

# CS, FC, FD, & SD Series 5, 1/2" thru 6"

## 2-Way and Flush Tank Clean Steam Ball Valves

### Installation, Operation, and Maintenance Instructions



#### **WARNING:**

For your safety and protection it is important that the following precautions be taken prior to working on the valve.

1. Depressurize and drain the line.
2. Cycle the valve to relieve any pressure trapped in the valve.
3. Disconnect any air and electrical connections to the valve assembly.
4. Know what the media is in the line and wear appropriate protective clothing and equipment. Obtain appropriate MSDS sheets.
5. To ensure safe product selection and operation, it is the responsibility of the process system designer and end user to determine the appropriate compatible materials of construction and adequate product ratings for the process system. Process system designer, installer, and end user are responsible for proper installation, operation, and maintenance.
6. When disposing of Teflon parts, do not incinerate or subject to open flames.

#### 1. General

This Installation, Operation, and Maintenance manual is for the safe use of PBM 3-piece, Adjust-O-Seal®, Bi-Directional, CS, FC, FD, and SD Series 5 ball valves. Please read the instructions carefully and save them for future reference.

#### 2. Installation

CS, FC, FD, and SD valves may be installed in either direction with the valve in the "open" position. Unless equipped with socket weld, sil-braze, or solder joint end fittings, CS & SD valves do not need to be disassembled before installation. For FC & FD valves, disassemble the valve and attach the tank pad to the vessel. Reassemble valve to tank pad. See IOM-WELD for welding of end connections or tank pads.

#### 3. Operation

For manual valves, operation consists of turning the handle 1/4 turn to close or open the valve. When handle is parallel with the pipeline, the valve is in the open position. These valves may also be automated with actuators and other valve automation equipment. Mechanical handle stops must be removed if manual valves are converted to automated valves. For automated valves, operation is controlled by the actuator placed on top of the valve. Valve stops are an integral part of the actuators. Good operating procedure requires periodic inspection of the valves and replacement of parts as required. Always use PBM factory authorized replacement parts.

#### Locking Handle Device, manual valves only – (When Supplied)

1. Depress handle lock bar inward toward the valve stem until it clears the stop on the valve body.
2. While maintaining the handle lock bar in this position, turn handle to desired position.
3. Release the handle lock bar, ensuring that it returns to the proper position against the handle.

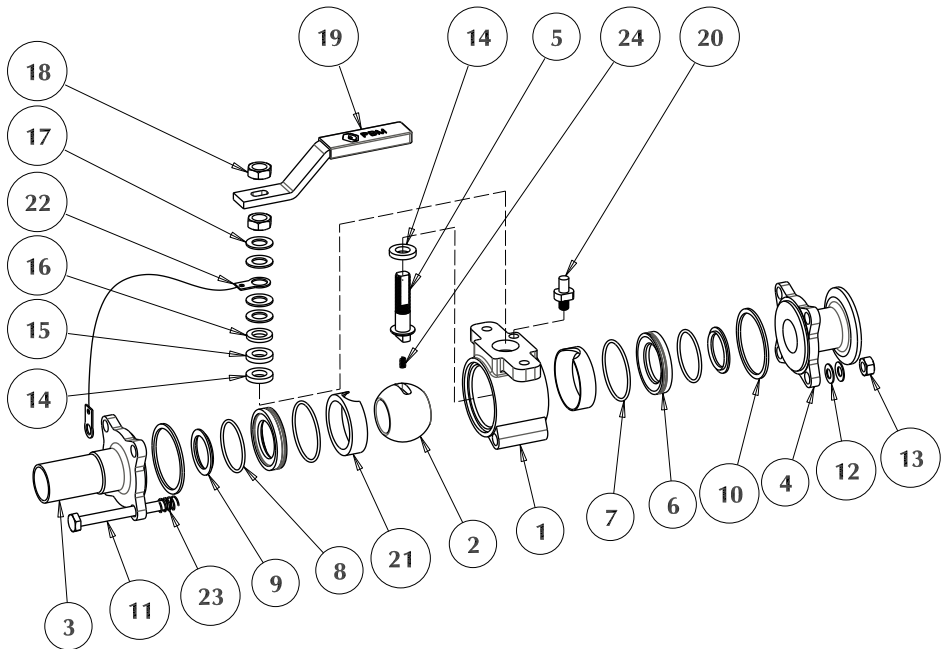
Follow instructions to ensure optimum performance:

#### Adjusting for Normal Wear

**Note: Valve to be in fully opened or fully closed position prior to adjustments.**

1. PBM Ball Valves are designed with the Adjust-O-Seal® feature. If the valve shows signs of leakage due to normal seat wear, tighten the end fitting fasteners evenly, in the staggered sequence as shown at bottom of Page 4, until the leakage stops and the valve operates smoothly:
  - a) Initially, there should be a space between end fittings and the body. This space is the key to the Adjust-O-Seal® feature and allows in-line adjustment of the seats and gasket.
  - b) End fitting fasteners should be tightened only until valve stem breakaway torque is reached (Torque Table - Page 4).
2. If valve shows signs of leakage in stem area due to normal stem packing wear, loosen the upper jam nut on the stem, then tighten the lower jam nut as follows:
  - a) For valves 2" and smaller, tighten nut to completely compress spring washers, then loosen nut 1/2 turn.
  - b) For valves 3", tighten nut until a gap of about 0.05" (1.3 mm) exists between the adjacent spring washers.
  - c) For valves 4" and larger, tighten nut until a gap of about 0.10" (2.5 mm) exists between the adjacent spring washers. Leakage should stop, and the valve should continue to operate smoothly.
3. After adjustments have been made to seats, or if packing leakage cannot be stopped, a repair kit will be required.

PARTS LIST	
ITEM	DESCRIPTION
1	Body
2	Ball
3, 4	End Fittings
5	Stem
6	Seat
7	Large O-Ring
8	Gasket
9	Encapsulation Ring
10	Small O-Ring
11	End Fitting Fastener
12	Fastener Spring Washers
13	Fastener Hex Nuts
14	Follower
15	Stem Packing
16	Stem Packings
17	Stem Spring Washers
18	Stem Hex Nut(s)
19	Handle (Manual Only)
20	Stop Pin (Manual Only)
21	Cavity Filler (If Any)
22	Ground Wire (If Any)
23	Body Bolt Ground Spring (If Any)
24	Stem Ground Spring (If Any)



### Disassembly of valve:

1. Isolate and depressurize the associated piping system. Cycle the valve to ensure there is no trapped pressure or fluid in the valve cavity. The valve should be left fully open or fully closed.
2. **For Automated Valves Only:** Remove all air and electrical power from the actuator, solenoid valve, and switchbox, if any. Then remove the automation assembly from the valve. Retain coupling and mounting bracket.
3. **For Manual Valves Only:** Loosen and remove the upper jam nut from the stem and then remove the handle.
4. For valves with welded end connections, the valve can be disassembled with the body subassembly swung out from the end fittings, or it can be disassembled with the body subassembly completely removed from the end fittings.
  - A. In order to swing out the body subassembly from the end fittings, fully open the valve and loosen the end fitting hex nuts. Then remove the fasteners, nuts, and lock washers between the body swing out ring and the stem.
  - B. Spring the connecting piping 1/8" to remove the compression on the body from the end fittings.
  - C. Swing the body out from the end fittings until the body completely clears the end fittings. The body's swing out ring will rotate about its fastener. The sprung piping can now be returned to its original compression, if desired.
  - D. In order to remove the body subassembly, loosen all end fitting fasteners. Then, remove the fasteners, including the nuts and lock washers, between the body swing out ring and the stem. Remove the fastener, including tag, nut, lock washers, and external ground spring, if any, that passes through the body swing out ring.
  - E. Spring the connecting piping 1/8" to remove the compression on the body from the end fittings.
  - F. Slide the body out from the end fittings until the body completely clears the end fittings. The sprung piping can now be returned to its original compression, if desired.
5. If the entire valve is to be removed from the piping, disconnect the end connections, remove the valve, then loosen and remove the body fasteners. Then pull the end fitting(s) free from the body. It may require force to remove.
6. Remove the seats, metal encapsulation rings, gaskets, o-rings, and cavity filler, if any.
7. Rotate the stem to orient the ball to the closed position. Slide the ball out, taking care not to nick or scratch the ball.
8. Remove the internal ground spring, if any, from under stem.

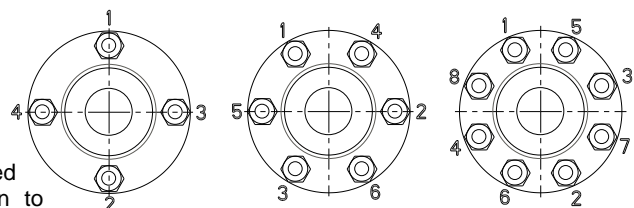
9. Remove the jam nut, any spring washers, and follower. For valves with gear operators, remove the gear operator, bracket, and coupling.
10. Push the stem into the body and out an open end of the body. The bottom packing may come off with the stem. If not, reach into the body counterbore and remove.
11. Remove the top packings from the body, the inner cavity filler, if any, and the seat from the body recess.

### Reassembly of valve:

1. Before reassembling the valve, examine the parts and repair or replace damaged or worn parts. Clean metal parts, as necessary, using a solvent compatible with the process fluid and a non-abrasive cloth. PBM recommends using new seats, body gaskets, and seals at each assembly.
2. Install a new packing onto the threaded end of the stem and slide it down until it contacts the shoulder.
3. Insert the stem into body bore and through the stem bore in the body. Install the remaining packings onto the stem with the S-TEF® (gray) packing installed last. Push the packings into the body counterbore. Install the follower onto the stem.
4. Install a spring washer onto the stem with the concave side facing upward. Install the external ground wire terminal onto the stem, if applicable, such that the ground wire extends towards the end fitting side of the body
5. Install a second spring washer onto the stem with the concave side facing downward. Install the remaining spring washers onto the stem in an alternating or *series* arrangement. No two adjacent spring washers should be facing the same direction or in a *parallel* arrangement
6. Lubricate the stem threads with an anti-galling lubricant.
7. Thread a stem hex nut onto the stem. For valves 2" and smaller, tighten the nut to completely compress the spring washers, then back off 1/2 turn. For 3" valves, tighten the nut until a gap of about 0.05" (1.3 mm) exists between the adjacent spring washers. For valves 4" and larger, tighten the nut until a gap of about 0.10" (2.5 mm) exists between the adjacent spring washers.
8. **For Manual Valves Only:** Install the handle on the stem such that stop pin will contact the right side of the handle when the valve is open and closed. Install and tighten the remaining hex nut to secure the handle to the stem. This step does not apply to valves with gear operators
9. Rotate the stem to the closed position of the valve. Insert the internal ground spring, if any, into the hole at bottom of the stem.
10. Orient the ball to the closed position and insert the ball into the body. Slide the stem tang into the ball slot, being careful not to nick or scratch the ball. Rotate the stem until the ball is in the open position.
11. Install the cavity fillers, if any, into the body and then lubricate the o-rings and 1/2" of each end of the body bore with a lubricant compatible with the process fluid.
12. Install the large o-rings onto the groove of the outer diameter of the seats and then carefully force the seats onto the body bore until they contact the ball.
13. Insert the metal seat encapsulation rings into the bores of the seats, then install the gaskets onto the body bore and install the small o-rings between the metal encapsulation rings and the gaskets.
14. Lubricate external threads of body bolting with anti-galling lubricant.
15. For valves with end fittings welded into the piping, with the valve open, spring the end fittings outward and slide the body between them. Release spring force from end fittings to allow end fittings to enter the body taking care not to cut o-rings.
16. For valves with the valve body in the swing-out position, spring the end fittings outward and slide the body between them. Release spring force from the end fittings to allow the end fittings to enter the body taking care not to cut o-rings.
17. For valves that were completely removed, with the valve closed, install end fitting against body.
18. Install fasteners, tagging, and spring washers (Place spring washers concave side facing each other), then install and hand-tighten hex nuts. The external ground wire connected to the stem should have its terminal installed underneath one of the closest nuts and lock washers, if applicable. If the valve is electrically grounded, install the external ground spring around the bolt that passes through the swing out ring.
19. Wrench-tighten the bolting or hex nuts according to the procedure shown at the bottom of Page 4, while maintaining an even gap between the body and end fittings, and until the stem torque, as shown in the torque table on Page 4 is reached. The torque is the measured stem torque as the valve leaves the closed position. Cycle the valve to verify freedom of operation and torque. If practical, check the valve seats and seals for leaks.
20. For valves with gear operators, reinstall the bracket, coupling, and gear operator.
21. **For Automated Valves Only:** Reinstall the automation assembly with the bracket and coupling. Then reconnect air and electrical power.
22. Insulate the valve, if applicable.

### Tightening Procedure for End Fittings:

1. Hand tighten fasteners.
2. Wrench tighten each fastener in increments per the staggered sequence illustrated at right until the spring washers begin to compress.
3. Continue tightening bolts or hex nuts 1/8 turn until the recommended torque value is achieved when measuring at the valve stem.



Replacement Kits and Parts						
Valve Size	Repair Kit (TFM™ / EPR)	Cavity Filler Kit (VTFE)	SD Ball (316L S/S)	CS Ball (316L S/S)	Stem (316L S/S)	Encapsulation Rings (316L S/S)
1/2"	CSTFC5 -- Z -- 1	SPTFC5 -- J -- 3	SPHLC502	SIHLC502	SPHLD505	SIHLC508E1
3/4"	CSTFD5 -- Z -- 1	SPTFD5 -- J -- 3	SPHLD502	SIHLD502	SPHLD505	SIHLD508E1
1"	CSTFE5 -- Z -- 1	SPTFE5 -- J -- 3	SPHLE102	SIHLE402	SPHLE505	SIHLE508E1
1-1/2"	CSTFG5 -- Z -- 1	SPTFG5 -- J -- 3	SPHLG102	SIHLG402	SPHLH505	SIHLG508E1
2"	CSTFH5 -- Z -- 1	SPTFH5 -- J -- 3	SPHLH102	SIHLH402	SPHLH505	SIHLH508E1
2-1/2"	CSTFJ5 -- Z -- 1	SPTFJ5 -- J -- 3	SPHLJ102	SIHLJ402	SPHLK505	SIHLJ508E1
3"	CSTFK5 -- Z -- 1	SPTFK5 -- J -- 3	SPHLK402	SIHLK402	SPHLK505	SIHLK508E1
4"	CSTFL5 -- Z -- 1	SPTFL5 -- J -- 3	ANH-L102	SIHLL502	SPHLL505	SIHLL508E1
6"	CSTFM5 -- Z -- 1	SPTFM5 -- J -- 3	SPHLM502	SIHLM502	SPHLM505	SIHLM508E1

### Notes for Table above:

- Standard repair kits include 2 TFM™ seats, 2 TFM™ gaskets, 2 TFM™ stem packings, and 1 S-TEF® (gray) stem packing, and 4 EPR O-Rings. Cavity filler kits include 2 VTFE fillers.
- Standard repair kits and replacement parts are TFM™.
- Replacement parts are one each per part number.
- For materials other than TFM™, substitute the correct material ID and code.
- For valves with grounding, add "G" to the end of the stem part number.

### Material Definitions:

TF	TFM™	Chemically modified polytetrafluoroethylene
VT	VTFE	Virgin Polytetrafluoroethylene
HT	S-TEF®	Stainless steel reinforced polytetrafluoroethylene
PK	PEEK™	Polyetheretherketone
UT	UHMWPE	Ultra High Molecular Weight Polyethylene
KY	KYNAR	Polyvinylidene Fluoride

Valve Size	Size Code	Valve Stem Nominal Breakaway Torque - TFM™ Seats	
		in - lbs	N-m
1/2"	C5	32	3.6
3/4"	D5	40	4.5
1"	E5	58	6.6
1-1/2"	G5	154	17.4
2"	H5	182	20.5
2-1/2"	J5	288	32.5
3"	K5	430	48.6
4"	L5	787	88.9
6"	M5	1,920	216.9

### Notes for Table at right:

- Stem torques are shown in nominal values and represent ideal conditions. (100 psig / 6.9 bar or less, ambient temperature, with fluid free of suspended solids and comparable in viscosity to water).
- For UHMWPE seats, multiply by 1.25. For S-TEF® or Kynar seats, multiply by 1.56. Consult factory for PEEK seat torques.
- Torque values measured at the stem, NOT at the fasteners.

