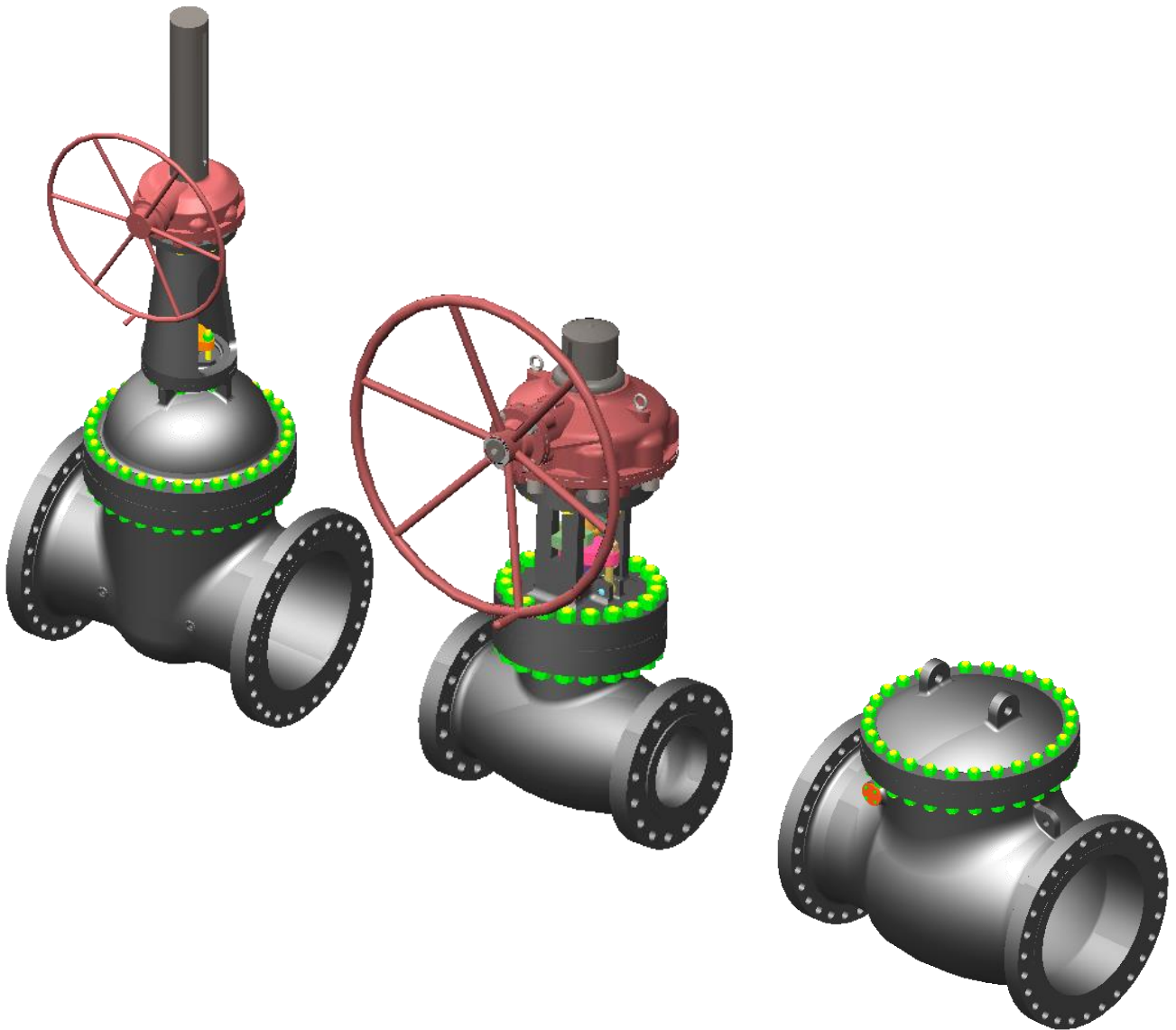


# Installation, Operation and Maintenance Manual of Bolted Bonnet Gate, Globe & Check Valves



<b>Contents</b>	<b>Page</b>
L&T Valves	3
Gate, Globe & Check Valves	4, 5
Exploded Views	6, 7, 8, 9
Delivery	10
Handling and Storage	11
Planning and Responsibilities	12
Installation	13, 14
Operation	15, 16
Maintenance	16, 17
Dismantling and Assembly Procedure	18, 19
Packing & Gasket Maintenance	19, 20, 21
Troubleshooting	21
Appendices	22

**Note:**

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



## L&T Valves

L&T Valves 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
- Special Valves and Customised Solutions

Designs for the valves are created by an experienced team of valve experts who have deep understanding of user-industry processes. 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 institutionalised 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 centre through a network of offices, stockists, automation centres and service franchisees.

## Gate Valves

Gate valves are multi-turn valves with rising stem i.e. they require a number of rotation of hand wheel for full close or full open of the valve. All Gate valves shall be used only in full open or full close position. If used in slight or half open position, the wedge (gate) may vibrate/chatter and also cause wire drawing at the seating area. Therefore Gate valves shall not be used for flow regulation.

All valves close by rotating the hand wheel clockwise and open by rotating counter-clockwise.

For hand wheel operated valves the projection of stem above the hand wheel indicates whether the valve is in open or close position. In gear operated valves as the stem top may not be visible, a separate indicator is provided to indicate the position of valve.

The valve is closed by driving the wedge down into the corresponding taper in the body. The wedge and body seat rings are matched and lapped for perfect sealing. When the valve is fully open, the stem backseats in the bonnet bush.

Typical exploded view of Gate Valve is shown in **Fig.1**. For actual construction details of valves supplied, please refer General Assembly Drawing (GAD) submitted.

### Range

Size	Pressure Rating
2" to 72"	Class 150
2" to 60"	Class 300
2" to 48"	Class 600
2" to 24"	Class 900
2" to 24"	Class 1500
2" to 10"	Class 2500

## Globe Valves

Globe valves are multi-turn valves with non-rotating stem and non-rising hand wheel. Globe valves can be used for normal flow regulation. However if it is used in slightly opened position when the differential pressure is very high, the seating may erode. It is advisable not to use a Globe valve for flow control below 10% of full opening.

All Globe valves close rotating the hand wheel clockwise and open by rotating counter-clockwise.

Typical exploded view of Globe valve is shown in **Fig.2**. For actual construction details of valves supplied, please refer General Assembly Drawing (GAD) submitted.

### Range

Size	Pressure Rating
2" to 20"	Class 150
2" to 24"	Class 300
2" to 20"	Class 600
2" to 18"	Class 900
2" to 10"	Class 1500
2" to 12"	Class 2500

## Swing Check Valves

Swing Check Valves automatically open by the velocity of medium and close by the gravitational force when the flow reverse or stops.

Typical exploded view of Swing Check Valve is shown in **Fig.3 & Fig.4**. For actual construction details of valves supplied, please refer General Assembly Drawing (GAD) submitted.

### Range

Size	Pressure Rating
2" to 30"	Class 150
2" to 36"	Class 300
2" to 30"	Class 600
2" to 24"	Class 900
2" to 16"	Class 1500
2" to 8"	Class 2500

## Exploded Views

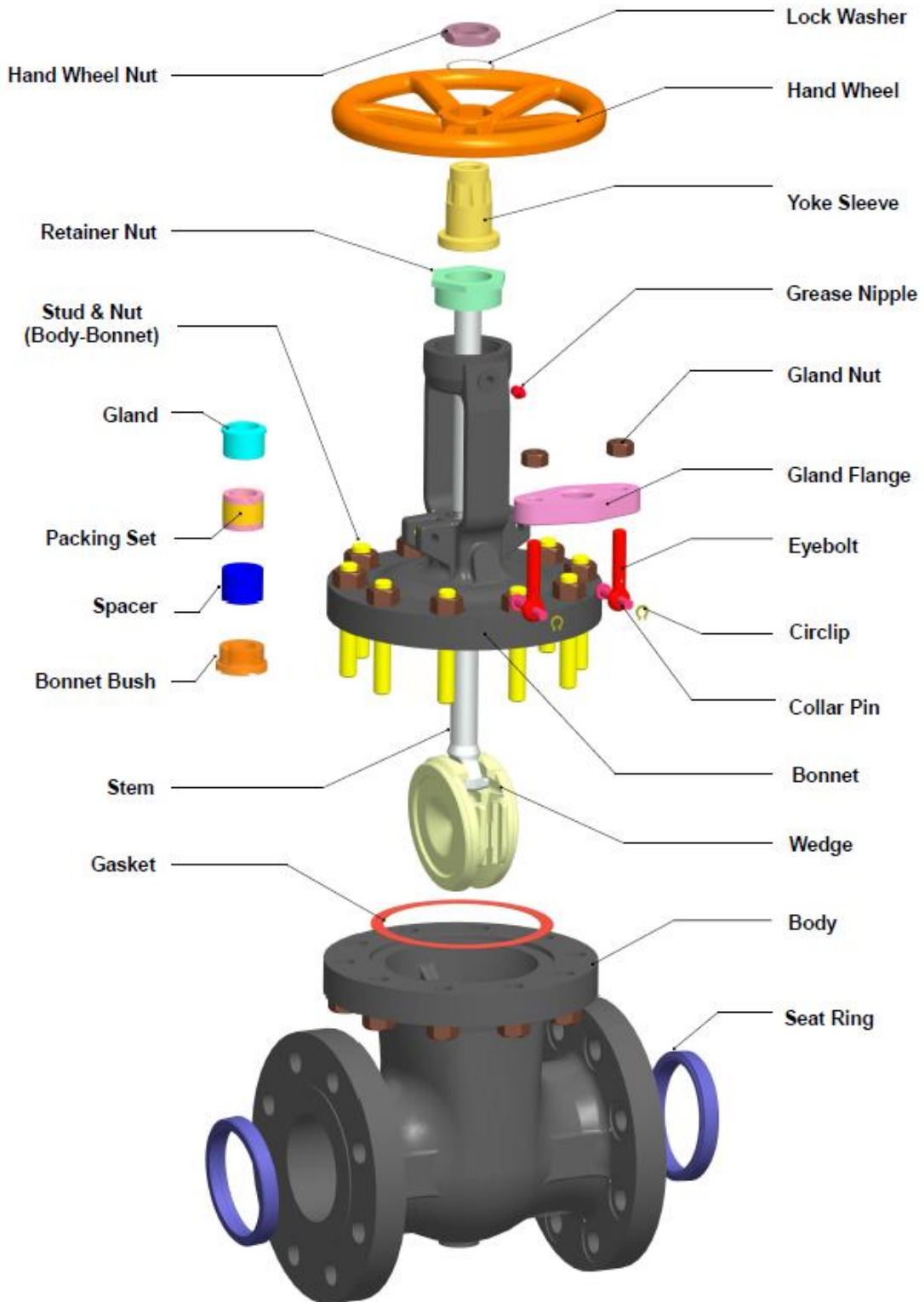


Fig. 1 Gate Valve - Typical

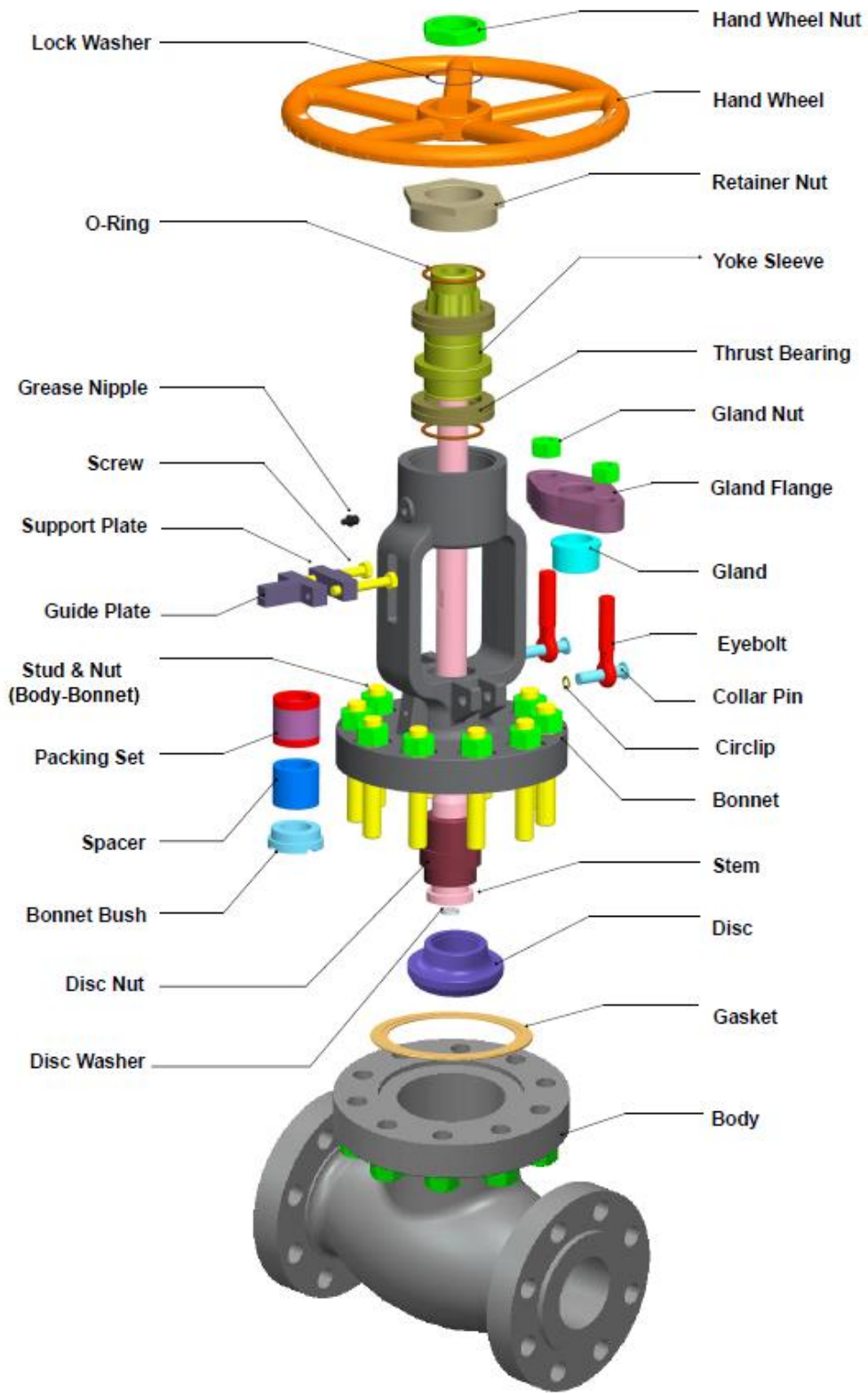


Fig. 2 Globe Valve -Typical

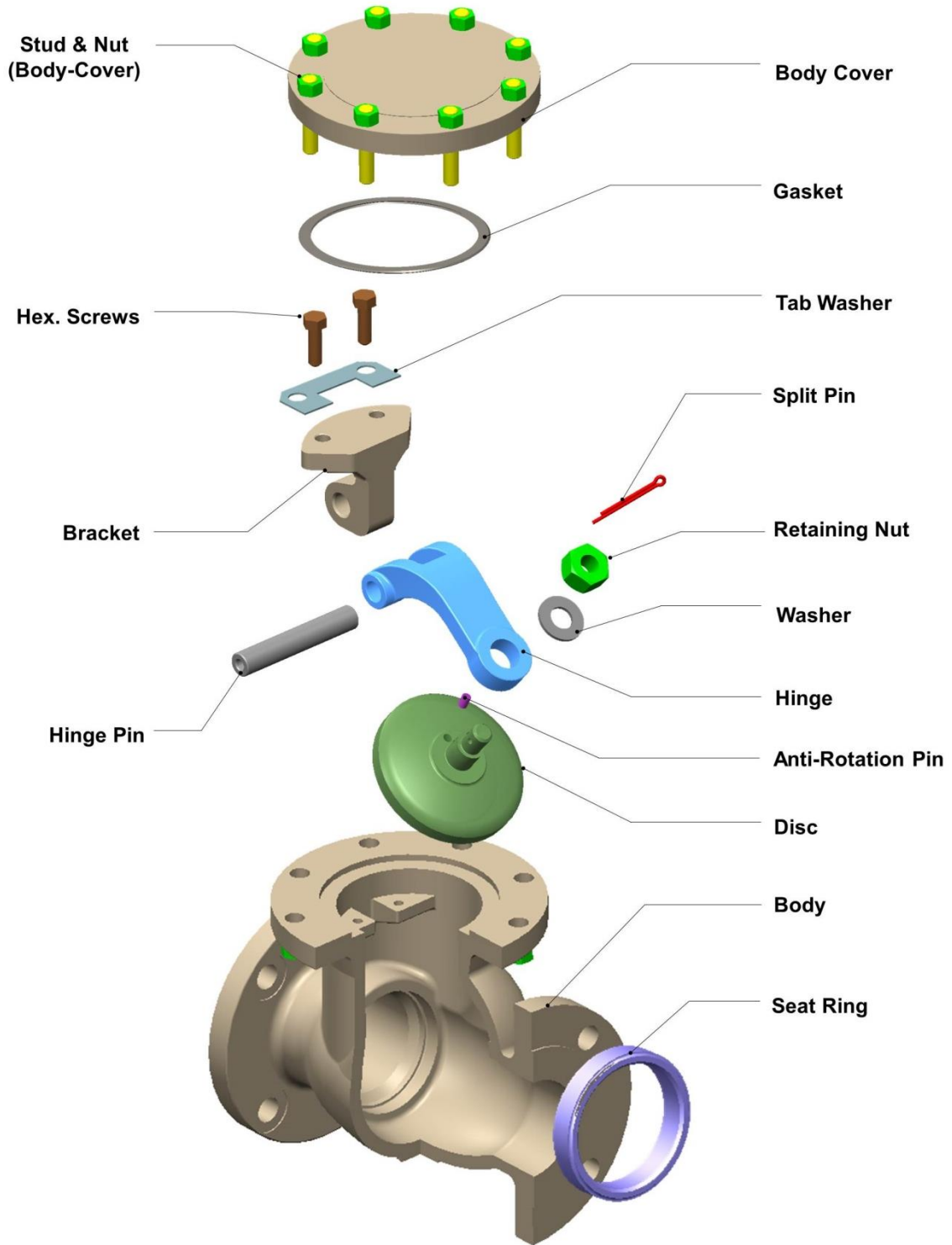


Fig. 3 Swing Check Valve (Internal Hinge type) - Typical



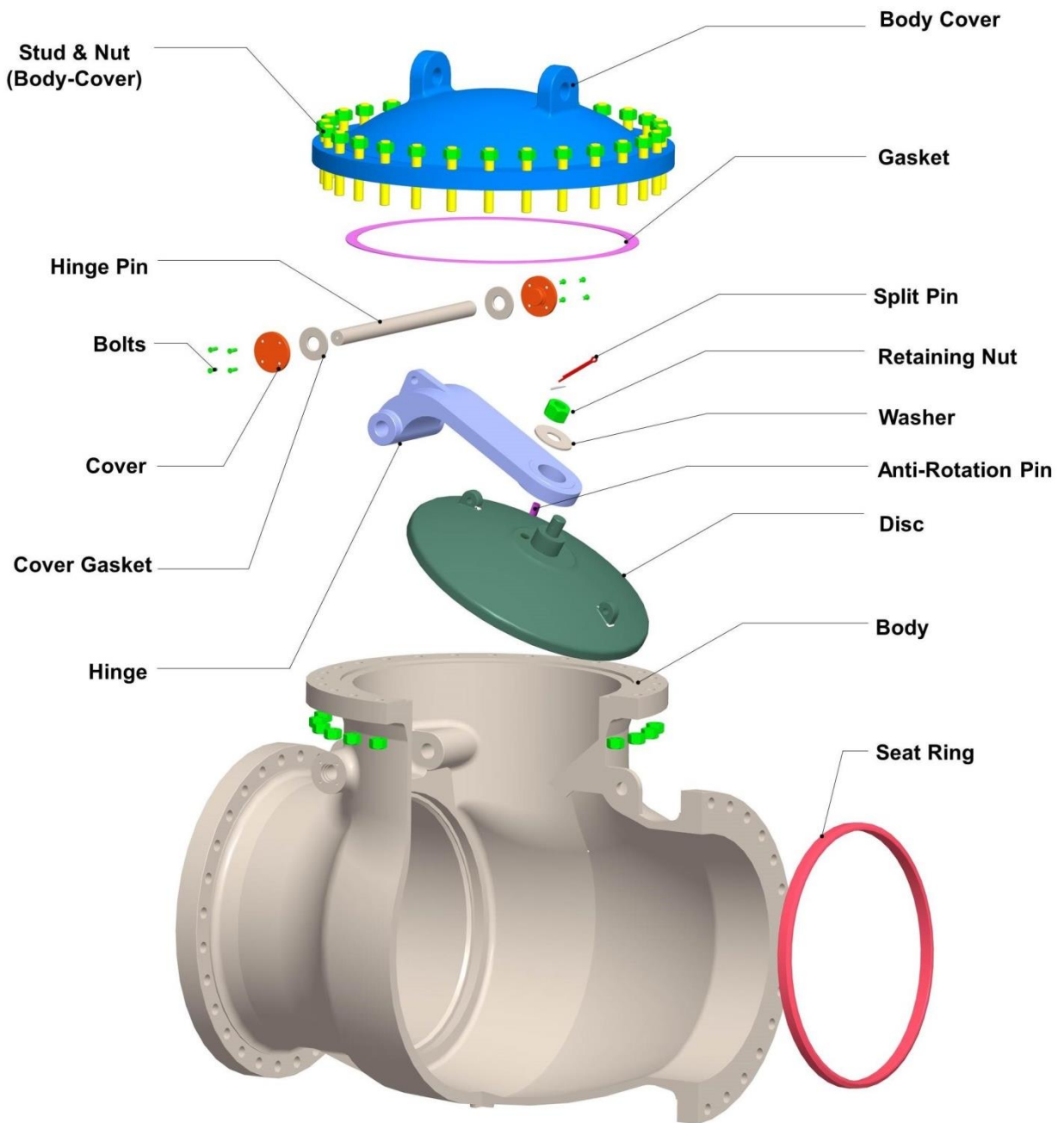


Fig. 4 Swing Check Valve (MESC cover type) - Typical

## Delivery

Orientation of the valve in the packing may be either horizontal or vertical depending on the delivered valve dimensions. Please check the packing slip attached to the container before opening the same. The valves and accessories shall be examined for any damages that might have happened during transportation and handling.

Valve identification details can be found on the identification plate and on the body of the valve. Typical identification plates are shown in Fig. 5, 6 & 7.


		<b>L&amp;T Valves Limited</b>	
API 600 / ISO 10434 ASME B16.34		Made in India	
SIZE	DN 100 (4")	CLASS	900
	153.2 BAR @ 38°C		86.3 BAR @ 425°C
BODY	WCB	CAT No	193
STEM	CR13		
DISC	HF	S. No	0001
SEAT	HF	DATE	06/2013

Fig. 5 Identification Plate Gate Valve


		<b>L&amp;T Valves Limited</b>		BS1873	ASME B16.34	Made in India	
SIZE	DN 100 (4")	CLASS	900	CAT No	493	DISC	HF
	153.2 BAR @ 38°C		86.3 BAR @ 425°C	BODY	WCB	SEAT	HF
S. No	001	DATE	06/2013	STEM	CR13		

Fig. 6 Identification Plate Globe Valve


		<b>L&amp;T Valves Limited</b>		BS1868 / API 594	ASME B16.34	Made in India	
SIZE	DN 50 (2")	CLASS	150	CAT No	513	DISC	HF
	19,6 bar @ 38°C		5,5 bar @ 425°C	BODY	WCB	SEAT	HF
S. No	001	DATE	08/2013				

Fig. 7 Identification Plate Swing Check Valve

Valves supplied for special requirements have a tag plate attached to the valve which indicates the same. Typical tag plates for special requirements are shown in Fig. 8.

⊕ SUITABLE FOR VACUUM SERVICE ⊕	
⊕ STEAM SERVICE VALVE ⊕	⊕ SUITABLE FOR HYDROGEN SERVICE ⊕ TAG No. : <input type="text"/>

Fig. 8 Typical tag plates for Special Requirements

Valves are provided with end protectors for avoiding damage to internals. Hand wheels and stem protector for gear operated valves are usually dismantled and packed separately.

**Note:**

Refer Appendix B for valves with CE & ATEX certification requirements.

## Handling and Storage

### Handling

Valves 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. For large size valves lifting lugs are provided for this purpose.

The crane wire shall 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.

Valve 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.

If the valve end protectors are removed for any check or testing, the same preservation and protection shall be done after the check or testing.

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 during storage.

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

Improper handling and /or storage may cause disc/seal damage or deformation of shaft 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 health and safety rules of work site.
- Wear all necessary personal protective equipment.
- Never use a valve on an application 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 equipment will be same as the line media temperature. The end user must take account of the line media temperature.
- If the processes or environment wherein the valves 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.
- 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 pipe line.
- Valves shall be protected by other devices to prevent over-pressurisation. (i.e., caused by temperature, fire etc.).

## Installation

### General

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

- It is recommended to install Gate and Globe valves with stem vertical up in longitudinal pipe lines. For other orientations of stem, refer to L&T valves.
- The performance of the valve 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.)
- It is recommended to install swing check valves at a distance equal to 10 times or more the pipe diameter from the upstream elbows for better performance.
- Downstream elbows have negligible effect on check valve performance; however in cases of severe downstream flow disturbances, a distance of 3 times pipe diameters is recommended between downstream elbows and check valve.
- It is recommended to install swing check valves in uniform flow lines and shall have sufficient flow to keep the disc at full open condition.
- 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.
- Some of the valves may be uni-directional, it shall be ensured that the valves are installed in the direction as marked in the body (Example: Swing check valves, Gate valves with cavity relief hole in wedge, Cryogenic gate valves etc.).
- 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 end flanges 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 closed position during installation
- The pipes/flanges shall 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-bonnet/cover joint, yoke, gland, gear unit/actuator) shall be retightened to the required torque provided in appendix.

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 flanges and 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 well lubricated for ease of installation
- Insert the gasket (not supplied with valve) and tighten the fasteners. Flange fasteners shall be tightened evenly, using suitable device in cross rotation to prevent damage to the flange.
- For sequence of tightening fasteners, 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.

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.

## Butt-welding Ends

- The valves provided with butt-welding ends preparation are as per standard ASME B16.25 or as per customer requirements. Please refer to the general assembly drawings for the exact butt-welding ends dimensions.
- The welding of valves onto the pipeline shall be performed by qualified welders using qualified procedures.
- Valves shall be kept in the closed position during welding.
- Care shall be taken to avoid weld spatter from falling onto the seating surfaces to prevent damage and maintain sealing effect between the metallic contacts.
- Local post weld heat treatment (PWHT) on the weld and heat affected zone (HAZ) shall be carried out if required by the procedure.
- It is recommended that the pipeline be flushed again after welding to avoid damage to wedge/disc and seat(s). The valve shall be kept fully open during flushing.
- After flushing is completed, operate the valve three times and ensure that it is smooth. It is recommended to carry out pressure testing of the weld joints.

## Operation

### General

- Performance 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 catalogue and general assembly drawing of the valve.

### Operation Mechanism

Gate and Globe valve opening/closing is achieved using Handwheel/Gear unit/Electrical/Hydraulic/Pneumatic Actuator.

### Gear Unit

Gear units are provided on valves for easier operation. Clockwise operation is for closing and counter-clockwise for opening of the valve (Fig. 9). The position of the valve can be noted using the position indicator provided on the gear unit. The number of turns will depend on the gear unit used.

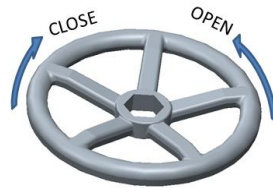


Fig. 9

Forcing the hand wheel, chain wheel against the stops will not provide tighter shutoff of the valve and may damage the seat faces, stem or gear unit.

### Electric Actuator

It gives multi-turn output and is either directly mounted on valve or on the gear unit. The actuator drives the gear unit shaft which in turn rotates the stem nut and because of this Gate / Globe valve stem travels linearly. Electrically actuated valves are provided with declutching mechanism for manual operation of the valve. For electric actuators, L&T Valves recommends to adhere to the instructions as per actuator IOM. Actuator settings are done at factory and normally resetting at site will not be required.

In Gate and Globe valves, electrically actuated valves shall be normally set as below:

Open : Position

Close : Torque

### Pneumatic / Hydraulic Actuator

Pneumatic/hydraulic actuators are fitted directly on the valve, without gear unit. It is recommended to 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 do not exert any radial loads on the valve stem, as it may lead to bending of the stem and excessive loading on the wedge. This in turn can cause the torque to increase and may lead to problem in valve operation

## Do's and Don'ts

### Do's

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.

While installing the operator, make sure that the valve is in fully closed position.

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.

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. Gate with pressure relief arrangement, Globe and Check valves have preferred sealing direction marked by an arrow on the valve body beneath the identification plate.

Make sure to supply rated voltage and frequency to the electrical actuator.

Swing check valves shall also be installed in vertical pipe line with flow in upwards direction.

### Don'ts

DO NOT lift the valve by the hand wheel, gear box, actuator or bypass arrangement.

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.

DO NOT over-tighten packing gland nuts. Over-tightening will increase the torque required to operate the valve.

DO NOT use impacting devices to tighten up the bolting on the body/bonnet (cover). Use suitable mechanical devices for tightening.

DO NOT tighten the body/bonnet nuts when the wedge/disc is in the fully closed position.

DO NOT keep the Gate valves in partial open condition to regulate flow.

## 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 50 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.

### Safety Procedure

Always prefer to 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

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

Item to Inspect	Gate	Globe / Stop Check	Check
Check for Gland leaks	✓	✓	-
Check Body-Bonnet/cover joint leaks	✓	✓	✓
Check Stem threads for Wear	✓	✓	✓
Ensure Stem and seal areas are free from debris	✓	✓	-
Check all lubrication points	✓	✓	-
Check condition of Gear Unit / Actuator (if used)	✓	✓	-
If conditions permit, operate valve	✓	✓	-
Inspect valve for obvious damage	✓	✓	✓
Inspect all external connections	✓	✓	✓

### 1. Check for Gland leaks

Check the tightness of the gland nuts and tighten evenly if required. If the leak persists, the packing shall be renewed. The pipeline shall be shut off so that there is no pressure inside the valve before the gland eye bolts are loosened. Refer assembly procedure. It should also be noted that the valve should be able to operate freely at all times. If the valve cannot operate due to excessive packing force, the packing has become worn and must be replaced during a system shutdown.

**Caution:** Do not overstress the bolting.

**Caution:** Do not attempt to replace gland packing when the line is under pressure.

### 2. Check for Body Bonnet/Cover Joint leaks

Check the tightness of the bolting and tighten the bolts at the vicinity of the leak. If the leak still persists, renew the gasket. The section of the pipe shall be shut off to ensure no pressure is trapped in the line, before dismantling the bonnet.

For the valves which are used at high temperature application, it is recommended to retighten the flange bolts after one month of operation to avoid the leak through joints.

**Caution:** Do not overstress the Bolting.

**Caution:** Do not attempt to replace gasket when the line is under pressure.

### 3. Check all Lubrication points

Grease the stem threads and Yoke sleeve in Gate and Globe valves periodically to reduce wear, operating torque, and to deter corrosion. Care should be taken to ensure that only the threaded portion of the stem is lubricated. (Grease: Copper gel or equivalent)

### 4. Check condition of Gear Unit / Actuator

Gear operated valves are fitted with enclosed water tight bevel gear units. Generally the gear units are filled with grease (ZENITH EPSB-1 or equivalent). They do not require any additional maintenance. However in case extreme difficulty in operation, remove the top cover and refill the grease.

In case of Actuator operated valves, the actuator shall also be operated to check smooth operation.

## Dismantling and Assembly Procedure

### Dismantling Procedure

- All valves are designed to permit inspection without removing the body from the pipeline. The section of the pipe shall be shut off to ensure no pressure is trapped in the line, before dismantling the valve for inspection.
- Gate and Globe valves can be inspected by removing the bonnet assembly. However, the valves shall be kept in fully open or partially open position to relieve pressure in the body cavity before removing the bonnet assembly.
- Check valves can be inspected by removing the cover.
- In case of Check valve, there is no stem and hence only the cover is to be removed. The disc is hinged inside the body. For ease of illustration only the word bonnet is used below in the dismantling and reassembly procedure. This may be changed to read as cover with respect to Check valves.
- Keep the valve in mid position and remove the handwheel / gear unit / actuator from the top of the valve (Fig. 10).
- Loosen the body-bonnet bolting and remove the studs and nuts
- Lift the bonnet assembly including stem and wedge out of the body (Fig. 11). Care shall be taken not to drop the wedge while lifting out.
- Mark the matching surfaces of the gate and body seat rings of Gate valves so that they are not interchanged during assembly.
- Remove the bonnet gasket.
- Carry out the required replacement of the parts and reassemble the valve with new parts
- For gear unit or actuator orientation change, refer Appendix A3.



Fig. 10

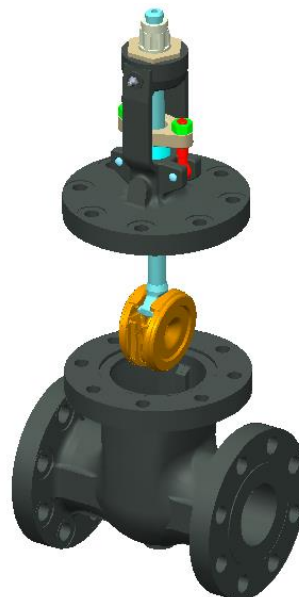


Fig. 11

## Assembly Procedure

- Place the gasket on body correctly. It is recommended to use fresh gasket. Refer Gasket Replacement Procedure.
- Lower the bonnet assembly including the wedge smoothly into the body, keeping the wedge in open position. Remember to match the marking done earlier on wedge and body seat rings.
- A blue bearing test will confirm if there is a uniform contact between wedge and body seat rings.
- If required replace the gland packing. Refer Packing Installation Procedure.
- Tighten the gland nuts as per torque given in Table 2.
- Fit the bonnet studs and tighten the nuts as per torque figures shown in Table 1, evenly working at diagonally opposite pairs. Do not over tighten as the gasket may get damaged.
- Assemble the Handwheel / Gear unit.
- Operate the valve from fully closed to fully open position manually and ensure smooth operation.

## Packing & Gasket Maintenance

### Packing Maintenance

Inspection of the gland leak should be a part of routine maintenance. If gland leak is noticed, the bolts holding the gland flange should be re-tightened gradually until leakage stops. If satisfactory sealing could not be achieved by this process, it may be desirable to increase or to replace the packing.

**Caution:** Extreme care should be taken when working on or around any pressurized equipment.

**Caution:** Excessive tightening of bolting may lead to over-compression of the packing against the stem, thereby producing excessive wear, loss of packing material and higher valve operating torque.

If gland travel reaches its maximum and leakage doesn't cease, the stem must be inspected for anomalies. Any deterioration in the surface finish of stem, particularly the region which is in contact with the packing such as dents, scratches, pitting or corrosion could be a potential cause for the leakage problems. Regular operation will minimize the chances of corrosion between the stem and packing. Misalignment of the stem could also be a reason for scratches which might cause gland leak. If any of the above conditions exist, the stem must be reworked or replaced. If none of the above anomalies could be observed in the stem, replacement of the packing may be necessary.

Replacement packing shall be ensured to be suitable for the operating conditions. The stuffing box shall be ensured to be dry and free from any sort of contamination. The following procedure must be followed for the replacement of packing on site.

## Packing Replacement Procedure

- It is always recommended to depressurize the line in which the valve is installed prior to replacing the packing. If this is not possible, the valve shall be opened to back seat so that the pressure could be arrested from entering the stuffing box.
- Loosen and remove nuts holding the gland flange in place. The gland flange and the gland will be free to move up the stem and the stem packing is exposed.
- Remove the old packing. Care should be taken to ensure that tools used to remove packing do not scratch either the stem shaft or the inside of the stuffing box. Clean shaft and box thoroughly.
- Replace original packing with the new ones as per the following instructions. In most cases, the packing will be die-moulded graphite / split braided filament rings.
- To open the split braided filament ring, twist the open ends in opposite directions to resemble an 'S' (Fig.12). In case of solid die-moulded packing, use a sharp knife and cut the rings at 30° angle. Slightly twist the ring and insert it around the stem. Do not open up the rings too much as it could get damaged.



Fig.12 Split braided filament ring

- Install each packing ring separately, tapping each ring after complete insertion to avoid air gaps / voids. The gland shall be used to set right the packing in the bottom of the stuffing box.
- The joints of split packing rings should be staggered 90 degrees to 120 degrees from the joints of adjacent rings.
- If lantern ring was provided, make sure it is replaced in its original position.
- Replace the gland and gland flange as was in the original condition and tighten the gland nuts to the torques mentioned in **Table 2** of Appendix A.
- Operate the valve a few times to ensure all parts are working smoothly.
- Inspect valve for leakage a week after installation.

## Gasket Maintenance

Inspection of the valve body/bonnet joint should be a part of routine maintenance. In addition to improper gasket installation procedure, temperature or pressure changes, vibrations, etc. also may cause leakage. If re-tightening of the bolting does not cease the leakage, the flanges shall be unbolted and gasket and sealing surfaces in the flanges needs to be inspected.

## Gasket Replacement Procedure

- Inspect the gasket seating surfaces and ensure it is devoid of any tool marks, cracks, scratches or pitting by corrosion.

- Replacement gasket shall be ensured to be suitable for the operating conditions. Inspect the gasket surfaces and ensure it is devoid of any damage.
- Threaded contacts in the stud bolts and nut shall be lubricated prior to reassembly.
- Install the stud bolts on the lower half of the flange. Insert the gasket between the flange facing to allow the bolts to center the gasket with respect to the valve neck bore. Install the balance of the bolts and nuts and bring all to a hand-tight condition.
- Tighten the bolts in the star pattern as indicated in **Appendix A** to the torque provided in **Table 1** of **Appendix A**. The sequence of bolt tightening is vital to avoid any leakage between the flanges and should be done with utmost care. It is also recommended to tighten the bolt in stages of 30, 60 and 100 percent of the final torque to ensure the bolts do not get over stressed.
- For the valves which are used at high temperature application, it is recommended to retighten the flange bolts 24 hours after the valve experiences the operating pressure and temperature to compensate for any relaxation or creep that may have occurred.

## Troubleshooting

Problem	Reason	Action
Valve Leaking	Valve not closed fully	Re-tighten the handwheel
	Valve seating damage	Dismantle and lap the seating
	Bypass valve not closed fully	Close the bypass valve fully
	Bypass valve seat may be damaged	Check the seating of the bypass valve
Not closing fully	Debris inside the valve	Clean the pipeline
Leakage through Gland	Packing loosened	Tighten the gland bolts
	Packing worn out	Replace the packing
Leakage through Bonnet / Cover joint	Bonnet / Cover bolting loose	Tighten the bolting
	Gasket damage	Dismantle and replace the gasket

## APPENDIX A

### TECHNICAL INFORMATION

#### A1 - References

##### Face to Face Dimensions

ASME B16.10	Face-to-Face and End-to-End Dimensions of Valves
04-SAMSS-001	Gate Valves (Saudi Aramco Specification)

##### End Connections

ASME B16.5	Pipe Flanges and Flange Fittings (NPS ½ through NPS 24)
ASME B16.47	Large Diameter Steel Flanges (NPS 26 through NPS 60)
ASME B16.25	Buttwelding Ends

##### Testing Standard

API 598	Valve Inspection and Testing
EN12266 PART-1	Industrial Valves - Testing Of Valve

#### A2 - Tightening Sequence & Torque

The tightening sequence for all possible number of bolting, the star logic to be followed is explained below:

- Tighten the first four nuts in the sequence shown Fig.13. This helps in correct location of the mating parts.
- Tighten the other bolts in the sequence shown Fig.14.
- The sequence goes clockwise around the bolt.
- Ensure that the recommended torque (refer Table1 & 2) is maintained in all bolting.

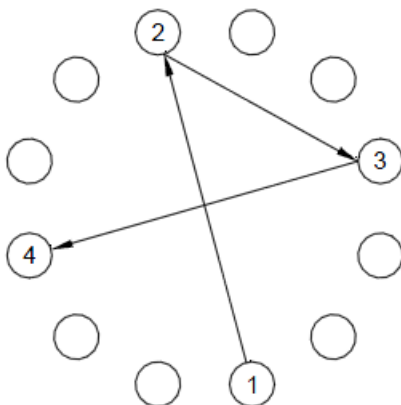


Fig.13. Initial Tightening

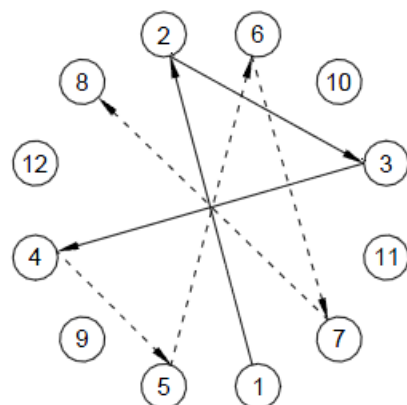


Fig.14. Sequence of Tightening

**Table 1 Body-Bonnet/Cover Tightening Torque**

THREAD SIZE, inch-TPI	TORQUE, Nm		
	B7/B7M/B16/L7/L7M/ L43/660 CL.A/UNS N07718/UNS 09925	B8 CL.2/B8C CL.2/ B8M CL.2/B8T CL.2/ XM-19	UNS N06625 Gr 1
1/4-20 UNC	7	7	5
5/16-18 UNC	15	15	10
3/8-16 UNC	25	25	15
7/16-14 UNC	40	40	25
1/2-13 UNC	60	60	40
9/16-12 UNC	90	90	60
5/8-11 UNC	120	120	80
3/4-10 UNC	215	215	145
7/8- 9 UNC	345	315	230
1-8 UNC	520	475	345
1.1/8-8 UN	765	625	510
1.1/4-8 UN	1075	880	715
1.3/8-8 UN	1460	975	975
1.1/2-8 UN	1925	1285	1285
1.5/8-8 UN	2480	1655	1655
1.3/4-8 UN	3140	2090	2090
1.7/8-8 UN	3900	2600	2600
2-8 UN	4775	3180	3180
2.1/4-8 UN	6900	4600	4600
2.1/2-8 UN	9575	6380	6380
2.3/4-8 UN	12865	8575	8575
3-8 UN	16835	11225	11225
3.1/4-8 UN	21545	14365	14365
3.1/2-8 UN	27065	18045	18045

lbf.ft = Nm / 1.35582

**Table 2 Gland Tightening Torque**

VALVE SIZE	TORQUE, Nm											
	GATE VALVES						GLOBE VALVES					
	CLASS											
	150	300	600	900	1500	2500	150	300	600	900	1500	2500
2"	10	15	20	35	35	90	10	15	30	125	205	715
2.1/2"	15	20	-	-	-	-	-	-	-	-	-	-
3"	15	20	35	-	70	185	20	20	55	120	315	1555
4"	20	20	50	55	90	-	30	40	80	190	445	-
5"	30	40	-	-	-	-	-	-	-	-	-	-
6"	30	40	90	100	135	490	30	65	105	375	1330	-
8"	30	45	95	135	220	-	55	115	200	505	1530	-
10"	35	65	125	180	335	1150	60	100	240	790	3515	-
12"	55	70	155	270	445	-	60	175	650	1590	-	-
14"	55	75	230	290	585	-	95	245	720	-	-	-
16"	60	90	240	290	-	-	145	-	-	-	-	-
18"	75	115	255	380	1185	-	155	-	-	3065	-	-
20"	90	120	270	470	-	-	205	-	-	-	-	-
22"	95	175	-	-	-	-	-	-	-	-	-	-
24"	135	185	330	770	2415	-	-	-	-	-	-	-
26"	140	200	525	-	-	-	-	-	-	-	-	-
28"	145	260	600	-	-	-	-	-	-	-	-	-
30"	155	260	650	-	-	-	-	-	-	-	-	-
32"	155	260	-	-	-	-	-	-	-	-	-	-
34"	190	480	685	-	-	-	-	-	-	-	-	-
36"	190	480	805	-	-	-	-	-	-	-	-	-
38"	205	505	-	-	-	-	-	-	-	-	-	-
40"	330	530	1000	-	-	-	-	-	-	-	-	-
42"	340	560	1000	-	-	-	-	-	-	-	-	-
44"	345	-	-	-	-	-	-	-	-	-	-	-
48"	395	735	-	-	-	-	-	-	-	-	-	-
54"	465	1155	-	-	-	-	-	-	-	-	-	-
56"	465	-	-	-	-	-	-	-	-	-	-	-
60"	485	1400	-	-	-	-	-	-	-	-	-	-
64"	720	-	-	-	-	-	-	-	-	-	-	-
72"	810	-	-	-	-	-	-	-	-	-	-	-

lbf.ft = Nm / 1.35582



**Note:**

Gland Tightening Torque values provided is applicable for standard graphite die-moulded packing with split braided filament end rings. Torque value will depend on the packing material used. For other packing materials, please consult factory.

**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 yoke 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 yoke, lift the actuator/ gear unit slightly and rotate it for few turns in counter-clock wise direction so as to remove the stem from actuator bush. Thus actuator/gear unit can be dismounted from valve. (Fig. 15 & 16)

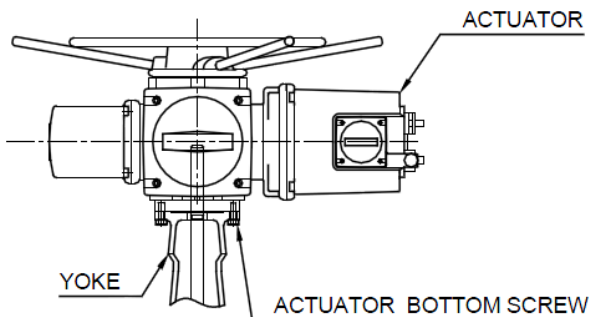


Fig. 15

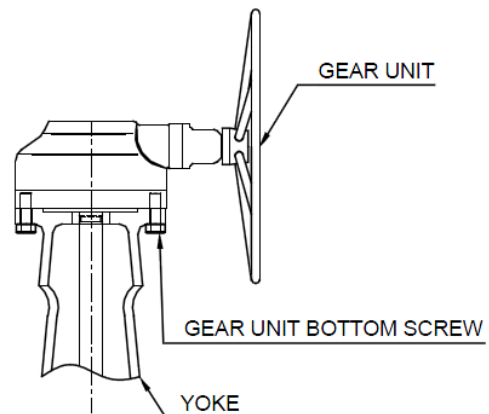
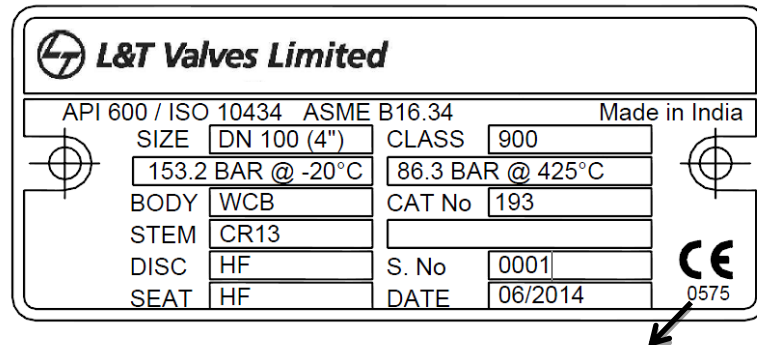


Fig. 16

## APPENDIX B

For valves with CE & ATEX 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, pressure-temperature rating as shown below



According to PED 97/23/EC

Fig.B.1 'CE' Marking Name Plate

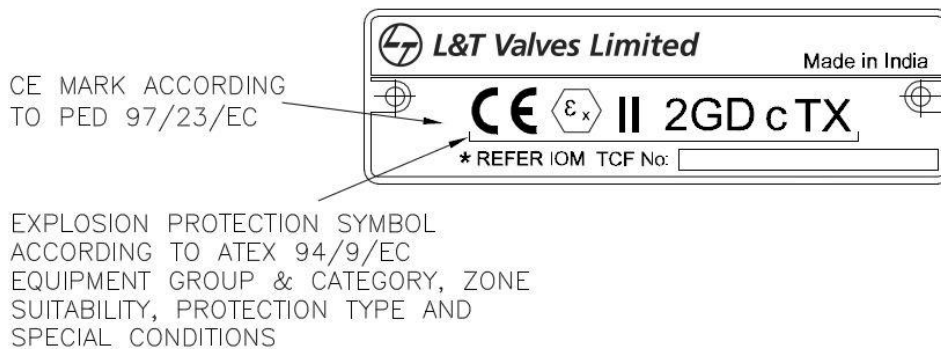


Fig.B.2 ATEX Name Plate

Definition of name plate marking above:

- 'II' = Equipment group
- '2' = Equipment category
- 'G' = Gas zone suitability (Zones 1 & 2)
- 'D' = Dust zone suitability (Zones 21 & 22)
- 'c' = Type of protection (i.e.) constructional safety (EN 13463-5)
- 'X' = Special conditions (EN 13463-1).
- **Special Condition: X**

Surface temperature: As per EN 13463-1:2001(E) paragraph 14.2.g, the temperature class or maximum surface temperature cannot be marked on the product as it is dependent on the operating conditions. However the maximum allowable operating temperature for the product is marked on the nameplate.

- Material tractability markings are hard marked on the valve body

CAUTIONARY NOTES



#### 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).
- 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.).
- End user to ensure that the accessories (actuator, limit switches, solenoid valve, etc.) if fitted with valve are of ATEX qualified as per the directive.
- Valves are not suitable for terminal connections. In such cases, valves shall be fitted with blind flanges.



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*As we continuously endeavor to improve our products, the data given herein is subject to change. Please refer [www.lntvalves.com](http://www.lntvalves.com) for the latest IOM.*