

# MICROFINISH CRYOGENIC BALL VALVES

## INSTALLATION OPERATION AND MAINTENANCE MANUAL



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## 1.1 INTRODUCTION

Microfinish Cryogenic Ball Valves have been designed and manufactured to give you long, excellent and trouble free service.

This manual provides you with all the relevant information to install, operate and maintain the valve for long trouble free life. **Please note that all the drawings provided in this manual are typical views.**

### **CAUTION:**

1. **The valves should be used in a system and ensure that pressure and temperature limits (as specified in name plate) are not exceeded.**
2. **Valve surface temperature may become extremely cold due to operating conditions. Prevent any type of direct contact with the valve that may harm the workers.**
3. **The valve should be used in a well designed, adequately supported piping system such that it will not be subjected to undue forces or hydraulic shocks during service.**
4. **The valves are not designed to operate during or after earthquakes or under fatigue conditions. It is the responsibility of the owner to determine if fatigue conditions exist.**

## 2.1 PRIOR TO INSTALLATION

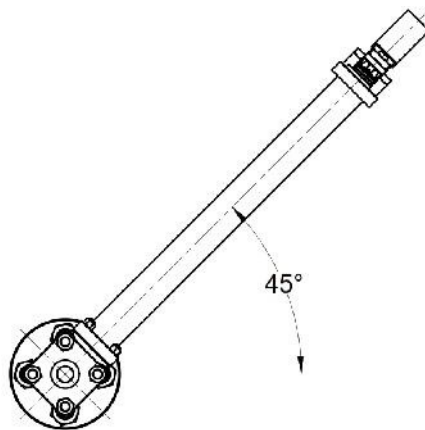
- 2.1 On receipt of material check for any damage during transportation.
- 2.2 Wrapping and protection applied should be left in place until the valve is installed.
- 2.3 If the valves are left exposed, they should be protected against entry of foreign material in the valve parts.
- 2.4 Flush the pipe clean before mounting the valve in the pipeline, impurities such as sand and parts of welding electrodes could damage the ball surface and the seats.
- 2.5 If the valves are stored for the long time, they should be cleaned, lubricated and tested prior to installation. It is advisable to store the valve in full open position.
- 2.6 In lever operated valves, the position of the handle is an indication of whether the valve is open or closed. When the handle is aligned with axis of the pipe the valve is in open. When it is perpendicular to the pipe, the valve is in closed position.

**CAUTION:** Microfinish recommends that all products which must be stored prior to installation be stored indoors, in an environment suitable for human occupancy. Do not store product in areas where exposure to relative humidity above 85%, acid or alkali fumes, radiation above normal background, ultraviolet light, or temperatures above 49°C or below 4°C may occur. Do not store within 50 feet of any source of ozone.

## 3.1 INSTALLATION

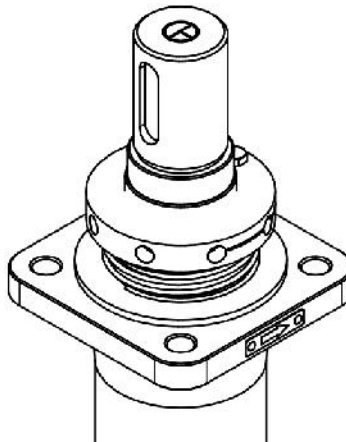
- 3.1.1 Keep the valve on its polyethylene bag until ready for use. Check the valve nameplate for identification of materials.
- 3.1.2 All the Microfinish Cryogenic Floating Ball Valve is Uni-directional for flow in one direction only and therefore can only be installed in one direction. With the valve in the closed position, install it with the relief hole in the ball on the upstream side to ensure that cavity relief is upstream. Note arrow stamped on the body, on a metal tag welded to the body, or on the bonnet plate indicating flow path.

**CAUTION:** Microfinish recommends, the Cryogenic Valves should be mounted in vertically position only or bonnet not tilted more than 45° from the upright vertical position. (Refer Figure-1)



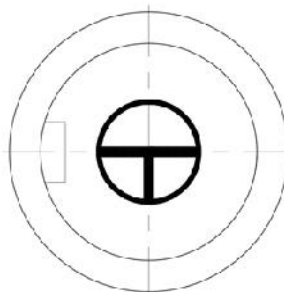
**Figure-01**  
**Valve Tilting Limitation**

3.1.3 All Microfinish cryogenic Floating Ball valves are uni-directional and must be installed for flow in one direction as indicated by arrow on the bonnet pad. (Refer Figure-2)



**Figure-02**  
**Direction of Flow**

3.1.4 When the valve is in the closed position the ball relief hole will be seen in the upstream port of the valve as indicated by the arrow. The stem head has an engraved mark identifying the ball port and the pressure relief hole direction (Refer Figure-3)

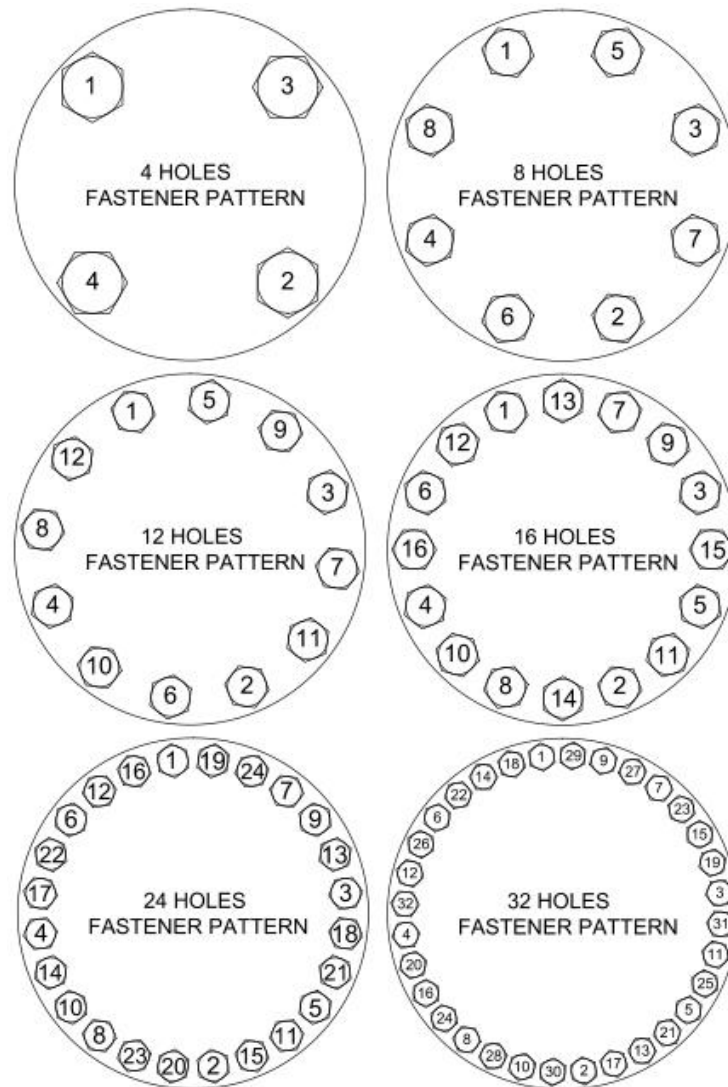


**Figure-03**  
**Valve Top View**

- 3.1.5 Valve should not be designed to carry the weight of the piping. To avoid distortion and jamming. Proper support of the pipeline will minimize strain on the valve caused by shock in the pipe system. The valve can be supported by its body with pipe clamps and supports. Do not fasten supporting structure to the valve flanges.
- 3.1.6 Do not attempt to correct pipe misalignment by means of flange bolts.
- 3.1.7 If necessary, tighten the gland packing uniformly during the trial operation of the valve.
- 3.1.8 When mounting the screwed end, butt weld end, socket weld end and flanged end type valves the following respective procedures must be followed, for better performance.

### 3.2 FLANGED END VALVE INSTALLATION

- 3.2.1 Be sure that flange gasket and fasteners are suitable for the operating conditions.
- 3.2.2 Insert the valve in fully open position, along with suitable gasket between valve flange and mating flanges. Align the flange both holes and hold in the place.
- 3.2.3 Hold the nut first on backside of the valve and then insert the bolts.
- 3.2.4 Tighten all the bolts to finger tight.
- 3.2.5 Use two spanners to tighten the joint, in the sequences as shown (Figure-4)



**Figure-04  
Bolting Sequence Chart**

### **3.3 SCREWED END VALVE INSTALLATION.**

- 3.3.1 Keep the valve in 'Full open' position
- 3.3.2 Clean the both mating parts before assembly.
- 3.3.3 Valves with screwed ends should be treated as a single unit and should not be dismantled when installing to the pipeline.
- 3.3.4 Use correct size wrenches with flat jaws on hexagon or octagon ends.
- 3.3.5 Do not use undersized threads on section pipe where the valves are to be installed.

### **3.4 SOCKET WELD END VALVE INSTALLATION**

- 3.4.1 Keep the valve in 'Full open' position.
- 3.4.2 Clean the both mating parts before assembly.
- 3.4.3 First insert the pipe to full depth of the socket then pull out about 1.5mm and weld it.
- 3.4.4 Provide adequate support to the pipe on each side of the valve prior to welding.
- 3.4.5 Weld on each ends of the valve with continuous bead. The welding rod should not be exceeding 3.2mm diameter.
- 3.4.6 While welding, do not allow the temperature of valve body seat area to exceed 120°C (248°F) to prevent seat and seal damage. Use a temperature stick and a wet cloth wrapped around the center section to prevent overheating.
- 3.4.7 When socket end valves are purchased with not extended nipple, before welding remove the central body along with ball and seats, place a spacer of same dimensions and then weld the ends.
- 3.4.8 Remove the spacer and reassemble the valve body assembly when the system cools down to ambient temperature.

### **3.5 BUTT WELD END VALVE INSTALLATION**

- 3.5.1 Keep the valve in 'Full open' position.
- 3.5.2 Clean the both mating parts before assembly.
- 3.5.3 Welding of valves shall be performed by a qualified welder according to the ASME Boiler Construction Code Section IX.
- 3.5.4 Align the valve to pipe line, ensuring proper fit to minimize pipe load, and maintain the 2 to 3mm gap co-axially.
- 3.5.5 Use an internal welding backing ring where practical.
- 3.5.6 While welding, do not allow the temperature of valve body seat area to exceed 120°C (248°F) to prevent seat and seal damage. Use a temperature stick and a wet cloth wrapped around the center section to prevent overheating.
- 3.5.7 Do not allow rapid application of excess welding material.
- 3.5.8 After finishing the welding operation clean the pipeline and valve parts by flushing or pigging to remove the impurities formed during welding.
- 3.5.9 It is recommended not to rotate the valve to the closed position before flushing the line.

### **4.0 OPERATION AND MAINTENANCE**

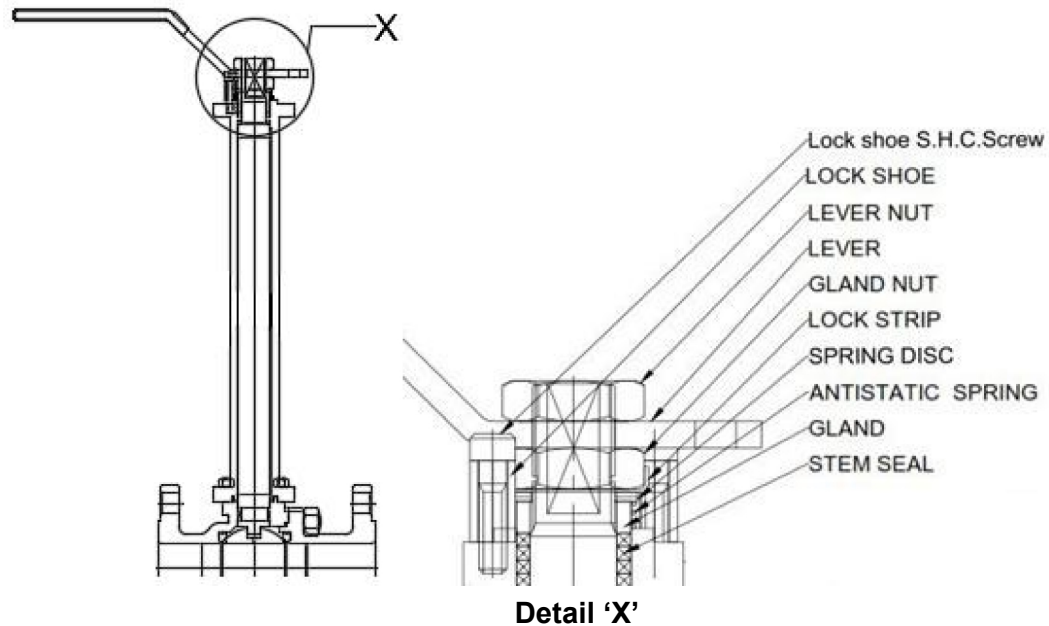
- 4.1.1 Flush the valve and pipeline with nitrogen, whilst preventing the introduction of air, moisture or water into the cryogenic valves and pipelines, as this will freeze the valve and render in inoperable.
- 4.1.2 Valve is intended for on-off service only; it should not be used for throttling services.
- 4.1.3 The cryogenic ball valve needs no regular maintenance or lubrication.
- 4.1.4 Valve should be "fully opened" or "fully closed" to prevent damage to the seat and ball caused by wire drawing.

- 4.1.5 Valves should be opened and closed slowly to avoid hammering effect on the valve and pipeline.
- 4.1.6 After a long service life, when through valve leakage is observed, the seats can be interchanged.
- 4.1.7 Do not try to correct the through valve leakage by giving packing pieces behind the seat to make it tight. Instead replace the seat.
- 4.1.8 If a through leak occurs, ensure that the valve is fully closed. Don't use extra leverage or extra force on the stem to prevent leakage. If leakage persists, replacement of seats is necessary.
- 4.1.9 If a body seal leak develops, do not over tighten the body end cover studs and nuts. This may damage the valve. Instead body seal should be removed and replaced by new one.
- 4.1.10 If stem leak develops, tighten the gland nut until leakage has been stopped. If the stem leak cannot be stopped then replacement of stem packing is necessary.
- 4.1.11 Replacement of stem packing:  
When replacing the packing, be sure that the valve is not under pressure. Remove all accessories including actuator to give access to the packing. After loosening and removing the gland nut, the packing can be removed by means of a hooked wire.
- 4.1.12 Stem packing adjustment;
  - a. Microfinish valves include the feature of an externally adjustable stem seal in the event there is leakage experienced from the stem area.
  - b. If possible, relieve any pressure within the valve during the adjustment process. If this is not possible, it is still safe to perform this adjustment on a valve in the field.
  - c. Operate the valve once in the No load condition.
  - d. Loose the Gland Nut / Chuck Nut for 2 rounds.
  - e. Operate the valve for 3 times
  - f. Tight the Gland Nut / Chuck Nut as per [Table-01](#) column "X".
  - g. Again loose the Gland Nut / Chuck Nut.
  - h. Operate the valve for 3 times.
  - i. Retighten the Gland Nut / Chuck Nut as per [Table-01](#) column "Y".
  - j. Operate the valve for 3 times.
  - k. Record the No load torque.
  - l. If this first action has not stopped the leak, repeat steps "d" to "j". Only perform this adjustment action a maximum of 3 times. If the leakage has not stopped after three attempts, stop the test as further attempts could be detrimental to elements of the stem packing system.

<b>BALL VALVE CHECK NUT TIGHTENING TORQUE (Nm)</b>				
<b>CHECK NUT SIZE</b>	<b>GRAPHITE</b>		<b>PTFE</b>	
	<b>X</b>	<b>Y</b>	<b>X</b>	<b>Y</b>
M10x1.5	10	5	9	5
M12x1.25	15	7	13	5
M18x1.5	19	11	17	11
M22x2	22	19	20	15
M30x2	29	19	27	18
M40x2	34	22	32	20
M48x2	60	38	40	50
M60x2	70	47	90	70
M68x2	80	70	120	90
M74x2	90	82	140	100

**Table No- 01 Check Nut Tightening Torque**

Part	Quantity
Thrust Washer	1
Stem Seals	5
Bonnet Seal	1
Seats	2
Thrust Bearing	1
Body Seals	2



**Figure-05**

For smaller valves with a double nut design, the Gland nut is held in place by a locking strip. The adjustment of the stem seal to tighten the packing cannot be carried out while this locking clip is firmly in place. It first needs to be loosened by pulling back the tabs from the nut with a flathead screwdriver, so the nut can be rotated and reset the stem seal. When the action is complete, you need to re-secure the locking strip to the nut by pushing back up the tabs.

## 5.0 DISASSEMBLY

For your safety and protection, it is important that the following precautions be taken prior to removing the valve from service or before any disassembly of the valve.

**CAUTION:** Do not try to operate a valve that exhibits any sign of leakage. Isolate the valve and either repair or replace it.

### 5.1 DISASSEMBLY FROM PIPE LINE

- 5.1.1 Keep hands out, since remotely actuated valves could close at any time. Disconnect all auxiliary piping of jackets and pneumatic or electric connection.
- 5.1.2 Wear any eye shield, protective clothing, gloves, and footwear. Have available running water. Have a suitable fire extinguisher when media is flammable.
- 5.1.3 De-pressurize all the lines and drain the system fluid. Cycle the valve several times to relieve any pressure still inside the valve
- 5.1.4 Keep the valve in full open position. Remove the valve and place it on a level surface in vertical position.

## **WARNING!**

<b>VALVES SHALL NOT BE DISMANTLED IN CLOSED POSITION</b>
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### **5.2 DISASSEMBLY OF THE FLOATING BALL VALVE**

- 5.2.1 Flush the valve to remove the residuals in the valve
- 5.2.2 Support the valve on a platform.
- 5.2.3 Remove all accessories if fitted and also adapter, lever or gear operator.
- 5.2.4 Remove check nut / gland nut, spring, locking plate, gland and bonnet.
- 5.2.5 Unscrew the body end connection studs and separate the body and end pieces/tail piece.
- 5.2.6 Place the disassembled parts on clean wooden or cardboard surface. Do not keep ball and seats on cement or metal surfaces to avoid damage.
- 5.2.7 Take out the seat rings and body seal. Body seal to be replaced during re- assembly.
- 5.2.8 Keep the valve in CLOSED position and remove the ball.
- 5.2.9 Push the stem into the body cavity and then takeout through the end port. Remove the stem washer and stem seal.
- 5.2.10 Clean all parts carefully. If necessary use suitable solvent.
- 5.2.11 Check all the sealing surfaces and parts for damage or uneven wear. Minor scratches or flashes on the ball surface can be removed using a fine abrasive cloth.
- 5.2.12 Check the condition of the stem.

### **5.3 DISASSEMBLY OF TRUNNION MOUNTED BALL VALVE – 2PC**

- 5.3.1 Follow the points in clause 5.2.1 to 5.2.3.
- 5.3.2 Remove lever / adapter or gear operator and bracket.
- 5.3.3 Remove check nut, spring disc, gland and anti-static spring.
- 5.3.4 Remove stuffing box, stuffing bearing, stuffing box seal and bonnet.
- 5.3.5 Pull the stem from top and take out. Remove anti-static spring, stem washer and stem seals.
- 5.3.6 Remove trunnion and trunnion seal.
- 5.3.7 Unscrew the body end connection studs and separate the body and tailpiece.
- 5.3.8 Remove seat retainer, lip seal and seat springs from body and tailpiece
- 5.3.9 Remove the ball from body and also remove trunnion bearing and thrust washer.
- 5.3.10 Remove seat retainer from body and springs.
- 5.3.11 Place all parts on clean soft surface. Do not keep the parts on cement or metal surfaces to avoid damage.
- 5.3.12 Clean all the parts carefully. If necessary use suitable solvent.
- 5.3.13 Check all the sealing surfaces and parts for damage or uneven wear. Minor scratches or flashes on the ball surface can be removed using a fine abrasive cloth.
- 5.3.14 Check for the wear or any damage at all the sealing area of stem, ball, seat, bearings and stuffing box bore. Correct / replace the damaged parts if necessary.

### **5.4 DISASSEMBLY OF TRUNNION MOUNTED BALL VALVE - 3PC**

- 5.4.1 Follow the points in clause 5.2.1 to 5.2.3
- 5.4.2 Remove lever / adapter or gear operator and bracket.
- 5.4.3 Remove gland flange.
- 5.4.4 Remove stuffing box, stuffing bearing, stuffing box seal and bonnet.
- 5.4.5 Push the stem from top and take out from bottom. Remove anti-static spring, stem washer and stem seals.

- 5.4.6 Remove ball support bottom plate, ball support washer and ball bearing.
- 5.4.7 Unscrew the body end connection studs and separate the body and both tailpieces.
- 5.4.8 Remove seat retainer, lip seal and seat springs from body and tailpiece.
- 5.4.9 Remove the coil springs.
- 5.4.10 Remove the ball from body.
- 5.4.11 Place all parts on clean soft surface. Do not keep the parts on cement or metal surfaces to avoid damage.
- 5.4.12 Clean all the parts carefully. If necessary use suitable solvent.
- 5.4.13 Check all the sealing surfaces and parts for damage or uneven wear. Minor scratches or flashes on the ball surface can be removed using a fine abrasive cloth.
- 5.4.14 Check for the wear or any damage at all the sealing area of stem, ball, seat, bearings and stuffing box bore. Correct / replace the damaged parts if necessary.

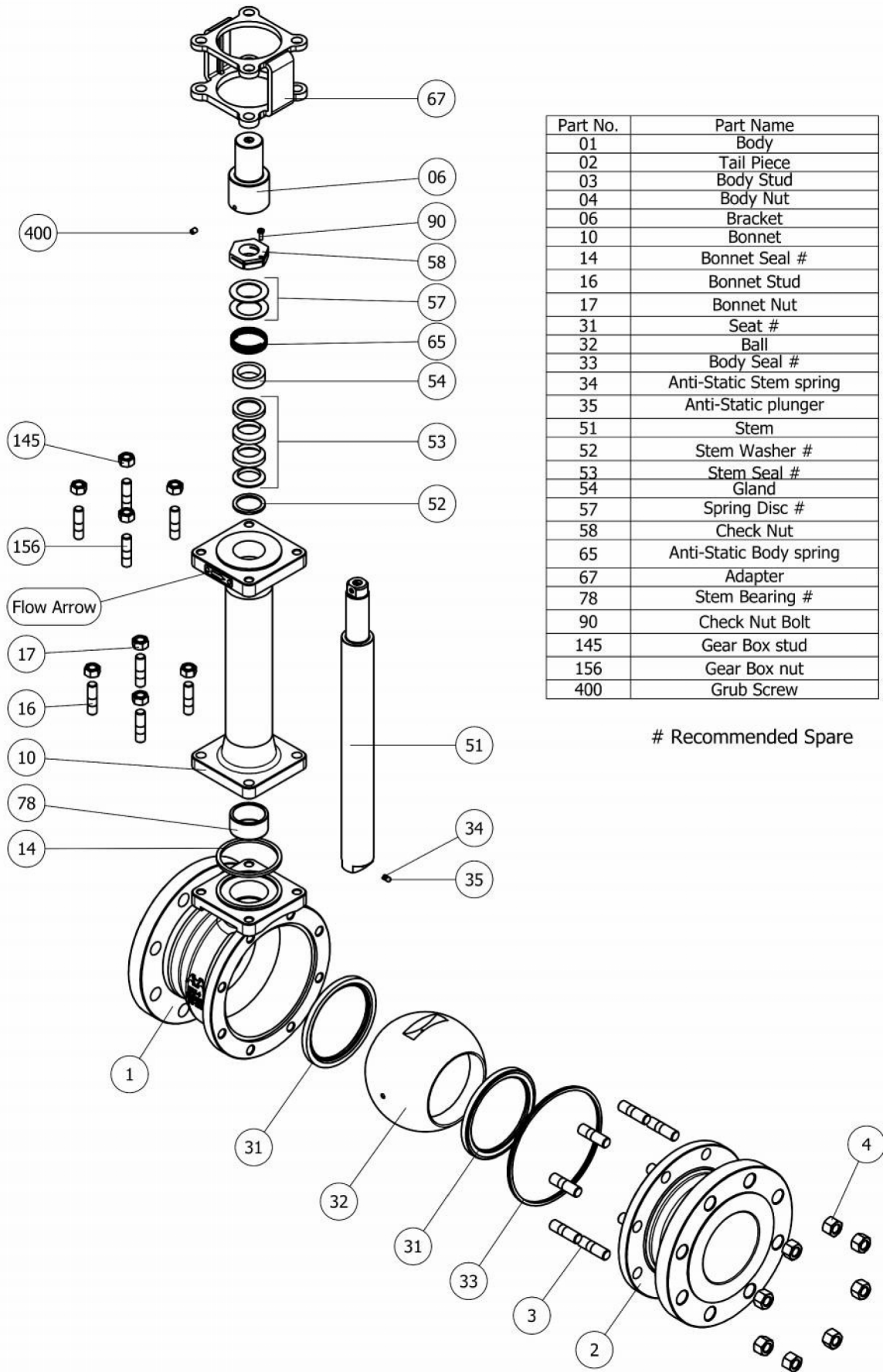
**CAUTION:** Follow the safety rules and regulations to avoid personal injury or equipment damage.

## 6.0 REASSEMBLY

- 6.1.1 After complete disassembling becomes necessary, replacement of seats & seals is recommended.
- 6.1.2 Clean and inspect all the parts for damage & change any part if in doubt.
- 6.1.3 For reassembly follow the disassembly in reverse procedure.
- 6.1.4 For Cryogenic Ball Valve needs no any lubricant during assembly. Use only relevant lubrication if necessary.
- 6.1.5 For the Lever or the Gear operator valve, it may be necessary to adjust the Lever or Gear operator travel stops to ensure proper setting of the ball in the open and closed position. Check proper assembly of the key in the stem key way.

STUD / NUT SIZE	TIGHTENING TORQUE (Nm)	
M 6	11	14
M 8	25	30
M10	30	40
M 12	35	45
M 14	55	70
M 16	85	105
M 20	170	210
M 24	290	340
M 27	425	500
M 30	570	670
M 33	800	935
M 36	1000	1250
M 42	1350	1600
M 46	1700	1950
M 48	1785	2045
M 50	2200	2450
M 56	2800	3200

**Table No-02 Tightening Torques for Fasteners**



Part No.	Part Name
01	Body
02	Tail Piece
03	Body Stud
04	Body Nut
06	Bracket
10	Bonnet
14	Bonnet Seal #
16	Bonnet Stud
17	Bonnet Nut
31	Seat #
32	Ball
33	Body Seal #
34	Anti-Static Stem spring
35	Anti-Static plunger
51	Stem
52	Stem Washer #
53	Stem Seal #
54	Gland
57	Spring Disc #
58	Check Nut
65	Anti-Static Body spring
67	Adapter
78	Stem Bearing #
90	Check Nut Bolt
145	Gear Box stud
156	Gear Box nut
400	Grub Screw

# Recommended Spare

Figure-06  
Floating Ball Valve

Part No.	Part Name	Part No.	Part Name
01	Body	57	Spring Disc
02	Tail Piece	58	Check Nut
03	Body Stud	65	Antistatic Body Spring
04	Body Nut	66	DU Thrust Bearing #
06	Bracket	67	Adapter
10	Stuffing Box or Bonnet	69	Trunnion
13	Coil Spring #	71	Trunnion Bearing #
14	Stuffing Box or Bonnet Seal #	78	Stem Bearing #
28	Drain & Vent Plug	90	Check Nut Bolt
31	Seat #	132	SHCS for Stuffing box
32	Ball	142	Trunnion Stud
33	Body Seal #	144	Bracket Stud
34	Antistatic Stem Spring	153	Trunnion Nut
35	Antistatic Plunger	155	Bracket Nut
37a	Fire Safe Seal #	184	Sealant Plug
39	Trunnion Seal #	194	Dowel Pin
46	Seat Retainer	313	Bakup ring #
50	Key	435	Lip Seal #
51	Stem		
52	Stem Washer #		
53	Stem Seal #		
54	Gland		

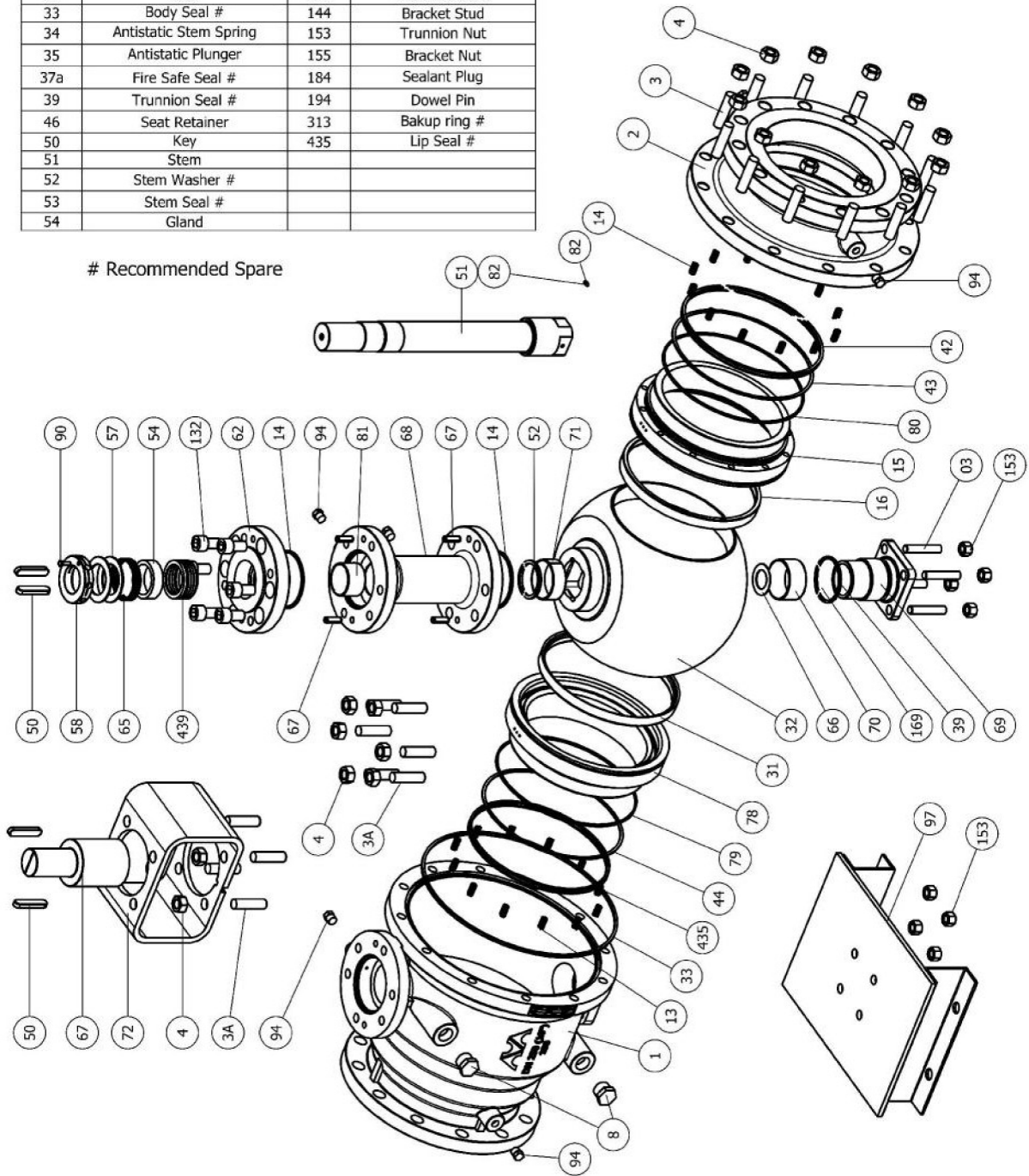





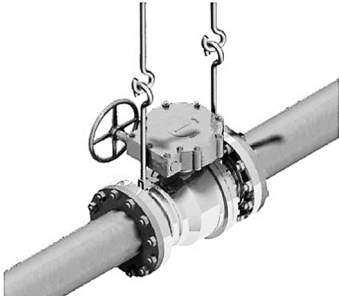




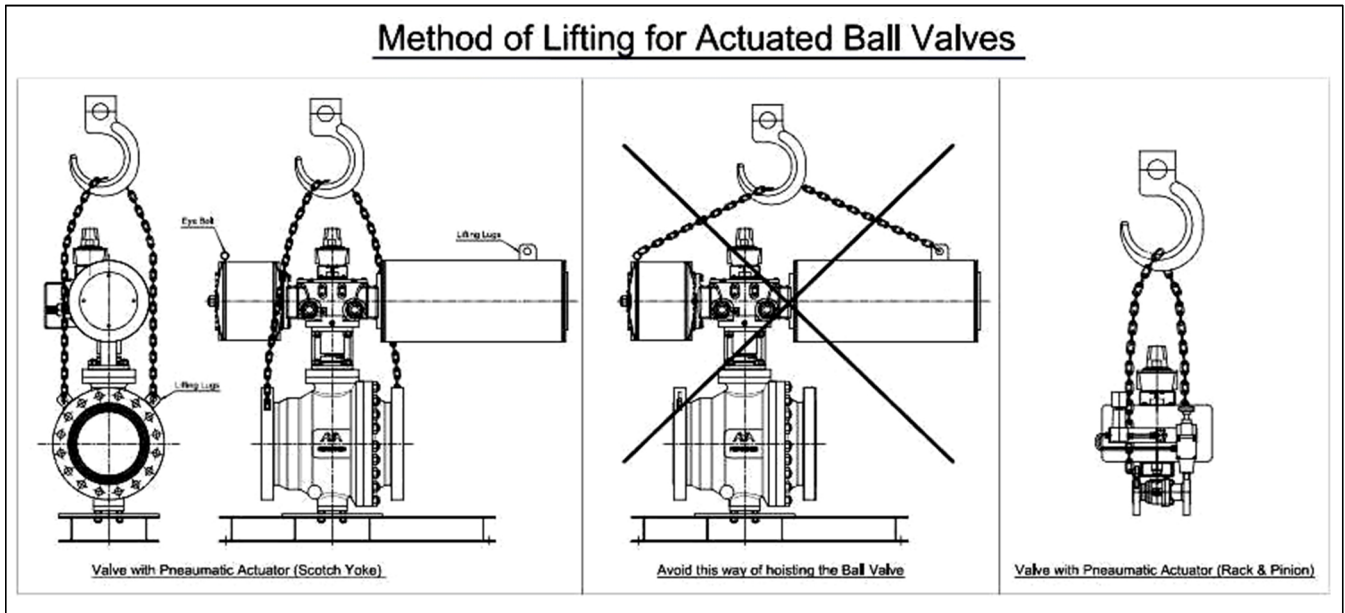
Figure-07  
Trunnion Mounted Ball Valve

### 7.0 Lifting instructions

Lifting plates are provided for valve weighing 25 KG and above unless otherwise specified by the customer. Lifting plates are verified for suitability through design calculations with respect to valve weight along with the operator assembly and accessories. Lifting sketches and handling instructions for safe lifting operation for valves weighing more than 25 KG is as shown in the below figures. The safe working Limit (SWL) of each lifting point is marked on the lifting plate. Lifting plates are to be affixed to the valve flange for valves weighing 25 KG and above by balancing with respect to center of gravity of the valve along with the valve accessories if any.

	
<p><b>Way of Hosting the Ball Valve</b></p>	<p><b>Avoid this way of Hosting the Ball Valve</b></p>
	
<p><b>Way of Hosting the Ball Valve</b></p>	<p><b>Avoid this way of Hosting the Ball Valve</b></p>
	
<p><b>Valve ready for Disassembling supported on Platform</b></p>	<p><b>Way of supporting the Ball Valve</b></p>
	
<p><b>Way of supporting the Ball Valve</b></p>	<p><b>Way of supporting the Ball Valve</b></p>

➤ **Method of Lifting for Actuated Ball Valves**



➤ **Instruction for lifting the valve assembly**

Valve shall be lifted using the lifting lugs provided on the valve. Eye bolts provided on the actuator shall not be used for lifting the entire valve – actuator assembly. Eye bolting actuator shall be used only for lifting the actuator during maintenance if any.

Along with the lifting lugs provided on the valve, eye bolts provided on the actuator may also be used for balancing if needed while lifting.

While lifting the valve assembly care should be taken to see that the tubing and accessories mounted on the valve and actuator are not damaged.

## TROUBLESHOOTING

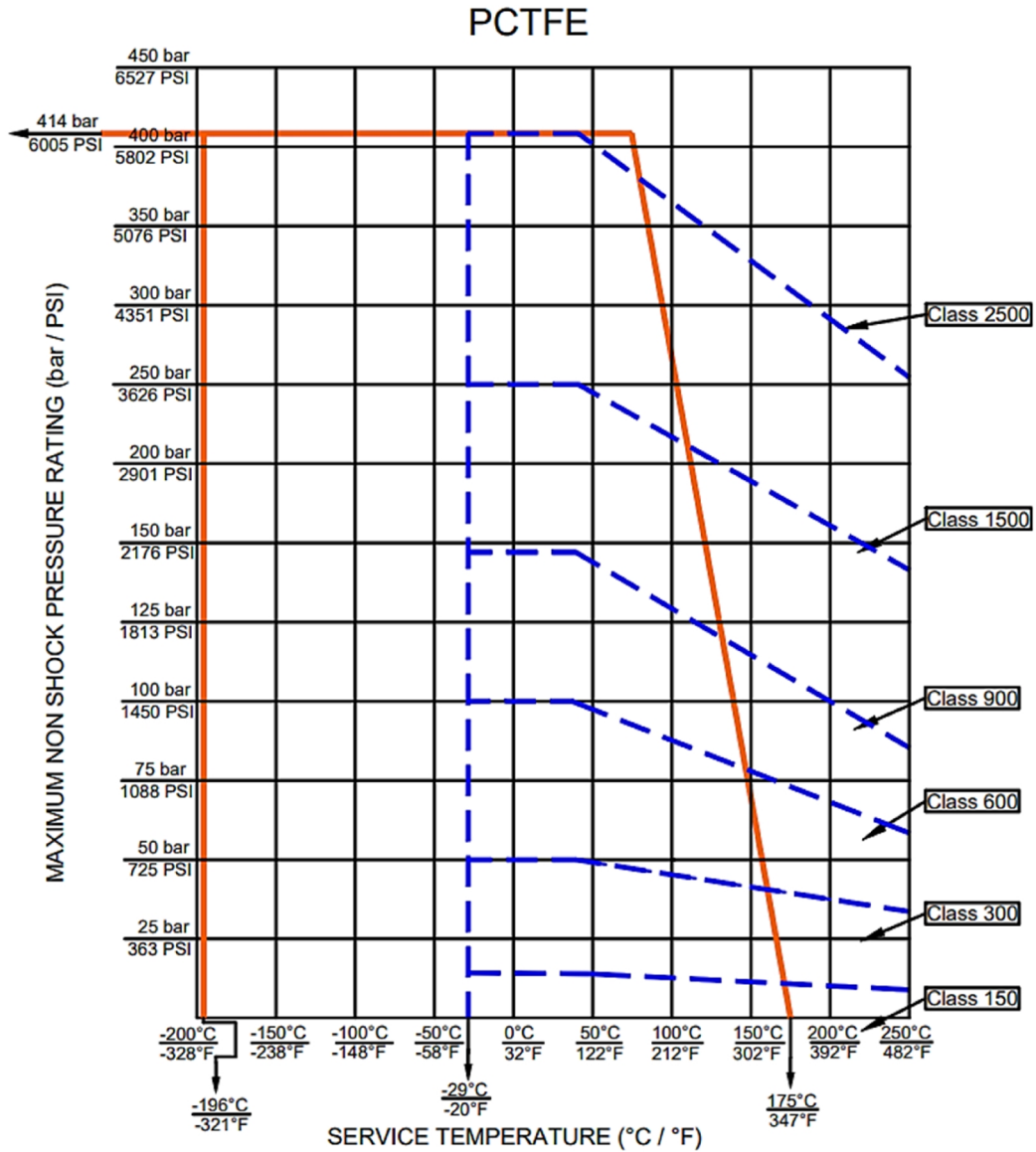
Sl.No.	Nature of Defect	Cause	Remedy
1	Seat Leakage	<ol style="list-style-type: none"> <li>1. Damage of Seat due to presence of foreign particles.</li> <li>2. Damage of 'Seals/Gasket at the seat/retainer.</li> <li>3. Damage of seat in weld end valves due to improper precautions.</li> <li>4. Damage of seat at high temperature.</li> <li>5. Improper closing of actuator operated valves.</li> <li>6. Damage of seat due to rust at body of seat retainer.</li> </ol>	<p>Dismantle, clean &amp; replace by new seats</p> <p>Dismantle, clean &amp; replace by new 'Seals/Gasket'</p> <p>Suggest following right steps as per IOM manual.</p> <p>Check for suitability of seat material and design.</p> <p>Ensure correct closing of actuator.</p> <p>Dismantle, clean &amp; reassemble/replace.</p>
2	Gland Leakage	<ol style="list-style-type: none"> <li>1. Loosening of check nut or locking bolt.</li> <li>2. Damage of stem seal/stem washer</li> <li>3. Misalignment of actuator, bracket &amp; stem.</li> </ol>	<p>Tighten the check nut &amp; locking bolts</p> <p>Replace the stem seal/stem washer.</p> <p>Ensure correct alignment.</p>
3	Body Seal Leakage	<ol style="list-style-type: none"> <li>1. Improper tightening of Body bolting.</li> <li>2. Improper precautions in case of weld end valves.</li> <li>3. Misalignment of pipe line mating flanges.</li> </ol>	<p>Ensure proper tightening of Body bolting.</p> <p>Suggest following right steps as per our IOM manual.</p> <p>Ensure correct alignment of flanges.</p>
4	High Torque operation	<ol style="list-style-type: none"> <li>1. High temperature of fluid handled.</li> <li>2. Highly viscous fluid handled.</li> <li>3. Insufficient air supply pressure in case of pneumatic operated valves</li> <li>4. Reducing of lever length by user due to less space.</li> <li>5. Pipeline flange pressure in case of single piece valves.</li> </ol>	<p>Check for suitability of material and design.</p> <p>Check for suitability of material and design.</p> <p>Ensure sufficient air pressure.</p> <p>Suggest using levers of correct length.</p> <p>Face the seat or seat seal to relieve extra pressure.</p>
5	Jerky operation	<ol style="list-style-type: none"> <li>1. Presence of foreign particles at seat contact area.</li> <li>2. Peeling of plating of Ball in case of metal seated valves.</li> <li>3. Insufficient air supply pressure in case of pneumatic operated valves</li> </ol>	<p>Dismantle, Clean &amp; Reassemble.</p> <p>Check for service condition/replace.</p> <p>Ensure sufficient air pressure.</p>
6	Gear Operator Damage	<ol style="list-style-type: none"> <li>1. Very high torque operation.</li> <li>2. Poor material of construction &amp; design.</li> <li>3. Transit damage</li> </ol>	<p>Check for causes as covered in SI.No.4</p> <p>Check for suitability.</p> <p>Replace the damaged spares &amp; report accordingly.</p>

**Table - 04**

# PRESSURE – TEMPERATURE RATINGS FOR PCTFE SEAT

## MATERIALS FOR FLOATING BALL VALVE

- The Pressure - Temperature rating of Ball valve is limited by either valve rating or seat capability.
- Factors such as nature of fluid, material of construction & other operating parameters can also influence Pressure -Temperature capability
- The Pressure - temperature rating given below should be used as guide only.

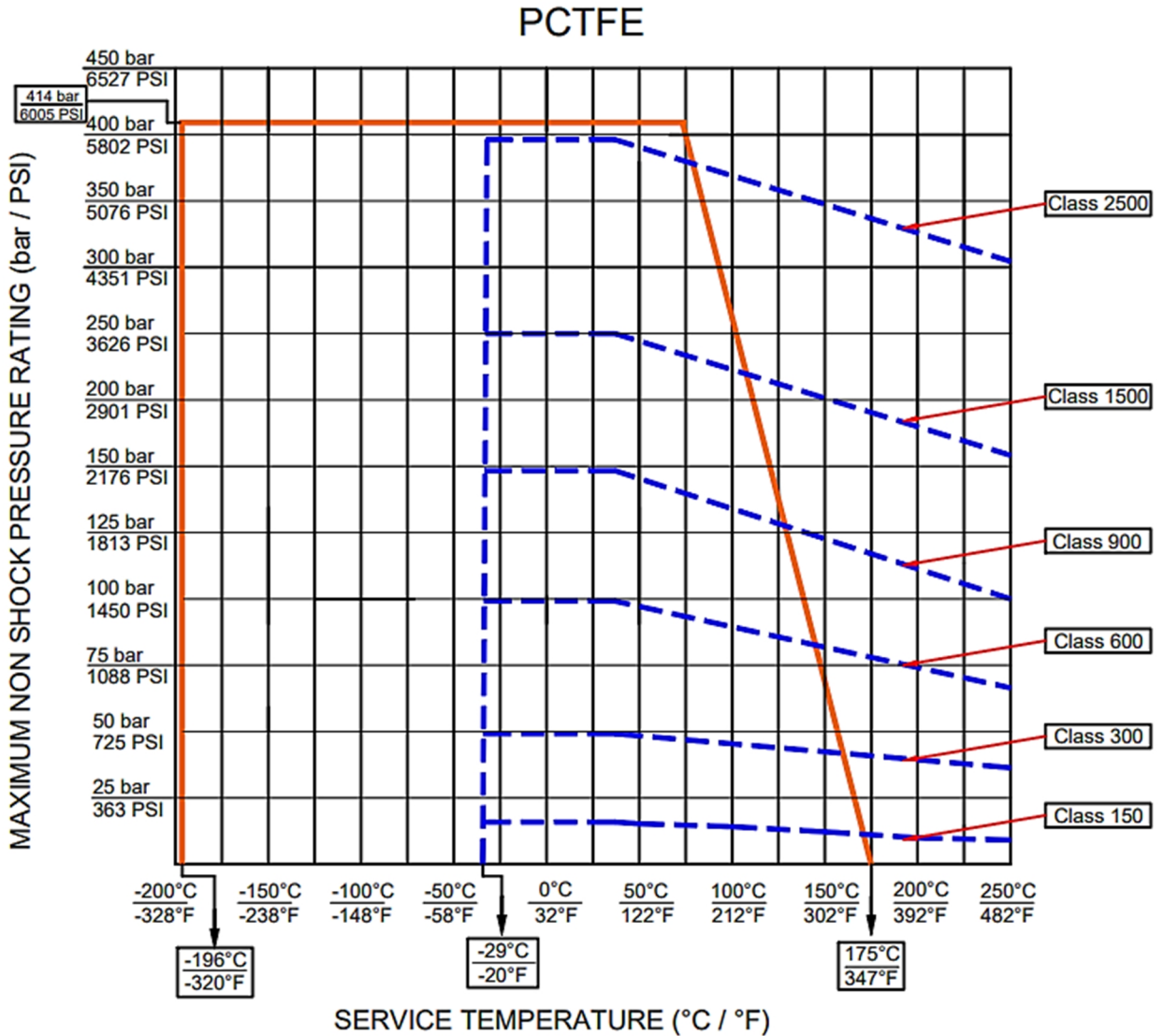


ASTM A351 Gr. CF8M Shell Rating

Figure-08

## FOR TRUNNION MOUNTED BALL VALVE

- The Pressure- Temperature rating of Ball valve is limited by either valve rating or seat capability.
- Factors such as nature of fluid, material of construction & other operating parameters can also influence Pressure-Temperature capability
- The Pressure- temperature rating given below should be used as guide only.



**ASTM A351 Gr. CF8M Shell Rating**

**Figure-09**