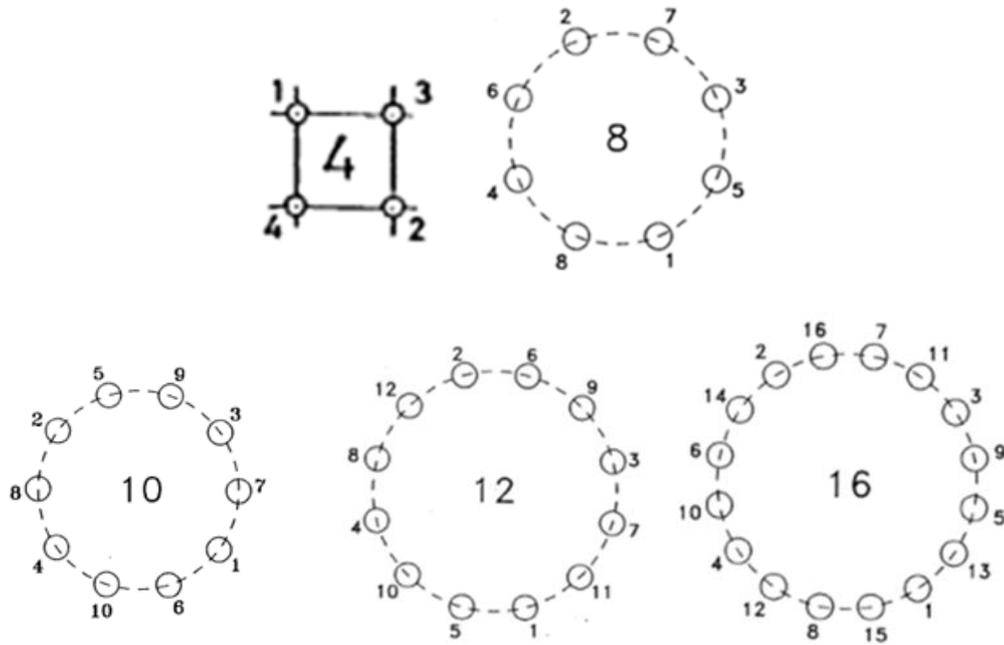


Fig. 7 Tightening Sequence

Table 1 Tightening Torque values for Lock Nut / Lever Nut bolting

THREAD SIZE	TORQUE (+/-10%), Nm
M10 x 1	4
M12 x 1.25	9
M14 x 1.5	13
M16 x 1.5	13
M20 x 1.5	25
M24 x 1.5	25
M27 x 1.5	25
M30 x 1.5	30
M36 x 1.5	30
M42 x 1.5	40
M48 x 1.5	40
M56 x 2	40

lbf.ft = Nm / 1.35582

**Table 2** Tightening Torque values for Valve Insert (applicable for Single Piece Ball Valves)

<b>INSERT SIZE</b>	<b>TIGHTENING TORQUE(+/-10%), Nm</b>
<b>M30 x 1.5</b>	<b>65</b>
<b>M40 x 1.5</b>	<b>70</b>
<b>M55 x 1.5</b>	<b>100</b>
<b>M75 x 1.5</b>	<b>175</b>
<b>M95 x 2</b>	<b>250</b>
<b>M120 x 2</b>	<b>350</b>
<b>M140 x 2</b>	<b>500</b>
<b>M190 x 2</b>	<b>980</b>

lbf.ft = Nm / 1.35582

**Table 3** Tightening Torque values for Body Connector bolting - Carbon Steel

<b>BODY BOLTING SIZE</b>	<b>TIGHTENING TORQUE(+/-10%), Nm</b>
<b>M6</b>	<b>15</b>
<b>M8</b>	<b>22</b>
<b>M10</b>	<b>25</b>
<b>M12</b>	<b>36</b>
<b>M16</b>	<b>120</b>
<b>M20</b>	<b>180</b>

lbf.ft = Nm / 1.35582

**Table 4 Tightening Torque values for Body Connector bolting - Stainless Steel**

<b>BODY BOLTING SIZE</b>	<b>TIGHTENING TORQUE(+/-10%), Nm</b>
<b>M6</b>	<b>10</b>
<b>M8</b>	<b>12</b>
<b>M10</b>	<b>15</b>
<b>M12</b>	<b>26</b>
<b>M16</b>	<b>65</b>
<b>M20</b>	<b>127</b>

lbf.ft = Nm / 1.35582

### **A3 - Actuator / Gear Unit Reorientation Procedure:**

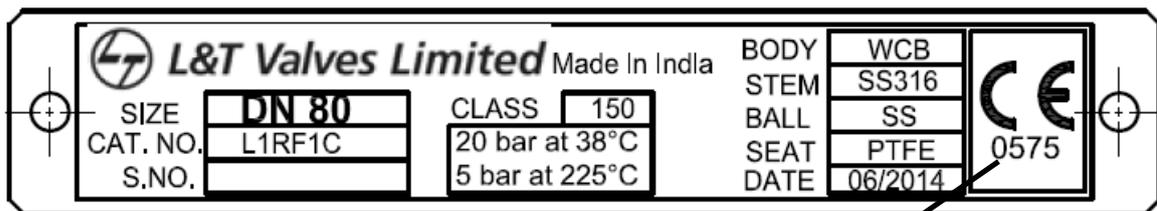
Gear unit or Actuator orientation change procedure is given below,

- Depressurize the line and keep the valve in half open position.
- Remove actuator/gear unit bottom screws.
- Rotate the actuator/gear unit and change orientation to required position, match holes in the bracket to that of the gear unit.
- Insert the bottom screws & tighten to required torque.
- Operate the valve 2 to 3 times before pressurizing line.
- In order to dismount actuator/gear unit from valve, after unscrewing the bottom screws of bracket, lift the actuator / gear unit slightly and rotate it for few turns in counter-clockwise direction so as to remove the stem from actuator bush. Thus actuator / gear unit can be dismounted from valve.

## APPENDIX C

For valves with CE certification requirements

- Each valve has a stainless steel name plate fixed to the body. The nameplate is marked with details of "figure number", along with various other details such as the materials of construction, Limiting temperatures, pressure rating as shown below



According to PED 97/23/EC

Fig.C.1. 'CE' Marking Name Plate

When installing or maintaining valves

- Observation shall be made for safety codes and working practices relevant to gas zones 1 & 2 and dust zones 21 & 22 (as defined in EN 1127-1:1998).
- The equipment shall not be subjected to frequently occurring disturbances.
- End user to ensure there is no external disturbances (e.g. Shocks, vibrations, electromagnetic fields etc.)
- Misuse of valves / valve components are strictly prohibited.
- If the processes or environments that the products are used in are likely to cause temperatures (high or low) that may cause injury to personnel if touched, then adequate insulation / protection must be fitted.
- Adequate safety measures shall be made for valves similar to pipe lines.
- Before equipment is installed in areas which may be subject to seismic activity or extreme climatic conditions consult L&T Valves with data.
- Maximum surface temperature of the equipment will be same as the line media temperature. The end user must take account of the line media temperature.
- All exposed parts shall be cleaned to prevent dust deposit or insulation is needed similar to pipe line.
- This equipment should be protected by other devices to prevent over-pressurization. (i.e. caused by external fire etc.).



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