

Installation, Operation and Maintenance Manual for AIL Cast Steel Gate, Globe and Check Valves

1.0 STORAGE

On receipt check that the valves and accessories are intact. Ensure that the valve is in fully closed position.

End protectors on either side of the valve should be kept intact and removed only at the time of installation.

Valve should be stored in a covered area. If the covered area is not available water proof covering material should be spread over the valves and the valves should be kept on a wooden pallet at least 6" (150mm) above the ground level.

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

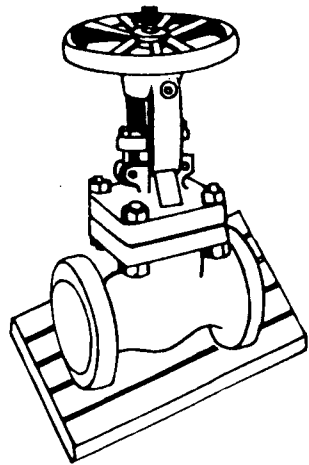


Fig. 1

2.0 CONSTRUCTION

AIL Gate, Globe and Check valves are of sturdy design and give tight sealing against varied pressure and temperature of the line fluid.

All gate and globe valves are of Outside Screw and Yoke (OS&Y) type.

All check valves are of swing type.

Gate Valves

ALL gate valves can be categorised into two by the type of Body-Bonnet joint and Gate design. This manual covers the following types.

- A) Valve with
 - 1. Bolted Body-Bonnet Joint
 - 2. Pressure Seal Bonnet Joint
- B) Valves with
 - 1. Flex Wedge type Gate
 - 2. Parallel Slide Gate

Check Valves

ALL Check valves are categorised into two by the type of Body-Cover joint. This manual covers the following types

- Valves with
 - 1. Bolted Cover Joint
 - 2. Pressure Seal Cover Joint

3.0 INSTALLATION

3.1 Preparation for Installation

Move the valves as close as possible to the installation site before removing packaging and end protectors. After removing the end protector, check the inside of the valve and remove any rust inhibitor or dirt. If the valves have been in storage for a long period clean the stem threads after removing the protective paper and apply fresh grease.

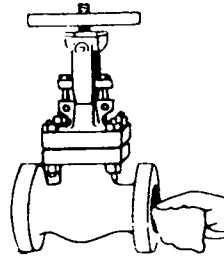


Fig. 2

3.2 Pre-commissioning Tests

All valves are factory tested in accordance with the relevant testing standard as mentioned in the product catalogue.

Wherever valves are required to be re-tested before installation ensure that proper Test rig is available at the site. Valves should be tested as per the relevant testing standard.

If water is used for testing it is recommended that after testing is over the valve internals be dried with dry nitrogen or air. It would be advisable to add corrosion inhibitor in the water.

3.3 Installation configuration

For best performance it is recommended that Gate and Globe valves are installed vertical with stem operating end at the top, horizontal or at any angle in between.

Swing check valves can be installed either in horizontal or vertical pipelines. However in vertical pipelines the flow should be only in upward direction. Swing check valves should not be installed at the outlet of a reciprocating pump as the pulsating flow is likely to damage the internals.

AIL Gate valves have bi-directional sealing capabilities and therefore can be installed in any direction. However if the valves are with pressure relieving feature (a hole in the upstream side of the gate) they can be installed only in the direction of arrow.

Though **AIL Globe valves** have bi-directional sealing capabilities, the direction of flow is influenced by the operating conditions. However for valves installed in drain lines of high temperature fluids (especially steam) flow over the disc is strongly recommended.

AIL Check valves are uni-directional and are installed such that the arrow mark is in line with the flow direction. If this is not ensured check valve will stop the flow altogether.

3.4 LIFTING TO POSITION

Valves should be lifted using suitable mechanical equipment. Chains, Slings and other lifting equipment should be regularly inspected. Do not attempt to lift the valve by applying load on hand wheel, Gear unit, Actuator or By-pass piping. Chains or Slings shall be fixed around the valve body.

3.5 Making End connections

AIL Gate, Globe and Check valves are offered with Flanged and Butt weld ends. The ends are machined in accordance to

the standard specified in the product catalogues unless otherwise specified by the customer.

3.5.1 Flanged connections

Gaskets and flange bolting which are not supplied with the valve should meet the requirements of end flange standard of the valve. Flanges should be pulled together evenly by tightening opposite pairs of bolts.

3.5.2 Welded connections

All welding should be performed by the qualified welders using approved procedures. It is recommended that good engineering practices are adopted to ensure that the heat from welding does not affect the internals. Though there are no soft seats to be affected in AIL Gate, Globe and Check valves, care should be taken to avoid weld splatter so as to prevent damage to metal to metal seating.

Gate and Globe valves are to be in fully closed position while welding on to the pipeline to prevent weld splatter from falling directly on to the seating surface and sparking between gate and body.

Local post weld heat treatment (PWHT) of the heat affected zone can be safe but we do not recommend that the entire valve be subjected to PWHT. Excessive direct heat may affect the stem packing and other operating equipments.

3.6 Installation of valve operators

As a standard AIL Gate and Globe valves are supplied with handwheel or gear unit for manual operation.

Check valves do not required any operators for they open and close automatically depending on the flow condition.

Whenever Gate and Globe valves are ordered with Actuators it is fitted at factory itself. All valves with actuators are set and tested at the factory before despatch.

It is strongly recommended that the actuator setting be not disturbed/alterd at site.

3.7 Start up

All valves should be checked for operation before start-up. For an actuated valve keeping the gate/disc in mid position by handwheel, start the actuator and check if the working direction is correct. If not, check the wiring corrections.

The pipeline should be cleaned by flushing thoroughly with water or air. The valves should be either fully closed or fully open during cleaning operation. If they are partially open the gate/disc seating may be damaged by the debris flushed out. Some pipelines are required to be flushed out at very high speed (such as steam blow in turbine inlet) and in such cases particles in the pipeline might damage even the body seating. Use metal protectors around the body seating to prevent damage.

3.8 Commissioning Tests

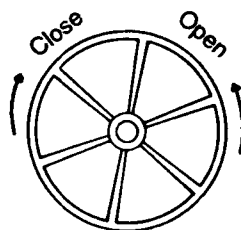
Valves are to be tested as per the relevant testing standard.

If there is an operational requirement to test the valves at higher pressures, temperatures or durations these test parameters should be specified and checked out with AIL prior to subjecting the valves to such tests.

4.0 OPERATION

4.1 Gate Valves

Gate valves are multi turn valves with rising stem i.e., they require number of turns of rotation of handwheel for full closing or full opening of the valve. All gate valves should be used only in fully open or fully close position. IF used in slight or half open position, the gate may vibrate/chatter and also



Top view of the Valve
Fig. 3

cause wire drawing at the seating area. Therefore gate valve should not be used for regulation.

All valves close by rotating the handwheel clockwise and open by rotating anti-clockwise.

For handwheel operated valves the projection of the stem above the handwheel indicates whether the valve is in open or close position. In Gear operated valves as the stem top will not be visible, a separate indicator can be provided if required.

4.1.1 Wedge Gate Valves

The valve is closed by driving the wedge down into the corresponding taper in the body. The wedge and body seat ring are matched and lapped for perfect sealing. When the valve is fully open the stem back seats into the bonnet bush. However in the case of actuator valves the stem is not allowed to fully backseat to avoid damage.

ALL wedge gate valves fully close by torque limit and fully open (backseat) by travel limit.

4.1.2 Parallel Slide Gate Valves

Unlike Wedge gate valves. Parallel slide gate valves do not require wedging action for seating. Two independent discs, held together by a disc carrier and a spring, moves down parallel and close the valve. As soon as the body port is sealed, a stopper in the stem prevents further travel. When the valve is opened, the disc moves up and the stem backseats. However in the case of actuator valves the stem is not allowed to fully backseat to avoid damage.

AIL Parallel slide gate valves fully close and open by travel limit.

4.2 Globe Valves

All Globe valves are multi turn valves with rotating stem and rising handwheel. Globe valves can be used for normal flow regulation. However if it is used in slightly opened position

when the differential pressure is very high, the seating may erode. It is advisable not to use a globe valve for flow control below 10% of full opening.

All valves close by rotating the handwheel clockwise and open by rotating anti-clockwise.

As the stem travel is very small in Globe valve compared to a same size gate valve, it is difficult to make out whether the valve is in open or close position from the stem position.

Generally, Globe valves are handwheel operated. In case the Globe valve is required to be gear operated the valve will be modified to non-rotating stem.

4.3 Check Valves

ALL Check valves are swing type which automatically opens by the velocity pressure of the flow and closes by the gravitational force when the flow reverses or stops.

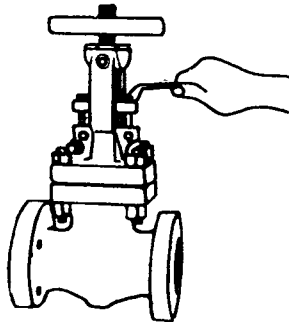


Fig. 4

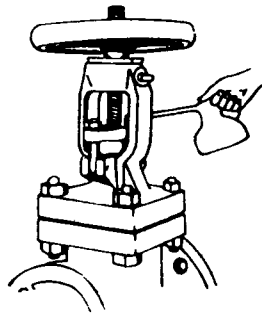


Fig. 5

5.0 IN-LINE MAINTENANCE

Gate and Globe valves require only a minimum in-line maintenance for satisfactory performance.

- 5.1 Check the gland eye bolts for tightness at regular intervals. If loose tighten them evenly.
- 5.2 Grease the stem threads in Gate and Globe Valves as required.

5.3 Apply a drop of oil into the stem packing area to reduce the friction between stem and packing.

5.4 Grease the Yoke sleeve in gate valve through the grease nipple regularly.

6.0 ROUTINE MAINTENANCE

6.1 Gland leak

Check the tightness of the gland eye bolts and tighten evenly if required. If the leak persists, the packing must be renewed. For this the valve must be either in fully open position (back seated) or the pipeline must be shut off so that there is no pressure inside the valve before the gland eye bolts are loosened.

Caution: For certain applications like high pressure steam, toxic chemicals, etc., it is not safer to remove the gland even with valve fully back seated. It is advisable to shut off the pipeline before attempting to renew the packing.

Most of the packing rings are already cut so that they can be inserted around the stem. In case of solid moulded packing like Graphite rings, use a sharp knife and cut the ring at 30° angle. Then slightly twist the ring and insert it around the stem. Do not open up the ring as it could break.

6.2 Body-Bonnet joint leak

BOLTED BODY-BONNET JOINT:

Check the tightness of the bolting and tighten the bolts at the vicinity of the leak. If leak still persists, renew the bonnet gasket. The pipeline must be shut off before dismantling the bonnet.

Pressure Seal Bonnet Joint:

In this type of joint, there is no need for any maintenance as the line pressure itself aids the sealing. The possibility of leak in this type of bonnet is very remote. If any leak is found, the gasket must be renewed (see section 7.0).

6.3 Gear units

Gear operated valves are fitted with enclosed water tight bevel gear units. The gears are designed to function without maintenance for many years. All gear units are lubricated with a heavy bearing grease when assembled and may be refilled as required.

6.4 Actuators

For operational details and maintenance instruction consult the Actuator manufacturer's instruction manual.

Ensure that proper electrical connections are given as indicated in the wiring diagram for the specific actuator.

7.0 PERIODIC MAINTENANCE

7.1 Dismantling

All valves are designed to permit inspection without removing the body from the pipeline. The section of the pipe must be shut off before dismantling the valve for inspection.

7.2 Gate and Globe valves can be inspected by removing the bonnet assembly. Check valves can be inspected by removing the cover assembly.

7.3 In the case of Check valves there is no stem and hence only the cover is to be removed. The disc is hinged inside the body. For ease of illustration only the word bonnet is used in the dismantling and reassembly procedure. This may be changed to read as cover with respect to check valves.

7.4 Bolted bonnet / cover valves

7.4.1 Keep the valve in mid position and remove the handwheel/gear unit/actuator from the top of the valve.

7.4.2 Loosen the body-bonnet bolting and remove the studs and nuts.

7.4.3 Lift the bonnet assembly including the stem and gate/disc out of the body. Care should be taken not to drop the gate/disc while lifting out. Mark the matching surfaces of the gate and

the body seat rings of gate valves so that they are not interchanged during reassembly.

7.4.4 Remove the bonnet gasket.

7.5 Pressure seal bonnet/cover valves

7.5.1 Keep the valve in mid position.

7.5.2 Stopper should be first removed from the stem.

7.5.2.1 For handwheel operated valves the stopper can be taken out by removing the cylindrical pin and the split pin.

7.5.2.2 For gear operated valves, first remove the position indicator and then the stopper will be clearly visible.

7.5.2.3 For actuator valves, first the actuator is to be dismantled from its thrust base and then the stopper will be visible for removal. After removing the stopper assemble the actuator again on to the adopter.

***Important:** Stopper is machined to suit each and every valve and should not be interchanged. While dismantling please keep the stopper safely. As a measure of caution it would be advisable to measure the dimension and make a note of the dimension of cross hole to bottom of the stopper immediately after dismantling. This will help in making a spare stopper in an unforeseen event of stopper being lost in the shop.*

7.5.3 Loosen the yoke retaining nuts and pre-loading nuts of the bonnet.

7.5.4 Rotate the handwheel in clockwise direction so as to close the valve.

The stem-disc will travel down and after touching the bottom, the yoke assembly will lift up along with actuator/gear unit.

7.5.5 Removal of bonnet retainer.

7.5.5.1 For threaded retainer unscrew the retainer in anti-clockwise direction using a special tool through the driving slots. In case of difficulty cautious hammering at the slots will be effective

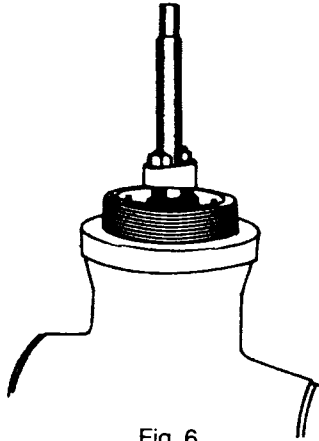


Fig. 6

7.5.5.2 For Segmented retainer

- a) remove any two bonnet pre-loading studs
- b) push the bonnet down so that the segmental rings can slide over the top of the bonnet.
- c) drive a pin through the hole provided on the body and remove the segmental ring out.
- d) by rotating the other segmental rings to the same position (opposite the hole), they can be removed.

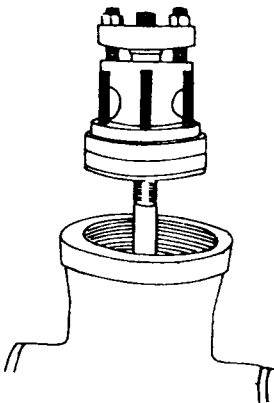


Fig. 7

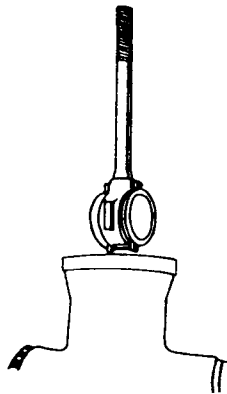


Fig. 8

7.5.6 Lift the bonnet using gland studs.

7.5.6.1 There is no need to remove the gasket set from the bonnet and it can be used many times if there is no damage during dismantling.

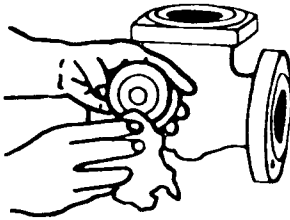


Fig. 9

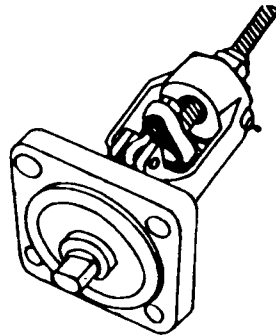


Fig. 10

7.5.6.2 It is also not necessary to remove the gland packing and can be re-used as it is if there is no damage.

7.5.7 Lift the entire stem-disc assembly out of the body. Check the disc seating and do not dismantle the assembly unless any damage is noticed. If damaged then remove the locking wire, lock nut and bolt of the disc carrier.

7.6 Inspection

7.6.1 Check the seating on the body seat ring and gate/disc for wear or damage.

7.6.2 Check the stem and back seat for damage.

7.6.3 Lap the seating of gate/disc if required. If the body seating is damaged it may be lapped with a special tool without removing the body from the pipeline. However for this the valve should be installed at a convenient location. Otherwise the body should be removed from the pipeline for lapping the seating face.

7.7 Reassembly of Bolted bonnet/cover valves

7.7.1 Lower the bonnet assembly including the gate/disc smoothly into the body, keeping the gate/disc in open position. Remember to match the markings done earlier on gate and body seat rings. A blue bearing test will confirm if there is a uniform contact between gate/disc and body seat rings.

7.7.2 Replace the gland packing, if necessary and tighten the eye bolts onto the gland.

7.7.3 Place the gasket on the body correctly.

7.7.4 Fit the bonnet studs and tighten the nuts evenly working at diagonally opposite pairs. Do not over tighten as the gasket may get damaged.

7.7.5 Assemble the handwheel/gear unit/actuator.

7.7.6 Operate the valve from fully closed to fully open position manually and ensure free operation.

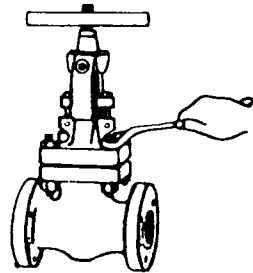


Fig. 11

7.8 Reassembly of Pressure seal bonnet/cover valves.

7.8.1 Assemble the disc, disc carrier, stem and limit pieces with a bolt. Tighten the lock nut till the drill hole in the bolt aligns with the hole in the lock nut. Insert a stainless steel wire and fold it.

7.8.2 Keeping the discs pressed closely, slide the disc-stem assembly smoothly into the body without damaging the seating surfaces.

7.8.3 Lower the bonnet along with the gasket smoothly through the stem into the body.

7.8.4 If the gasket is to be renewed,

a) first lower the bonnet alone into the body

b) put the bottom ring over the bonnet

- c) place the graphite ring over the bottom ring
- d) put the top ring and spacer over it
- e) push the gasket set into the cavity available between bonnet OD and body bore.

7.8.5 If it is a threaded retainer apply anti-seize compound like Molybdenum Di-sulphate grease liberally on the threaded portion of the body and the retainer. Tighten the retainer in clockwise direction fully into the body till it touches the step in the body bore.

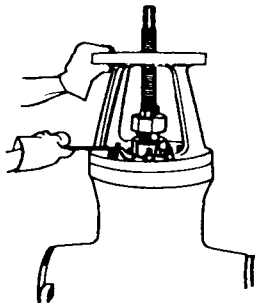


Fig. 12

- 7.8.6 If it is segmented retainer,
- a) remove the pre-loading studs and insert the segmental rings one by one in the groove provided in the body.
 - b) align the segments in the body groove such that mid portion of one of the segments come against the hole in the body.
 - c) fix the pre-loading studs.

7.8.7 Yoke assembly

- a) place the yoke assembly over the stem and rotate the handwheel so that yoke sleeve/actuator bush engages with the stem
- b) yoke assembly will descend on to the body cover face
- c) rotate the bonnet so that pre-loading studs and body studs are aligned to the drilled holes in the yoke.

d) open the valve fully to get the disc back seated and bonnet is raised up

e) In that condition tighten all the studs.

7.8.7.1 While tightening the yoke bolting ensure that there is a minimum gap of 1.5 mm between the yoke raised face bottom and the retainer top. If this is not achieved then remove the yoke and tighten the threaded retainer further. There is no need to check this aspect in the case of segmented retainer.

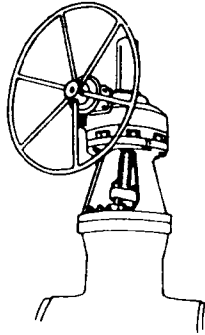


Fig. 13

7.8.7.2 Tighten the bonnet nuts so as to pre-load the gasket but do not over tighten.

7.8.8 Replace the gland packing, if necessary and tighten the eye bolts on to the gland.

7.8.9 Stopper assembly

a) screw in the stopper onto the stem and align the drill holes.

b) insert the cylindrical pin and lock it with the split pin.

c) in case of gear operated valve assemble the position indicator back.

d) for actuator valves, remove the actuator from the adaptor and assemble the stopper. Then mount the actuator back onto the adaptor.

7.8.10 Operate the valve from fully closed to fully open position manually and ensure free operation.

- 7.8.11 When the valve is pressurized for the first time after reassembly, the pre-loading nuts will loosen because of compression of bonnet gasket. Retight the nuts when the valve is under working pressure but do not over tighten.

7.9 Actuator Setting

Limit switches are required to be set to trip on travel limit or torque limit for full open/close position depending on the design of the valve.

The following chart provides the setting parameters. ‘Torque’ indicates that the actuator shall trip by torque limit switch.

‘Position’ indicates that the actuator shall trip by travel limit switch.

Type of valve	Close	Open
Wedge gate	Torque	Position
Parallel slide	Position	Position
Globe	Torque	Position

- 7.9.1 How to set the Limit switches?

- 7.9.1.1 To set Close on Torque:

The limit switch is set at the factory to the required torque for zero leak. Normally when the valve is dismantled for servicing it may not be required to adjust the torque setting. While testing after servicing, if it is found that the valve is not fully closed at the initial setting, close the valve manually. If the leakage stops, increase the torque setting of the actuator.

- 7.9.1.2 To set Open on Position:

Open the valve manually till it gets back seated. Then close the valve by rotating the handwheel by 1/2 revolution or by 3 to 4 mm. At this position set the limit switch.

- 7.9.1.3 To set Close on Position:

Close the valve manually till the stopper touches the actuator bush. Then open the valve by rotating the handwheel by 1/2 revolution or by 2 to 3 mm. At this position set the limit switch. Check the operation so that the closing is by the limit switch and not by the stopper.

7.9.2 For detailed procedure on periodic maintenance, dismantling and actuator settings refer to Actuator manufacturer's instruction manual.

8.0 TROUBLE SHOOTING GUIDE FOR GATE, GLOBE AND CHECK VALVES

Trouble	Probable cause	Remedy (see section)
Leaks across the gate/disc	a. Valve not closed fully	a. Re-tighten the handwheel (4.1)
	b. Limit/torque setting of the actuator disturbed	b. Reset the switches as required (6.4)
	c. Valve seating damaged	c. Dismantle, and lap the seating (7.0)
	d. By-pass valve not closed fully	d. Close the valve fully
	e. By-pass valve seat may be damaged	e. Check the seating of the by-pass valve
Leaks through gland	a. Packing loosened	a. Tighten the gland eye-bolts (6.0)
	b. Packing worn out	b. Replace the packing (6.0)
Leaks through bonnet/cover joint	a. Bonnet/cover bolting loose If this does not seal then suspect	a. Tighten the bolting (6.2)
	b. Gasket damage	b. Dismantle and replace the gasket (6.2)
Not closing fully	a. Debris inside the valve	a. Clean the pipeline (3.7)
	b. Limit/Torque settings of the actuator disturbed	b. Reset the switches as required (6.4 & 7.9)