

# **INSTALLATION, OPERATION AND MAINTENANCE MANUAL FOR AIL TRUNNION MOUNTED BALL VALVES**

## **1. STORAGE AND HANDLING OF VALVES**

On receipt check that the valve is in fully assembled and in tact, The valve should be in open position to protect the ball surface from any inadvertent handling damage.

Prior to shipment from the factory, end protectors are attached to the inlet and outlet of each valve, for protection from mechanical damage and for prevention of the intrusion of dust and any other foreign objects into the valve bore, during transit. These valve end protectors should be kept intact and be removed only at the time of installation.

Valve should be stored in a covered area, which is dust-free, least humid and well ventilated place. Always care shall be exercised not to damage the extended portion of stem housing, gear units/actuators, which are very vulnerable to damage due to wrong or careless handling. Placing valves directly on the ground or on the concrete floor is not recommended. Under no circumstances should the valve be stored outdoors. The valve should be kept on a wooden pallet at least 6” above the ground level.

Always AIL Ball Valves are shipped with balls in fully open position for protection of ball and seat ring surfaces. Valve should always be left open during the storage period.

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

While transporting the valve from storage area to installation site, it should not be dragged on the ground. For moving with a crane, valves should be positively slinged with a wire around the valve body and end flanges or through the lifting lugs provided. The crane wire should not be in direct contact with valve operating gear units / actuators. Do not rope or chain through the valve port.

Negligence of the above cautions may cause ball / seat damage or deformation of seat or stem, which will affect sealing and operational torque performance of the valves.

## **2. VALVE INSTALLATION**

Before installation, remove all foreign matter from the pipeline by flushing the line with water or compressed air. As normally any site are dusty and full of loose components, ensure not to remove valve end protectors before valves are ready for mounting.

After removal of end protectors, thoroughly clean inlets and outlets of both pipes and valves so that flange gasket faces are free from dust, which may affect sealing performance.

Any scratch or defect on gasket contact faces of valve flanges and pipe flanges should be carefully detected and corrective actions like applying sand paper or grinding stone to make the surface smoother, shall be done.

Do not rope or chain through the valve port

Before coupling the flanges, first align bolt holes of valve flanges with those of pipe flanges (ie companion flanges), then insert gaskets and tighten bolts. *Refer bolt tightening sequence and the necessary torque (charts attached)*. These shall be strictly followed to ensure a leak tight joint between pipe and valve. If the valve and pipes are not aligned accurately, unbalanced tightening will cause excessive stress on bolts and hence the alignment should be ensured.

For larger flanged valves, which are provided with foot support, first the flanges are to be aligned and bolted with the pipe flanges. Then only the ground / pedestal support to be brought up to the foot support of the valve. The foot support need not be bolted on the floor.

In general, installation of a flanged valve does not require procedures beyond those normally used for the installation of flanged fittings. The valve may be installed in any position and either end of the valve may be installed upstream. The most ideal orientation for a ball valve.

For a weld end valve, it should be installed in the FULL OPEN POSITION. If the valve must remain closed during installation, extra care shall be exercised to avoid weld spatters falling on the ball surface. Alignment of the valve with the pipe must be as accurate as possible so as to get a most favorable condition for weld deposition.

***CAUTION : temperatures in excess of 100 deg C in the seat ring area will result in seat ring damage. Temperature indicating crayons should be used to monitor and control temperature in this area during welding.***

### **3. VALVE OPERATION**

Ball valves are 90 deg operation open. ie quarter turn of the ball makes the valve either fully open or close. Valves do not have any preferred direction of installation. Easiness or proximity of handwheel operation is the only consideration, while fixing the valve on to the pipeline. *Refer general assembly drawing of a gear operated ball valve for understanding the internal construction.*

Normally clockwise operation is for close and anti-clockwise operation for open. By observing the position indicator provided on the gear unit or the actuator, the open or close position of the valve can be ascertained.

AIL trunnion mounted ball valves are generally fitted with a self locking gear unit, for a manually operated valve. Electric actuators, which gives a multi-turn output, are fitted on the gear unit, so the actuator drives the input shaft of the gear unit, which in turn drives the valve stem. Stem is engaged with the ball- A fiat milled projection of the stem engages with a corresponding female milled slot on the ball, and hence any rotary motion of the stem has to rotate the ball.

Gear units have in-built mechanical stopper screws, for setting the exact open and close position of the ball.

In the fully open position of the valve, the ball bore should exactly align with valve bore, as otherwise the pig can get stuck during the pigging operation. The stopper screws are factory set to exact open and closed positions.

Pneumatic/gas/gas over oil actuators are fitted directly on top of the valve, without a separate gear unit, as these actuators themselves are quarter turn devices.

Ball valves are NOT recommended for throttling service. They are for either allowing free flow of fluid or to totally cut it off. If the ball is left half open/close it will lead to heavy erosion of both the ball and seat rings and hence cause heavy leakage.

Trunnion mounted ball valves are generally upstream sealing valves. Both the seats are floating and capable of axial movement in the pipe axis. The seat rings are kept pressed to the ball by means of flat springs. This feature ensures that valves are capable of passing the double block and bleed test requirements. Hence online bleeding of the vent or drain is possible, when the valve is in FULL OPEN or FULL CLOSE position. By this way it is possible to periodically ensure that both the valve seats are sealing or not.

#### **4. ON - LINE MAINTENANCE**

AIL TRUNNION MOUNTED ball valves are maintenance free. However maximum valve potential can be realized through the use of the maintenance procedures outlined in this section.

## **4.1 BLOCK AND BLEED**

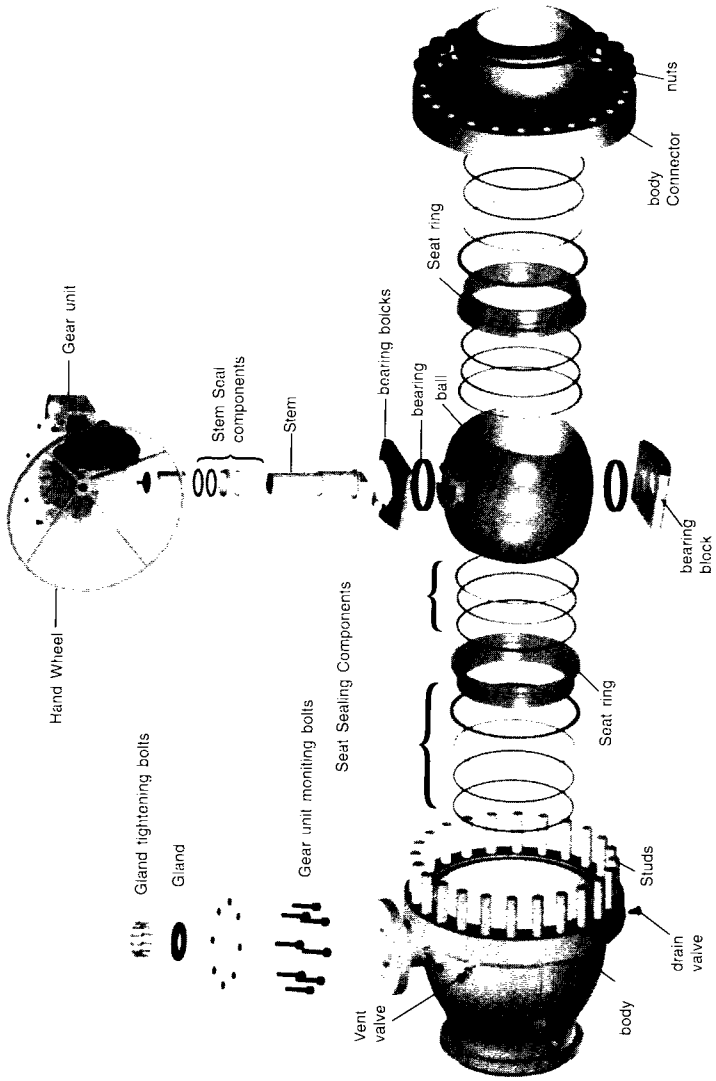
AIL ball valves are provided with vent and drain fittings/ valves. It is recommended that periodically the vent and drains are opened and flushed using a compatible / inert medium to prevent accumulation of dirt/debris in the body cavity leading to the erosion of internal sealing surfaces. In the standard design of pipeline ball valves, threaded connections of the valve body for drain and vent lines are sealed by threaded plugs. These should not be removed as long as the valve is under pressure.

However with line under pressure, the valve body cavity can be vented to atmosphere and completely drained off with the BALL IN CLOSED POSITION as follows

1. Close the ball valve.
2. Open the vent valve. If special vent plug is provided, fully remove the plug.
3. Open the drain valve, at the bottom.
4. Allow the flushing medium into the body cavity through the vent hole, allowing for drainage through the drain valve.
5. Continue flushing till all dirt/debris are completely evacuated from the cavity.

## **4.2 PERIODIC MAINTENANCE**

Periodic maintenance is performed according to a plant schedule that is convenient as well as to keep the valve in good working condition and realize full unit life. Longer seat life and easier operation can be obtained if sealant is injected periodically. This reduces abrasive



wear by providing a thin film of lubricant on mating sealing surfaces. Depending on the severity of the service environment, it is recommended that sealant be injected once every month or lesser intervals. While charging try rotating the ball through a small angle (say 10 deg ) and return it back to the original position.

Seal damage, due to operation in abrasive or extreme services environments, may eventually result in leakage. Unless the valve is severely damaged, leakage can be stopped by injecting sealant in the appropriate areas of seat and stem.

### **4.3 Seat leakage**

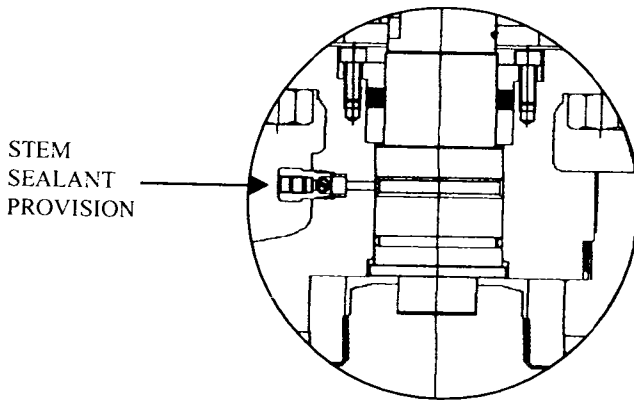
Seat leakage is controlled by injecting sealant into the secondary seat sealant injection system (see below for description)

Please note that a leak across the seat cannot be arrested by extra turns of the hand wheel (as in a gate valve). Because of high gear ratio and mechanical advantage of the gear units, enormous torques can be applied on to the stem, and can damage the stem or the gear unit stopper screws. Only application of sealant is the right answer to arrest/halt the seat leakage momentarily.

### **4.4 Stem seal leakage**

*Stem seal leakage can usually be controlled by injecting stem sealant into the stem housing. refer sketch stem seal system for provision of sealant injection facility.*

Refer to stem seal replacement section if sealant does not control leakage.



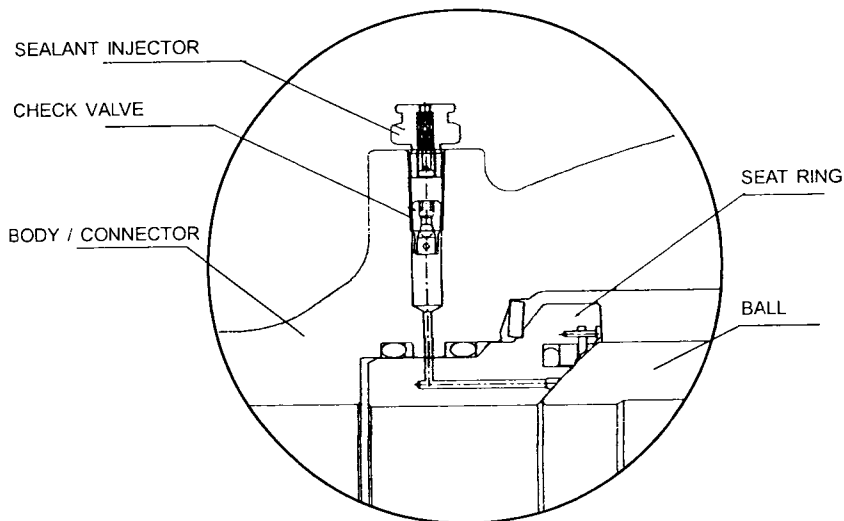
**Stem Seal System**

#### **4.5 STEM SEAL REPLACEMENT**

*It is desirable that the valve be relieved of pressure prior to seal replacement. If this is not possible, get in touch with AIL or their authorised service representative for additional information.*

*After checking to insure that no pressure is trapped in the valve, exercise the following steps in replacing the stem seal. Also refer the sketch "Stem seal system"*

- 1. note the position of the gear unit in relation to the valve, and remove it. preferably the mechanical stopper screws in the gear unit is not disturbed. however if essentially such a disturbance is needed, the position shall be marked to facilitate exact resetting when reinstalling the gear unit*
- 2. Remove the key and its retaining screw and washer, if provided.*



## SEAT SEALING SYSTEM

3. *Loosen all the hexagonal cap screws, which hold the gland. remove the gland from its place.*
4. *Take out both the graphite seals (two numbers).*
5. *Keep the new graphite seals.*
6. *Place the gland back in its place and tighten all the cap screws. Diagonally opposite screws shall be tightened in sequence.*
7. *It is advisable to conduct a stem seal leak test (before fixing the gear unit), it shall be done as follows. Pressurise the body cavity ( either through the drain or vent) using 80 to 100 psi air or nitrogen. As the valve is in fully open or dose condition, the cavity will get fully pressurised upto the stem seals. Apply soap solution on top of the gland to ensure no leak. Now gear unit shall be mounted back in its position, after ensuring correct orientation.*

## **5.0 SECONDARY SEALING SYSTEM**

Following comprises the secondary sealing system

### **5.1 SECONDARY SEAT SEALING SYSTEM**

Refer sketch “seat sealing system”. Both the seats are provided with sealant (special grease) charging facility (two button head injectors can be easily noticed, protruding out of the valve body, one for each seat). The sealant charged passes through the injector, a check valve and through a small drilled hole into the seat ring and reaches the seating surface of the seat ring, which contacts the ball. The charge gets uniformly distributed on the seat surface through a circular groove. A film formed on the seating surface provides for immediate and emergency sealing of a leaking seat ring.

### **5.2 SECONDARY STEM SEALING SYSTEM**

The stem housing is provided with one packing feed injector, very close to the valve cover flange. Special graphite based stick sealant can be screwed inside after removing the grub screw inside the injector. This sealant goes directly on to a groove provided in the stem outer diameter and hence forms a packing around the stem. Once this packing is injected, online replacement of the top ring is possible.

*ALL trunnion mounted ball valves (sizes 8" and larger) are always provided with the above referred sealant injection facility for both seats as well as for stem. This is an extremely useful emergency facility. In the unlikely event of a leakage across the seat, charge sealant No. 735 or 1033, using a sealant gun.*

## 6. **REGULAR MAINTENANCE**

These are major repairs which necessitate removal of valve from the pipeline, such a replacement of ball, seat rings, stem etc *it is suggested that such repairs are undertaken only under the direct supervision of ALL service engineer.*

Before removal of valve from the pipeline, the pipeline is to be necessarily DEPRESSURISED. Also vent/drain off the body cavity handling equipment as required for the weights involved shall be ascertained from records/drawings. Valve shall be suitably and correctly slinged, before start of flange bolt loosening. Once all the flange bolts are removed, move and place the valve safely on to a wooden platform and shall be transported to the repair shop. It is advisable to keep the valve in fully open position and with the end protectors in place, while in storage, till service is undertaken.

### **RECOMMENDED SPARES**

It is recommended that following minimum spares are available with the customer

- one soft seal kit comprising of rings, nylon insert, gland packing and gaskets
- one set of bearings and thrust washers
- sufficient quantity of emergency sealant.