CRYOGENIC 3PC C87 SERIES FLOATING BALL VALVES

Installation, Operation and Maintenance Manual

MICROFINISH VALVES

Quality you can trust.

Warnings & Safety Instructions

For your safety and protection, the following precautions must be taken before working on valves.

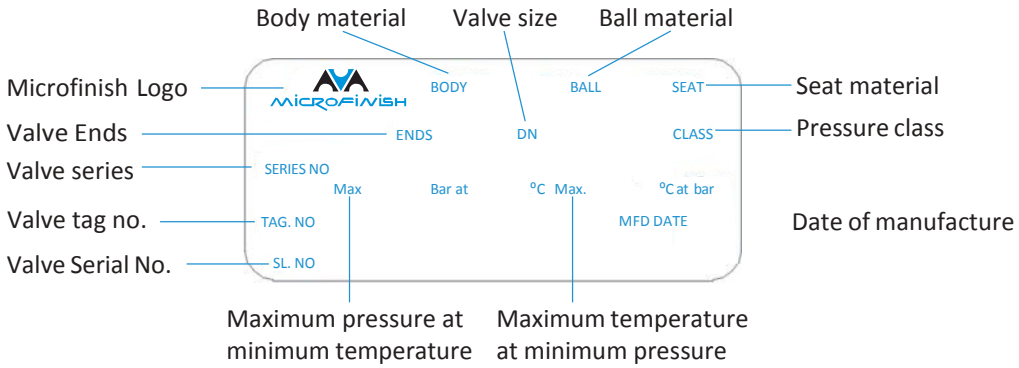
- It is the prime responsibility of the end-user to determine the appropriate compatible material for construction and the product ratings for the intended service.
- User should ensure that valve pressure and temperature limits (as specified on the name plate) are not exceeded.
- The valve should be used in a well-designed, adequately supported piping system such that it will not be subjected to undue forces or hydraulic shocks during service.
- Valve surface temperature may become extremely cold due to operating conditions. Prevent any type of direct contact with the valve that may harm or injury.
- 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.
- Isolate the valve that exhibits any sign of leakage, do not try to operate it, either repair or replace it.
- Read the entire IOM carefully and make sure everything is clear, for doubts consult Microfinish engineering team.

Note: All the illustrations in this manual are for reference only

1. Introduction

Microfinish cryogenic ball valves are designed and manufactured for long lasting, trouble free, service.

This Installation, Operating & Maintenance manual covers the instructions required for safe use of Microfinish cryogenic ball valve. Check the valve nameplate for identification of materials.



Storage

Prior to storage, inspect the valve for shipping damage. The valves are packed individually in a hermetically sealed plastic bag filled with dry nitrogen. It is recommended to keep the valve in its bag and in a clean and protective environment until ready for use. Keep all protective packaging, flange covers and end caps attached to the valves during storage.

Long term storage

Valves intended for long-term storage, shall be kept as shipped, protected against humidity, moisture, dust, dirt, sand, mud, salt spray, and sea water. Manual ball valves will remain in the open position during the period of storage. Actuated valves (fail to close position) remain in closed position; (fail to open position) remain in open during this time.

Prior to Installation

Ball valves should be operated for at least two complete cycles prior to installation. Verify smooth operation, if valve stored exceeds 6 months in a long term storage, it is advisable to check and re-tighten the body fasteners as per the torque table 2 and the pattern defined in figure 4.

Flush the pipeline, and verify it is cleared of impurities such as sand, grit, welding splatters, or any particles that might damage the ball surface or valve internals.

2. Installation

2.1. General

2.1.1. Microfinish cryogenic ball valves are unidirectional; valve installation shall be in the direction indicated by the **arrow** mark attached to the body and bonnet (Refer Figure1). The arrow indicates the High pressure (HP) side, at its tail, and the low pressure (LP) side, at the arrow head. The arrow direction does not always indicate the normal direction of cryogen flow; on the contrary, in most applications the valve should be installed with the arrow pointing in the opposite to the normal direction of cryogen flow. To clarify this issue, the high pressure side should be specified when the flow stops and the valve is in its closed position; **Although it may seem trivial, Microfinish has found this to be a very common error in industry which causes double the work, a waste of raw materials, and even a safety concern.**

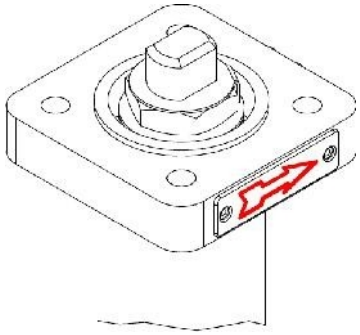


Figure 1. Arrow plate – Doesn't always indicates the direction of the flow

2.1.2. The function of the bonnet of a cryogenic valve is to allow proper heat transfer, and steep temperature gradient along the bonnet's length between cryogenic temperatures as low as -196°C / -320°F at the valve center line, and a temperature of around -10°C / 14°F at the cryogenic ISO top pad. This feature allows the soft parts of the valve gland packing to remain ductile. According to the BS 6364 standard a 10 inch (250 mm) cryogenic bonnet shall be installed in the vertical position or inclined up to 45° from the vertical axis as shown in figure 2. For confined spaces and systems characterized by high vibration, Microfinish offers a 6 inch (150 mm) bonnet, not compliant with BS 6364. A cryogenic valve with 6-inch bonnet shall be installed only in the vertical position.

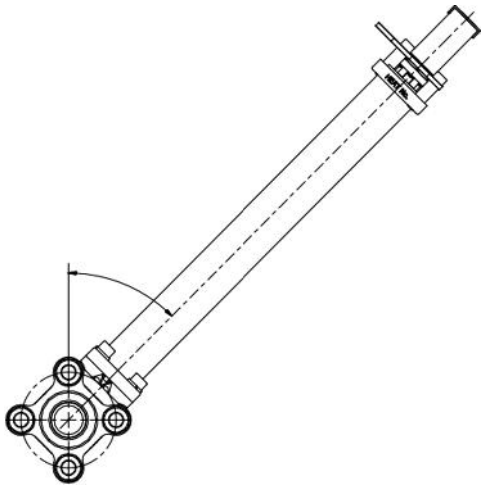


Figure 2. Valve tilting limitations

2.1.3. Support the pipeline properly and eliminate strain of the valve due to hydraulic forces and/or pipeline weight.

2.2. Screwed end valve

2.2.1. Valves with screwed ends should be treated as a single unit and should not be dismantled when installing to the pipeline.
2.2.2. Keep the valve in the fully open position.
2.2.3. Clean both mating parts before assembly.
2.2.4. Ensure pipe threads are matching with the valve threads.
2.2.5. Apply adhesives on the male thread to keep leak tight joint and connect the two parts.

2.3. Weld end valves

2.3.1. With the valve in the open position, remove body bolts and separate the valve center section from tailpiece (ends).
2.3.2. Remove the seats and body seals, place the seats on a clean surface and discard the used body seals.
2.3.3. Turn the valve handle to the closed position and slide out the ball; place the ball on a clean surface.
2.3.4. Assemble the valve body and tailpiece to the valve body with two studs and nuts.
2.3.5. Align valve with the pipeline, ensure proper fit to minimize pipe load.
2.3.6. Tack-weld the tailpiece to the pipeline.
2.3.7. Dismantle the valve fasteners and remove the valve body.
2.3.8. Place all parts on a clean surface.
2.3.9. Protect the tailpiece sealing faces from welding spatter and complete the welding.
2.3.10. Allow adequate time for cooling and then flush the pipeline.
2.3.11. With valve in the closed position, carefully slide the ball into the body.
2.3.12. Place the seats and the new body seals inside the body.
2.3.13. Insert the body center section between the ends.
2.3.14. Do not to score the tailpiece faces or damage the seals.
2.3.15. Insert the body bolts and nuts and complete the assembly.
2.3.16. Keep the valve in the open position until flushing process is completed.

2.4. In-line welding of valve with extended pups

2.4.1. Keep the valve in the "Full open" position.
2.4.2. Clean both mating parts before assembly.
2.4.3. Welding of valves shall be performed by a qualified welder according to the ASME Boiler Construction Code Section IX.
2.4.4. Align the valve to pipeline, ensuring proper fit to minimize pipe load, and maintain the 2 to 3mm gap co-axially.
2.4.5. Use an internal welding backing ring where practical.
2.4.6. While welding, do not allow the temperature of valve body seat area to exceed 120°C (248°F) to prevent seat or seal damage. Use a temperature stick and a wet cloth wrapped around the center section to prevent overheating.
2.4.7. Do not allow rapid application of excess welding material.
2.4.8. Complete the welding operation and clean the pipeline and valve parts by flushing or pigging to remove all impurities left during the installation and welding process.
2.4.9. Do not to rotate the valve to the closed position before flushing the pipeline.

3. Operation

3.1. To operate the Microfinish cryogenic ball valve turn the stem 90˚clockwise to close and 90˚ counter clockwise to open.

3.2. Manually operated valves, the position of the lever aligned with the valve/pipeline axis indicates valve open position; position of the lever perpendicular to the valve/pipeline axis indicates valve close position.

3.3. Do not leave the valve in the partial open position.

3.4. The valve is intended for on-off service only; it should not be used for throttling services.

3.5. Valve should be "fully opened" or "fully closed" to prevent damage to the seat andball.

3.6. Avoid side load on the valve stem.

4. Maintenance

4.1. 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.

4.2. Regular maintenance or lubrication is not required for cryogenic ball valve.

4.3. If a body seal leak develops tighten the valve bolting to the torque figure in Table 2; if the body seal leak continues, replace the body seal with new one.

4.4. If stem leak develops, tighten the gland nut to the torque figure in Table 1; if the stem leak continues, replace the stem packing with new one.

4.5. **Stem packing replacement:** prior to replacing the stem packing, verify that the valve is not pressurized. Remove all accessories including actuator to give access to the stem packing. After loosening and removing the gland nut, the stem packing can be removed by means of a hooked wire.

4.6. Stem packing adjustment:

a. Microfinish valves allows an externally adjustable stem seal in the event of stem leak.

b. Operate the valve once.

c. Loosen the Gland Nut / Chuck Nut for two turns.

d. Operate the valve three full cycles.

e. Tighten the Gland Nut / Chuck Nut as per **Table-1** column **"X".**

f. Loosen the Gland Nut / Chuck Nut.

g. Operate the valve three full cycles.

h. Retighten the Gland Nut / Check Nut as per **Table-1** column **"Y".**

i. Operate the valve three full cycles.

j. Record the torque.

k. If the first action has not stopped the leak, repeat steps "d" to "j". If the leakage has not stopped, replace the stem packing with a new set.

Table 1. Stem nut tightening torque (Nm)

Valve size	Series	Stem nut size	GRAPHITE		PTFE	
			X	Y	X	Y
DN15	C87F3	M10x1.5	10	5	9	5
DN20	C87R3					
DN20, DN25	C87F3	M12x1.75	15	7	13	5
DN25, DN32	C87R3					
DN32, DN40	C87F3	M18x2	19	11	17	11
DN40, DN50	C87R3					

The gland nut is secured from opening by a locking strip. Push down the tabs away from the nut with a flathead screwdriver, allow the gland nut a free rotation and reset of the stem seal. After tightening the stem packing secure the locking strip by pushing back the tabs toward the stem nut flats.

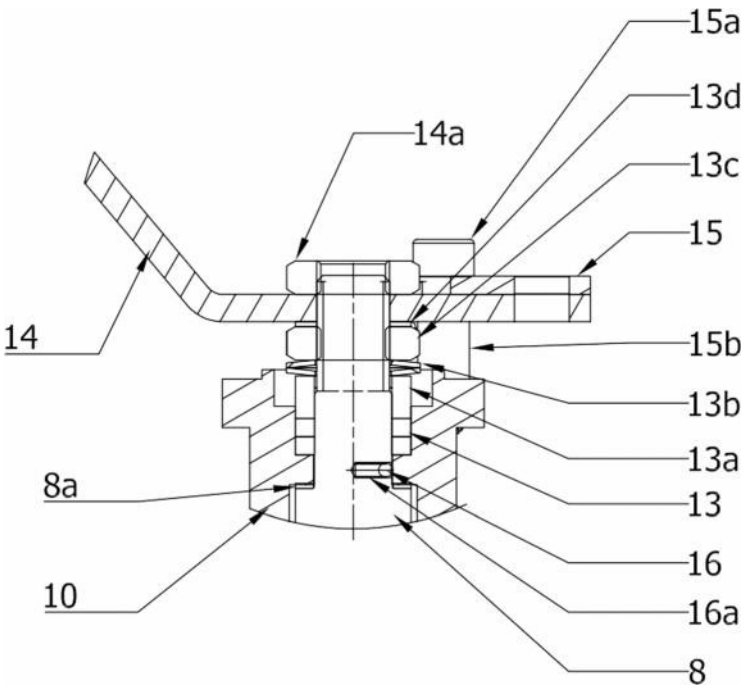


Figure 3. Stem seal arrangement

Item no.	Part description
8	Stem
8a	Stem thrust washer
10	Bonnet
13	Stem seal
13a	Gland
13b	Disc spring
13c	Stem nut
13d	Nut lock clip
14	Handle
14a	Handle nut
15	Locking disc
15a	Locking disc bolt
15b	Locking disc bush
16	Antistatic ball
16a	Antistatic spring

5. Disassembly

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

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 an eye shield, protective clothing, gloves and footwear.
5.1.3. When necessary keep water available nearby and/or fire extinguisher.
5.1.4. De-pressurize the line and drain the system.
5.1.5. Keep the valve in the fully open position.
5.1.6. Remove the valve and place it on a level surface.

5.2. Disassembly of the cryogenic floating ball valves

5.2.1. Flush the valve and remove any residuals from within.
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 the stem nut / gland nut, spring, locking plate, gland, stem and bonnet.
5.2.5. Release the studs and separate the body from the tailpiece.
5.2.6. Remove the seats, ball and body seals, place the seats on a clean surface and discard the used body seals.
5.2.7. Keep the disassembled parts on a clean surface.

6. Assembly

CAUTION !
Follow the safety rules and regulations to avoid personal injury or equipment damage

6.1. Use only Microfinish original spare parts.
6.2. Assembly of Oxygen service valve shall be held in an oil free zone.
6.3. Wear clean working clothes and latex gloves throughout the complete process.
6.4. Cover the working table with clean plastic sheet.
6.5. Before assembling the valve, examine all parts and replace any worn or damaged item.
6.6. Clean all parts carefully with Isopropyl Alcohol-IPA and keep them on the cleaned working area.
6.7. Lubrication is not required for Cryogenic ball valve for internals.
6.8. Use BAM approved grease for body fasteners.
6.9. For valve assembly, follow the disassembly steps (paragraph 5) in a reverse order.
6.10. Tighten the body bolts to the torque figures (Table 2) according to tightening pattern illustrated in figure 4.
6.11. Keep the valve in the open position for flushing purpose.

Table 2. Body bolts tightening torque

Valve size	Series	Thread size x pitch	Tightening torque for lubricated fastener	
			Nm	lbf.in
DN15	C87F3	M8x1.25	11 – 14	97 – 124
DN20	C87R3			
DN20, DN25	C87F3	M10x1.5	22 – 24	195 – 212
DN25, DN32	C87R3			
DN32	C87F3	M12x1.75	37 – 39	327 – 345
DN40	C87R3			
DN40	C87F3	M14x2	55 – 57	487 – 504
DN50	C87R3			

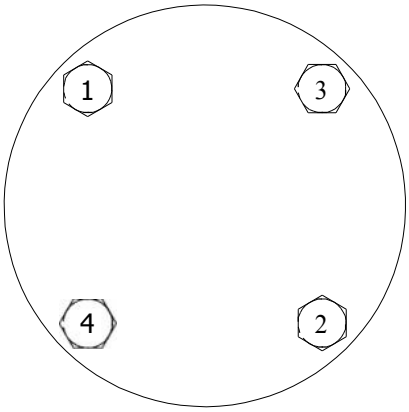
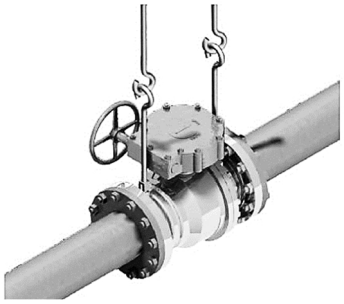


Figure 4. Fastener tightening sequence

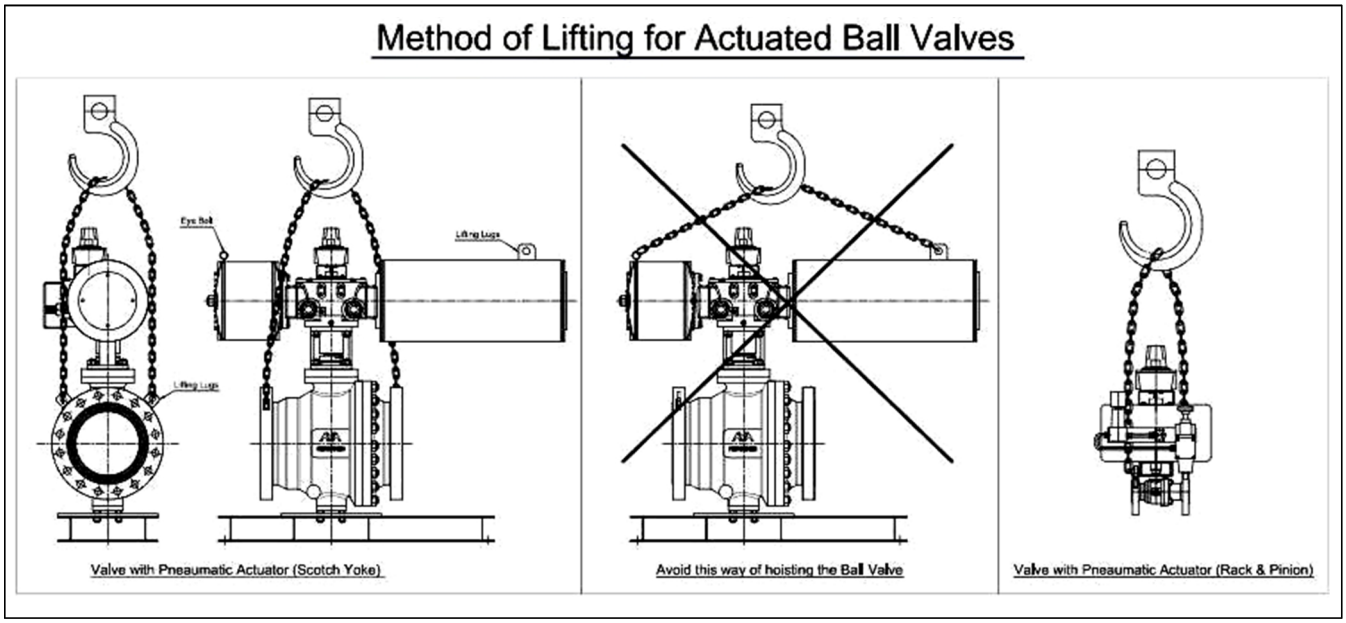
7. Lifting instructions

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.

	
Way of Hosting the Ball Valve	**Avoid this way of Hosting the Ball Valve**
	
Way of Hosting the Ball Valve	**Avoid this way of Hosting the Ball Valve**
	
Valve ready for Disassembling supported on Platform	**Way of supporting the Ball Valve**

	
Way of supporting the Ball Valve	Way of supporting the Ball Valve

➢ 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.

8.Troubleshooting

Sl.No.	Malfunction	Possible cause	Remedial action
1	In line leak	1. Damage of Seat due to presence of foreign particles. 2. Damage of seat in weld end valves due to improper precautions. 3. Damage of seat at high temperature. 4. Improper closing of actuator operated valves. 5. Damage of seat due to rust at body of seat retainer.	Dismantle, clean & replace by new seats. Follow right steps/instructions as per this IOM manual. Check for suitability of seat material and design. Ensure correct closing of actuator. Dismantle, clean & reassemble/replace.
2	Stem seal leak	1. Loosening of stem nut or locking bolt. 2. Damage/wear of stem seal/stem washer. 3. Misalignment of actuator, bracket & stem.	Tighten the check nut & locking bolts. Replace the stem seal/stem washer. Ensure correct alignment.
3	Body seal leak	1. Improper tightening of Body bolting. 2. Improper precautions in case of weld end valves. 3. Misalignment of pipeline mating flanges.	Ensure proper tightening of Body bolting. Follow right steps/instructions as per this IOM manual. Ensure correct alignment of flanges.
4	High torque operation	1. High temperature fluid handled. 2. Highly viscous fluid handled. 3. Insufficient air supply pressure in case of pneumatic operated valves. 4. Reducing of lever length by user due to less space. 5. Pipeline flange pressure in case of single piece valves.	Check for suitability of material and design. Check for suitability of material and design. Ensure sufficient air pressure. Use lever of correct length. Face the seat or seat seal to relieve extra pressure.
5	Jerky operation	1. Presence of foreign particles at seat contact area. 2. Peeling of plating of Ball in case of metal seated valves. 3. Insufficient air supply pressure in case of pneumatic operated valves.	Dismantle, Clean & Reassemble. Check for service condition/replace. Ensure sufficient air pressure.

9. SIL

Under normal operating condition, the Microfinish valve should be inspected for proper functioning and signs of deterioration every 6 months. For severe service condition, apply higher frequent inspection.

Severe operating conditions can be defined as:

- Operating temperature less than -20˚ C.
- Operating temperature higher than +230˚ C.
- Flow velocity higher than 5 m/sec for liquids, and 200 m/sec for gases.
- Acidic media PH < 5 or Alkaline media PH > 9.

For fail to open ESD System Microfinish recommend a partial stroke test once in 12 months to confirm the proper functioning of the system.

For fail to close ESD System it is necessary to plan system shut down; de-energize the system and inspect the functioning of the valve.

It is essential to record date, time, name and signature of the responsible engineer, air pressure on site, time to close the valve, time to open the valve. Record the date of valve repair and/or any maintenance activity.

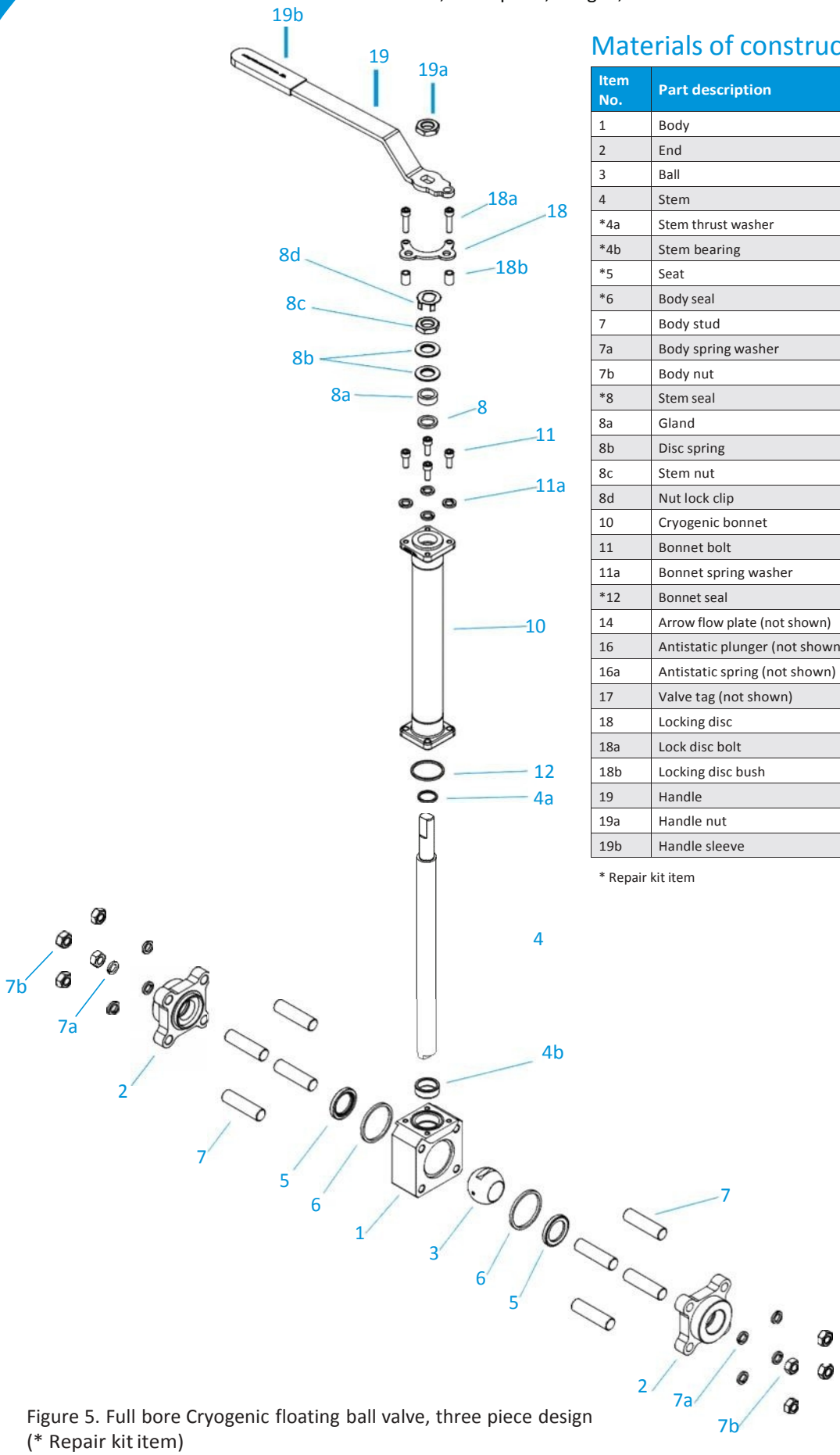
Microfinish recommends inspecting the valve wall thickness every time the valve is maintained. When the valve body thickness is reduced by 1 mm due to erosion or corrosion (combined corrosion and erosion allowance for the valve wall body thickness) the valve should no longer be used.

User should consult the Microfinish factory to obtain the product assessment, and other associated statistical data to satisfy SIL level.

Any failures affecting functional safety should be reported to the Microfinish factory.

Valve exploded view: Cryogenic floating ball valve

Full or reduced bore, three piece, flanged, threaded or welded end connection



Materials of construction

Item No.	Part description	Material specification
1	Body	ASTM A351 Gr CF8M, CF8
2	End	ASTM A351 Gr CF8M, CF8, CF3M, CF3
3	Ball	ASTM A351 Gr CF8M, CF8
4	Stem	ASTM A479 316, Nitronic XM-19
*4a	Stem thrust washer	CFT, PCTFE
*4b	Stem bearing	PTFE
*5	Seat	PCTFE, CFT
*6	Body seal	Graphite, PTFE
7	Body stud	ASTM A320 Gr B8M Class 2, Gr B8 Class2
7a	Body spring washer	SS304
7b	Body nut	ASTM A320 Gr 8M, Gr 8
*8	Stem seal	Graphite, PTFE
8a	Gland	SS304
8b	Disc spring	SS304
8c	Stem nut	ASTM A194 Gr 8
8d	Nut lock clip	SS304
10	Cryogenic bonnet	ASTM A351 Gr CF8M, CF8
11	Bonnet bolt	ASTM A320 Gr B8M Class 2, Gr B8 Class2
11a	Bonnet spring washer	SS304
*12	Bonnet seal	Graphite, PTFE
14	Arrow flow plate (not shown)	SS304
16	Antistatic plunger (not shown)	SS304
16a	Antistatic spring (not shown)	SS304
17	Valve tag (not shown)	SS304
18	Locking disc	SS304
18a	Lock disc bolt	SS304
18b	Locking disc bush	SS304
19	Handle	CS Zinc plated
19a	Handle nut	ASTM A194 Gr 8
19b	Handle sleeve	PVC

* Repair kit item

Figure 5. Full bore Cryogenic floating ball valve, three piece design (* Repair kit item)

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Quality you can trust.

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