WILLIAMS VALVE

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

TRUNNION MOUNTED BALL VALVE

WILLIAMS VALVE CORP.
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Revision	Effective Date	Description	Prepared by	Approved by
01	2025-09	Updated to new IOM format from legacy format	Eric Chen	Foster Voelker II

SAFETY GUIDELINES

Prior to commencing any valve maintenance or service work, it is essential to ensure that Operations has locked out, isolated, and fully depressurized all relevant piping and equipment to establish a safe working environment.

Maintenance must not proceed until Operations has formally confirmed that it is safe to do so.

All jobsite safety protocols, lockout/tagout procedures, and work permit requirements must be followed without exception. Special attention should be given to double-seated valves, such as ball valves and wedge gate valves, as the body cavity may remain pressurized even after the process lines have been depressurized. Therefore, personnel must exercise caution and verify that all valve cavities are completely depressurized before commencing any service or disassembly work.
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1 FOREWORD

The improper installation, operation, or maintenance of a valve can pose significant risk to personnel and the environment. The following instructions are offered as a reference to aid the valve user when installing, maintaining or operating Williams Floating Ball valves. This document consists of basic information should be of interest to the layman as well as the experienced valve user; however, it does not replace the need for an understanding of the particular application and is not intended to be a complete instruction for the inexperienced valve user.

2 VALVE COMPONENTS

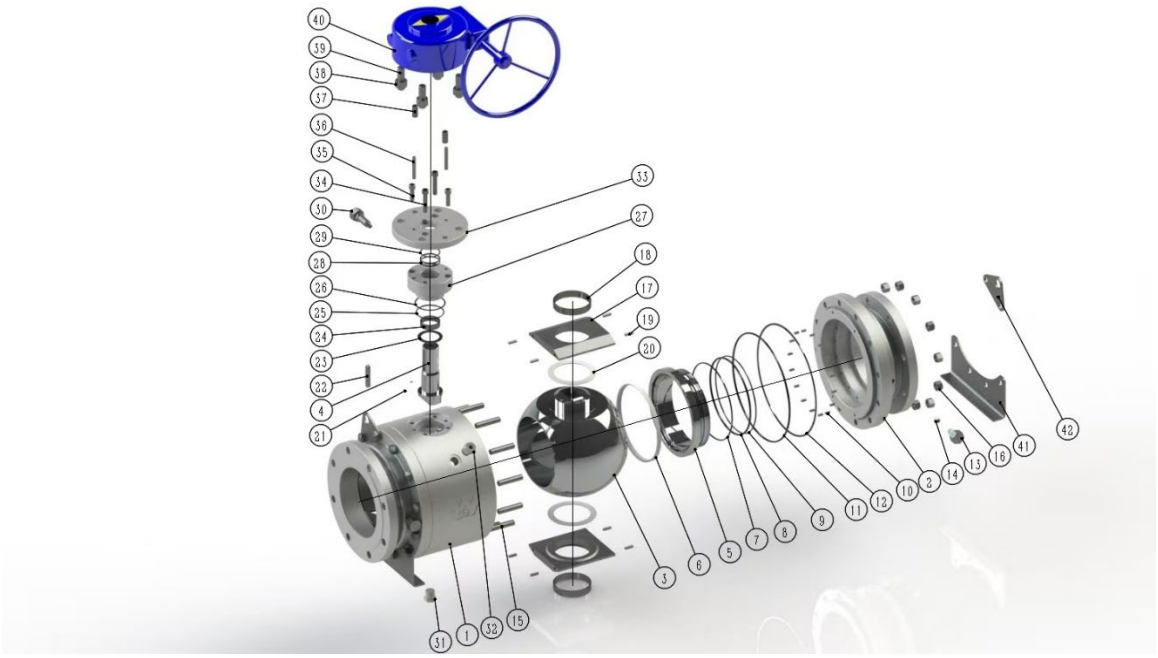

Figure 1 Plate Trunnion Structure

No.	Part Name	No.	Part Name
1	Body	22	Pin
2	Body Flange	23	Thrust Washer
3	Ball	24	Bearing
4	Stem	25	O-Ring
5	Seat Ring	26	O-Ring
6	Seat Insert	27	Gland
7	Seat Fire Safe Seal	28	Gland Fire Safe Seal
8	O-Ring	29	O-Ring
9	Spring	30	Sealant Injection Fitting
10	Pin	31	Vent Valve
11	Body Fire Safe Seal	32	Vent Valve
12	O-Ring	33	Gland Plate
13	Sealant Injection Fitting	34	Gland SCREW
14	Parallel Pin	35	Gland Plate SCREW
15	Body Stud	36	Pin
16	Body Nut	37	Key
17	Plate Trunnion	38	Stud
18	Bearing	39	Nut
19	Parallel Pin	40	GEAR
20	Thrust Washer	41	Lifting Lug
21	Pin	42	Leg Plate

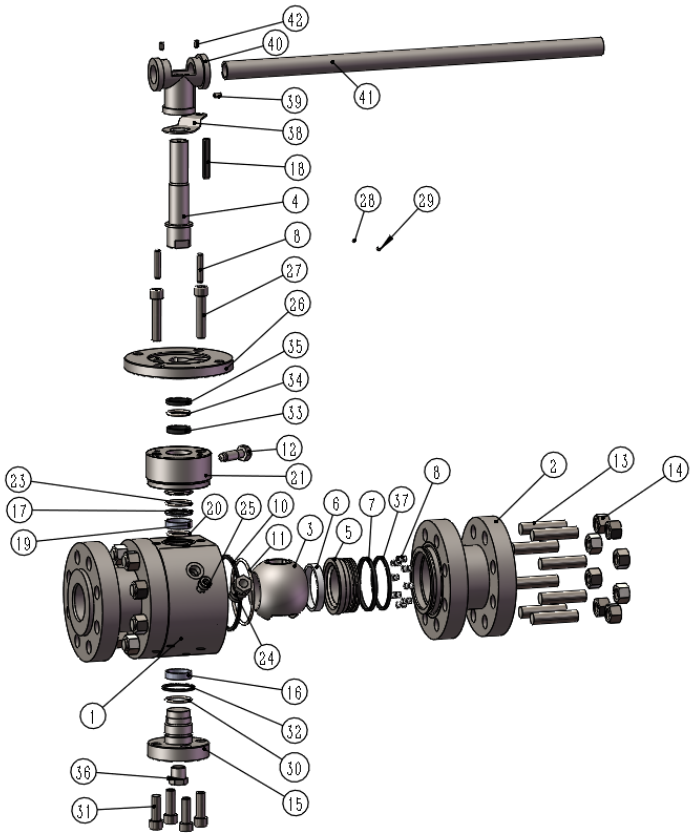

Figure 2 Post Trunnion Structure

No.	Part Name	No.	Part Name
1	Body	22	Gland Fire Safe Seal
2	Body Flange	23	O-Ring
3	Ball	24	Sealant Injection Fitting
4	Stem	25	Check Valve
5	Seat Ring	26	Gland Plate
6	Seat Insert	27	Gland SCREW
7	Seat Fire Safe Seal	28	Anti-static Ball
8	Spring	29	Anti-static Spring
9	Gland Plate PIN	30	Trunnion O-Ring
10	Body Fire Safe Seal	31	Trunnion Bolt
11	O-Ring	32	Trunnion Fire Safe Seal
12	Sealant Injection Fitting	33	Stem Fire Safe Seal
13	Body Stud	34	O-Ring
14	Body Nut	35	Gland Fire Safe Seal
15	Plate Trunnion	36	Vent Valve
16	Radial Bearing	37	Seat Fire Safe Seal
17	Thrust Washer	38	Locking Plate
18	Key	39	Screw
19	Radial Bearing	40	Handle Guide
20	O-Ring	41	Pipe
21	Gland	42	Screw

3 GENERAL INSTRUCTIONS

3.1 RECEIVING & HANDLING

A. Upon receipt, valves should be inspected for shipping damage. The areas to inspect are the pressure retaining shell, valve ends, and valve operating mechanisms such as handwheel, lever, actuator, stem, etc. Any damage observed during the inspection should be documented in an inspection report. Significant damage should be reported to Williams Valve Corporation to determine if repair or replacement of the equipment is necessary.

B. Valves should be stored in a sheltered environment providing adequate protection from weather, dirt, and damage. Materials attached to protect valves during shipment should not be removed until time of installation in the line.

C. Valves should only be handled with equipment that will safely support the valve assembly weight. Slings should never be placed around the handwheel, lever, stem or gland adjustment parts. Protect the valve ends by leaving end protectors in place until removal is necessary. Valves are shipped in the open position, to avoid damaging the ball surface.

D. Once the Equipment is installed, it is expected that the system will be operational within a reasonable time limit. No extraordinary care is required to maintain the equipment during idle time. However, prior to returning the equipment to service, it is recommended that it be checked for smooth operation and proper tightness of packing. Stem threads should be checked to ensure that they are still properly lubricated and free of debris.

E. For installed equipment that is expected to be idle for more than six months it is recommended that the valve be cycled from fully closed to fully open and returned to the idle position of the valve. This valve cycling should be performed once every six months for the duration of the idle period.

3.2 VALVE TRANSPORTATION / STORAGE

A. Valves should be adequately packaged to ensure protection from atmospheric conditions prior to transportation or storage. If the packaging is damaged, repair it so that the valve can be safely stored and transported. Avoid rotating the handwheel or lever before installation if possible.

B. Actuator and valve may be packaged separately.

C. The paint, the nameplate and the sealing faces of the end flanges shall be protected during transportation. No part of the valve can be dragged on the ground and the valve must be adequately protected from abrasion and impact during transport.

The valve shall be stored at a safe location to protect against rain and dust if it will not be installed immediately. Valves shall be stored in a ventilated and dry warehouse for protection. It is not permitted to store the valve outdoors.

D. Ball valves must remain fully open during transportation and storage to avoid damage to the ball.

E. Inspect and clean the valve if it has been stored over six months. Pressure test prior to use if the valve has been stored over twelve months.

3.3 PREPARATION FOR INSTALLATION

A. Prior to installing the valve, clean out all dirt and foreign matter from inside the piping system. Wherever possible, the line should be blown out with clean compressed air or flushed out with water to remove all dirt and grit. The valve should be cleaned out in a similar manner.

B. Check for adequate clearance around the valve to ensure that it may be operated properly and that enough free space is available for maintenance of the valve. Valves installed with the handwheel facing down present a head hazard if not placed at a proper elevation. Care should be taken to provide adequate headroom below the handwheel when it is in a fully open position. A clearance of 6 feet, 6 inches above the operating floor is usually sufficient.

C. Valves with actuators will require additional clearance around them for making service connections and maintenance to the actuator.

3.4 INSTALLATION

A. Precautions:

1. The valve body is a rugged structure but is not intended to be a means of aligning improperly fitted pipe. Care must be taken to ensure that any stresses caused by improper pipe alignment are relieved elsewhere in the piping system. Piping should be supported by hangers placed on either side of the valve and large heavy valves should be independently supported

B. The following general rules should be followed when installing the valve in the pipeline:

1. Keep pipe ends free of dirt, spatter, and grit.

2. Install the valve with flow in the proper direction with regard to valve internals. Ball valves are normally installed in horizontal pipes with the stem facing up. However, there are no limitations regarding the pipe or stem orientation. Ball valves are designed for bidirectional flow unless the ball is prepared for cavity relief. For a ball with a cavity relief, ensure that the installation of the valve is correct with respect to the flow direction arrow marked on valve.

3. Handle the valve only with equipment that will adequately support it, using a safe and proper technique.

4. Install the valve using good piping practices as governed by the applicable code or specification.

5. Flanged End Valves

   a. Check and align pipe flanges before valve installation.
   b. Use proper gasket type and size.
   c. Clean debris, dirt, and any other foreign particles off the surface of the flanges.
   d. Do NOT ATTEMPT TO FIT TWO FLANGES THAT ARE NOT ALIKE TOGETHER. For example, flat face with flat face or raised face with raised face is the proper procedure.
   e. Do NOT TIGHTEN BOLTS IN A CIRCULAR PATTERN: bolts must be tightened in a crossover or star pattern to load the gasket evenly.

6. Butt-Weld End Valves

   a. Valve, pipe, and weld rod must all be of materials that are mutually compatible.
   b. Welding should be performed by a qualified welder using the correct welding equipment and following all applicable site and industry procedures.
   c. After completion of the weld, it should be stress relieved if required by the welding procedure and subjected to a pressure test to ensure a sound weld.
   d. For butt-weld end valves, a sleeve pipe design is recommended to prevent damage to the soft-seated sealing surfaces from excessive temperatures during welding of the valve to the pipeline.
   e. For additional information, refer to WEW-RP-001 Guidelines for Installation of Weld End Valves.

3.5 POST INSTALLATION

A. Standard valves may be installed in either direction. Valves with an upstream relief hole in the ball, are uni-directional and must be fitted with the flow arrow pointing downstream.

B. Ball valves shall be of quarter-turn design (90° rotation) with clockwise closing and counterclockwise opening (Fig. 3). For lever-operated valves, ensure adequate clearance for unobstructed operation. For gear operated valves, the position is indicated by the arrow-indicator (Fig. 4).

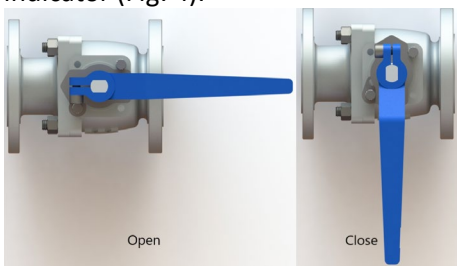

Figure 3

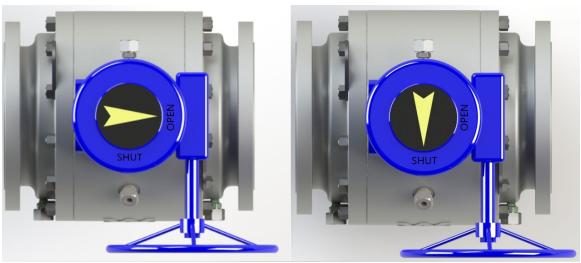

Figure 4

C. Double Block and Bleed:
Whether the valve is in the open or closed position, the upstream and downstream pressure can be isolated from the body cavity by the seats. The body cavity may be safely drained or vented through the valve body discharge port.

Note: It is strictly prohibited to drain or vent the body cavity while the valve is in a partially open position. All operations must be carried out by trained and qualified personnel only.

D. Drain valve
There are two functions of the drain valve: pressure relief and draining media from the ball valve cavity.

E. Lubrication and emergency grease injection:
If necessary, lubricate or inject grease into the seat or stem to maintain smooth operation and sealing performance. Regularly clean dirt and debris from the valve body and flush the valve to prevent buildup.
Please refer to cleaning procedure on page 11
Please refer to the grease injection procedure on page 11.
Please refer to Cleaning solution/sealing grease table on page 12

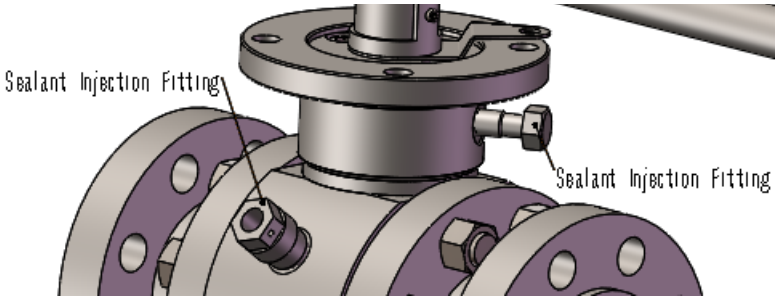

Figure 5

F. Verify the tightness of body/end adapters joint and packing gland.

G. Operate valve to make sure that nothing is preventing proper operation.

H. Pressure test the system to prove quality of flange bolting, welding, etc.

Note: Use of caustics or other chemical agents to flush pipe and valve may require the removal of the valve packing and gasket based on the compatibility of the flushing agent, gasket and packing material utilized.

3.6 MAINTENANCE & TROUBLE SHOOTING

3.6.1 Maintenance is a necessary measure to ensure the proper operation of the valves. Maintenance practices include:
a) Check the tightness of bolts and nuts.
b) Inspect the seal of the valve stem and body cover for all weather conditions.
c) Check for rust on the valve.

3.6.2 Maintenance of the gearbox
a) Check for damage and wear on the gearbox body.
b) Inspect the all-weather seal of the gearbox to prevent water ingress and corrosion.
c) Add factory-approved lubricating oil or establish a long-term maintenance mechanism if necessary.

Occasionally, valve age, type of service or other factors may result in problems such as packing leakage, Body/End Adapters joint leakage, seat leakage or loss of operation smoothness. The troubleshooting chart presented in the following Table 2 lists typical problems and methods for resolving them. It should be noted that this chart does not present all possible problems and all possible solutions and is not a substitute for regular periodic maintenance. It does, however, list the most common problems that can be encountered and the repair procedure that will most likely return the valve to its proper operational condition.

Table 2 - Troubleshooting Procedures

Observation	Possible Cause	Procedure
Valve difficult operation	•Sticking or deformed the stem •Excessive friction between ball and seat •Internal obstruction or Medium characteristics •Insufficient torque from gearbox damage	•Inspect and replace the stem; clean and apply high-temperature lubricant. •Grind or replace seat/ball; adjust seat spring preload; •Clean up dirt and flush the valve regularly •Repair Gearbox
Body/End adapter Joint Leakage	•Insufficient Bolting Tightness •Seal ring Damaged	•Check Bolting Torque •Replace Seal ring
Seat Leakage	•The seat does not operate properly •The limit switch is improperly installed •Valve is not fully closed	•Clean or repair seat •Re-adjust the limit switch •Operate valve to full closed position
Stem Leakage	• O-rings failure • Stem sealing surface is damaged	•Replace O-ring •Repair or Replace Stem

Cleaning procedure

Operating steps	Procedure
Check the valve	Inspection of the seat grease fitting and valve body drain nozzle
Check the equipment	Verify that the grease gun functions properly
Injection of cleaning solution	Inject enough cleaning solution into each valve seat through the grease injection port on the seat
Operate the valve	Open and close the valve three times
Injection of cleaning solution	Inject enough cleaning solution into each valve seat through the grease injection port on the seat

Immerse the valve	Wait for 1~6 hours to let the cleaning solution soak into blockages and contaminants.
Injection of cleaning solution	Inject enough cleaning solution into each valve seat through the grease injection port on the seat
Operate the valve	Open and close the valve three times

Grease injection procedure

Operating steps	Procedure
1 . Preparation procedure	Before grease injection, ensure to follow the "Table 2 - Troubleshooting Procedures". Perform analysis to find the cause of valve seat leakage. Clean the valve before grease injection.
2 . Verify valve position	Make sure the valve is fully closed.
3 . Inject standard sealing grease	Inject enough cleaning solution into each valve seat through the grease injection port on the seat.
4 . Operate the valve	Operate valve to full open position.
5 . Inject standard sealing grease	Inject enough cleaning solution into each valve seat through the grease injection port on the seat.
6 . Operate the valve	Open and close the valve three to four times, then return the valve to the fully closed position to evenly distribute the sealing grease.

Cleaning Solution/Sealing Grease Dosage Table

Valve size	Injection volume per seat (oz)	Injection volume per valve (oz)	Injection volume per seat (cm3)	Injection volume per valve (cm3)
2"	1	2	25	50
3"	1	2	35	65
4"	2	3	50	100
6"	2	4	65	130
8"	3	6	80	160
10"	3	6	90	180
12"	5	10	135	270
14"	5	10	155	310
16"	6	12	170	335
18"	9	18	265	525
20"	10	20	295	585
22"	11	22	330	655

24"	12	24	350	695
26"	13	26	395	785
28"	13	26	400	800
30"	15	30	445	890
34"	17	34	495	990
36"	21	42	620	1240
40"	32	64	960	1920
42"	34	68	995	1990

3.7 COMMON REPAIRS

The following general instructions are offered to make limited repairs to the valve. For major repairs, contact an authorized WILLIAMS VALVE CORPORATION representative for special instructions. Always give the information shown on the identification plate affixed to the valve.

A. Never use pipe wrenches to remove or replace bonnets on small valves, especially bronze. A pipe wrench will pinch or swage the body neck.

B. If leakage is observed through the gland packing, tighten the gland nuts slowly and evenly until the leakage stops.

Do not over-tighten the packing gland nuts. Over-tightening will increase the torque required to operate the valve. Follow the torque **Annex table 1** to ensure correct torque used when tightening the gland nut.

C. Any sign of leakage through the body joint seal should be addressed immediately by tightening the stud nuts until the leakage stops. Follow the torque table to ensure the correct torque is used when tightening the nut.

NOTE: Before removing the valve from the piping, ensure that the system has been fully depressurized and any dangerous fluids have been drained off. Failure to do so may cause serious bodily harm to personnel and/or damage to the valve.

D. During coating repair, the intact area surrounding the damage must first be lightly abraded and then ground to form a smooth transition layer, ensuring uniform blending between the existing and repaired surfaces. Throughout the repair process, climatic conditions must be controlled in accordance with the parameters established in the original coating procedure. The repaired area shall achieve the specified dry film thickness as defined by the relevant standard, with air spraying or localized brushing recommended depending on the size and nature of the repair. Drying time for the repaired coating must align with the requirements for standard paint application, and no installation or packaging shall proceed until the coating is fully cured. All additional painting requirements must conform to the project-specific painting specifications or, where applicable, the Williams Valve Painting Specification.

3.8 TOOLS & EQUIPMENT

Standard wrenches and tools are generally suitable for servicing valves. Common tools are:

A. Hoist to lift large or heavy items.

B. One set of box-end, open-end, or socket wrenches .

C. One set Allen-type hex key wrenches.

D. Standard packing tool or blunt hook to remove packing rings.

E. Combination oilstone, coarse and fine grit, to polish wedge and seat ring sealing surfaces.

F. Hammer and punches to drive out pins.

3.9 OPERATION

The following is general information on the operation of valves:

A. It is not good practice to leave a soft seated ball valve in the partially open(throttled) position as this will damage the seats and reduce valve life. Flow control ball valves, which contain seats suitable for this purpose, are available from Williams valve.

B. Any media, which may solidify, crystallise or polymerise, should not be allowed to stand in the ball cavity, as this is detrimental to valve performance and life.

C. When operating the valve, avoid using excessive side loading on the wrench.

D. The operation of the valve consists of turning the wrench a quarter turn clockwise to close. When the handle and the flats of the stem are in line with the pipeline the valve is open.

4 VALVE SPECIFIC STORAGE, INSTALLATION AND MAINTENANCE PROCEDURES

4.1 Plate Trunnion Structure

A. Periodic Inspections

1. Prior to commencing any work on the valve or removing it from line, refer to the "Health & Safety" instructions.
2. Never remove or maintain a valve or joint unless the line has been fully de-pressurised, drained and where necessary, purged of toxic/explosive / flammable media.

B. Disassembly

1. Fix the valve vertically, take care not to damage the flange sealing surface, turn clockwise to close the ball valve.

2. Operation:
   1) Lever

- Remove bolts, retainer and lever
- Remove stop plate, washer, locking plate and stop pin

2) T-Lever
- Loosen the bolt and pull out the steel pipe
- Remove screws, washers, and handle guide
- Remove locking plate, and screw.

3) Gearbox
- Disassemble the nut and lift the gearbox from the valve. Put it in a clean place.
- Remove the key and pin from the stem.

3. Bare valve
1)Put the valve in full open position, take off the key on the stem, remove the screw, lift the gland plate(pos.26).
2)Remove O-ring and graphite gasket from gland plate & gland flange (pos.27).
3)Remove the screw, gland flange and lubricator from the body.
4)Take out O-rings from gland flange. Remove gland plate and gland flange.
5)Remove ring and take off the stem, thrust washer, bearing and washer.
6)Lift ball and plate trunnion vertically out of valve body. Remove plate trunnion, bearing and thrust washer from ball.
7)Remove the spring.
8) Remove seat, spring, graphite gasket and O-ring from the body flange.

4. All components not replaced by items in the repair kit should be thoroughly cleaned and stored in a clean secure area. All sealing faces on the body, insert and ball must be checked for corrosion, erosion and scratches. If damage is found or there is any doubt, replace the component.

5. Cleaning the valve parts should be carried out using a suitable degreasing agent. Hard deposits can be removed using wire wool. Care should be taken on all seal faces to avoid damaging them.

C. Valve re-assembly

Proceed in reverse order as described at disassembly.

Prior to assembly, clean all parts thoroughly and inspect them for damage; any damaged parts should be repaired or replaced.

4.2 Post Trunnion Structure

A. Periodic Inspections

Same as Section 4.1 Plate Trunnion Structure

B. Disassembly

1. Fix the valve vertically, take care not to damage the flange sealing surface, turn clockwise to close the ball valve.

2. Operation:

1) Lever
- Remove bolts, retainer and lever
- Remove stop plate, washer, locking plate and stop pin

2) T-Lever
- Loosen the bolt and pull out the steel pipe
- Remove screws, washers, and handle guide
- Remove locking plate, and screw.

3) Gearbox
- Disassemble the nut and lift the gearbox from the valve. Put it in a clean place.
- Remove the key and pin from the stem.

3. Bare valve
   1)Put the valve in full open position, take off the key(pos.18) on the stem, remove the screw (pos.27), lift the gland plate (pos.26).
   2)Remove O-ring and graphite gasket from gland plate &gland flange.
   3)Remove the screw, gland flange and lubricator from the body.
   4)Take out O-rings from gland flange. Remove top flange and gland flange.
   5)Remove trunnion Bolt (pos.31) from post trunnion (pos.15), take off the post trunnion, Gasket, O-ring, bearing.
   6)Remove nut and take off body flange(pos.2), seat (pos.5), sealing ring, gasket, graphite rope, O-ring and spring.
   7)Remove seat, spring, graphite Rope and O-ring from the body flange.
   8)Lift the ball vertically and place it on a soft cloth or cardboard.
   9)Remove stem, thrust washer, bearing, anti-static Ball& spring together through the post trunnion hole from valve body.
   - 10)Repeat step 6 & step 7 to disassemble the body flange and other components on the other side.

4. All components not replaced by items in the repair kit should be thoroughly cleaned and stored in a clean secure area. All sealing faces on the body, insert and ball must be checked for corrosion, erosion and scratches. If damage is found or there is any doubt, replace the component
5. Cleaning the valve parts should be carried out using a suitable degreasing agent. Hard deposits can be removed using wire wool. Care should be taken on all seal faces to avoid damaging them.

C. Valve re-assembly

Proceed in reverse order as described at disassembly.

5 VALVE ASSEMBLY TORQUES

5.1 Annex Table 1 Recommended Bolts Torque N.m

Size	Torque	Size	Torque
1/2	50~60	1-5/8	1800~2200
9/16	70~80	1-3/4	2200~2600
5/8	100~130	1-7/8	2800~3300
3/4	160~210	2	3500~4200
7/8	280~330	2-1/4	4200~4800
1	420~500	2-1/2	6100~7000
1-1/8	500~600	2-3/4	8200~9400
1-1/4	850~1000	3	10300~11800
1-3/8	1100~1300	3-1/4	14000~16000
1-1/2	1400~1800	3-1/2	17000~19600

Annex Table 1