KVT’s Hi-Fluidic®

Forged and Cast Steel Globe Valves

Operation & Maintenance Manual

Fluid Flow & Valve Specialist
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A. Bonnet Seal Styles of Pressure Seal Valves

Key Valve Technologies Limited (KVT) pressure seal valves have been designed in a range of sizes and pressure classes. These basic styles (shown in Fig. 1) relate to gate (Wedge gate, WGV), parallel slide (PSGV), globe (YGB & SGB) and stop check (YSC) valves. KVT is also introducing a live-loaded bolted bonnet configuration as an optional item.

A.1 Style

The upward tightening force for the pressure seal gasket is achieved by tightening the nuts on the studs in the bonnet which protrude through the bonnet retainer. The internal fluid pressure also forces the bonnet upward toward the thrust ring, increasing the pressure on the gasket.

Live-loaded bonnet (with spring washer) - Option

Compression of the pressure seal gasket is achieved by tightening the nuts on the studs in the bonnet which protrude through the bonnet retainer and by the internal fluid pressure. The Belleville washers allow for greater energy storage and consequently, automatically reapply bolt load to the gasket when the hydro-pressure is removed or the pressure is reduced.

A.2 Receiving Inspection

All valves must be examined for signs of damage that may have occurred during transportation. Any damage should be analyzed and a report should be properly issued. Serious damage should be reported to KVT or a sales representative so that suitable arrangements for repairs can be made.
without delay.

A.3 Storage

Valves should be stored in a suitably protected environment to prevent contamination by weather, dirt or dampness. The valve is shipped with end protectors on the inlet and outlet which should stay on the valve until it is ready for installation.

NOTE: If this involves actuators, please refer to the applicable manufacturer’s instruction for storage.

WARNING: During the installation, welding and construction stages, the valve middle-section around the packing flange and stem should be protected at all times; as foreign objects as a result of welding, grinding, etc. can get in between the tapered area of the packing flange and stem, this can cause extensive damage to the stem and associated parts during valve cycling. In whatever event, prior to cycling, the area between the stem, packing flange and gland bushing must be thoroughly cleaned of all foreign matter.

A.4 Handling and Preparation

For large valves, a hoist is needed to assist installation. A sling should be placed under the valve body so that the unit can be lifted vertically into its final position. End protectors must be removed from the valve and connections must be checked for their cleanliness. Any foreign objects which are visible must be removed from the end connections on flanged and weld-end valves. The weld-end preparation must be cleaned properly with a suitable solvent such as acetone or alcohol. Do not use solvents containing chloride or fluoride.

A.5 Special Instructions for Globe Valve Installation

Globe valves must be installed with the inlet in the direction of the arrow. This must be checked carefully before installing the valve. Placing a globe valve in the opposite direction of arrow will cause the flow to have more turbulence and consequently cause vibrations due to higher flow resistance.

NOTE: All globe valves should be installed at least five pipe diameters away from upstream pumps, elbows, fittings or equipment. If closer installation is required, please consult the KVT Engineering Department.
CAUTION:
KVT design Y & T type globe valves are recommended to be installed with the bonnet up and the angle of incline of the line should be no more than 45° from horizontal. Also, the roll angle of the valve bonnet should be no more than 45° from side to side

When welding valves into Piping, the valve should be partially open (25~50%)

CAUTION:
To avoid arcing (arc sparking) effects in the trim (Valve inner side) during SMAW(ARC) or GTAW(TIG) welding into the pipe, the electric pole should be connected near the welding area. In this case, do not fasten the pole on the top part(s) of valve such as the stem, gland bolts, yoke bars, bonnet clamp bolts, or yoke flange.

A.6 Rechecking Bolt Tightness

In order to ensure a pressure seal between the valve's body and bonnet, it is essential to check the bolt’s tightness. If possible firmly backseat the valve and increase the line pressure as much as possible to the normal operating pressure and temperature. Recheck and retighten the gasket bolts (i.e., body/bonnet bolts) as necessary to the values given in Table 1.

The following procedure is used:
1. If possible fully open and firmly backseat the valve.
2. Remove one nut at a time, thoroughly lubricate stud-nut threads and nut flats with an approved high-temperature nickel base anti-seize compound 1100°C or higher “NEVER SEEZ” or equivalent and torque to recommended values shown in Tables A.1.
3. Remove opposite nut and repeat procedure until all nuts have been re-torqued.
4. Recheck bolt torque by going once around clockwise

NOTE: If the gasket has to be replaced, it is also recommended to replace the retainer, and follow Body-Bonnet Torquing Procedure, Section B.4.

PRECAUTION - Pressure seal design bonnet

The tightness of the gasket bolt must be rechecked after the
operating test pressure and temperature have been carried out.

CAUTION:
If the pressure seal gasket is not pulled up concentrically in relation to the body/bonnet top bore axis, at a lower pressure the gasket may not be properly seated. Consequently, leakage may occur. Moreover, non-uniform contact may provide a source of leaks in the future. Therefore, when possible, backseat the valve fully when pulling up the pressure seal gasket bolts. The packing bolts must also be verified in conformity with Table A.1.

Table A.1 Bonnet/Gasket Torque Values

<table>
<thead>
<tr>
<th>STUD SIZE</th>
<th>BOLTING MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B7, B16, 630, A-574</td>
</tr>
<tr>
<td></td>
<td>N-m</td>
</tr>
<tr>
<td>M10 (3/8” – 16UNC)</td>
<td>27</td>
</tr>
<tr>
<td>M12 (1/2” - 13UNC)</td>
<td>68</td>
</tr>
<tr>
<td>M14 (9/16” - 12UNC)</td>
<td>95</td>
</tr>
<tr>
<td>M16 (5/8” - 11UNC)</td>
<td>129</td>
</tr>
<tr>
<td>M18 (3/4” - 10UNC)</td>
<td>231</td>
</tr>
<tr>
<td>M22 (7/8” – 9UNC)</td>
<td>366</td>
</tr>
<tr>
<td>M25 (1” – 8UN)</td>
<td>556</td>
</tr>
<tr>
<td>M28 (1-1/8” – 8UN)</td>
<td>814</td>
</tr>
<tr>
<td>M32 (1-1/4” – 8UN)</td>
<td>1146</td>
</tr>
<tr>
<td>M34 (1-3/8” – 8UN)</td>
<td>1560</td>
</tr>
</tbody>
</table>

NOTE: (1) For graphite gaskets, use the following values.
   a. If the valve is not pressurized, use 125% of the above torque values.
   b. If pressurized to design pressure (operating) use 75% of the above values.
   c. For pressures between zero and design pressure, the torque to be used is approximated by liner interpolation.
(2) Torque tolerance ±10%
(3) Above Torque Values are with the bolts lubricated.
(4) For temperatures inside the valve body, above 400 °C use 75% of the value.

NOTE: As good maintenance practice for future preventive maintenance, it is recommended bolt tightness is rechecked once annually for operating pressure.
and temperature according to the same steps listed in the RECHECKING BOLT TIGHTNESS section.

A.7 SAFETY WARNINGS,

It is important to take heed of the following

▶ Personnel making any adjustments to the valves should wear safety equipment normally used in situations working with fluid in pipelines where valves are installed.

▶ Before removing a valve from a line, line pressure must be relieved without exception.

▶ Do not attempt to force out the pressure seal gasket using a crane, hoist, chain-block, etc. The gasket may be tightly attached to the valve body and if pulled using a crane, jack, or other means, it may suddenly release, causing personal injury and/or extensive damage.
B. OPERATION

B.1 General
All valves require examination before being put into operation. In addition, valves should be inspected regularly during operation and receive prompt attention when trouble arises. As a general rule, valves should be subjected to scheduled maintenance.

B.2 GENERAL ASSEMBLY INFORMATION
1. The most important thing is to keep all parts thoroughly clean. Any rust and dirt should be removed from all parts with a wire brush or dry cloth. Oil and grease should be removed with suitable solvents.
2. All threaded parts (cap screws, nuts, studs) must be well re-lubricated. The stem and yoke nut threads should be clean of any old grease before being used for the new application. Use the correct lubricant for each individual part.
3. Repaired or replacement parts must be checked to see that all repair procedures have been carried out and that all replacement parts (e.g., packing rings, gasket, etc.) have been checked for size so that they will fit into the valve being serviced.
4. All orientation marks assigned during disassembly must be observed so that correct orientation is maintained. Where applicable, orientation marks should be made on parts near the serial number on the body (e.g., wedge, disc, seat, etc.)

B.3 BONNET/GASKET TORQUEING PROCEDURE
B.3.1 General
1. Clean all studs and nuts. Visually inspect all threads to ensure removal of all foreign objects, rust, corrosion, burrs and previous lubricants.
2. Liberally bonnet clamp the stud threads and the surface under the nut head with NEVERSEEZ 5000 or nickel-based anti-seize compound 1100°C and upwards, or an approved equivalent. Also, lubricate the female threads of the nuts and nut flats and wipe off any excess lubricant that may be sticking to any of the stainless steel parts with recommended solvents.

   Recommended solvents for this work are:
   a) unused or redistilled acetone
   b) alcohol

3. After tightening bolts by hand, follow the bolt tightening sequence shown in Fig. B.1. This sequence depends on the quantity of bolt used. The drawing illustrates the logical sequence that should be followed.
**B.3.2 Application of torque**

When applying torque to the bolts, each bolt should be torqued in steps of approximately 20% of the final torque shown in Table A.1 torque values. If possible, after the final torque has been applied to the pull-up bolts, increase the line pressure as much as possible to normal operating pressure and temperature. Recheck and retighten the bolts if necessary, and follow steps 1-4 in Section A.6.

**IMPORTANT:** It is possible to retrofit certain sizes of KVT pressure seal valves with longer bolts and Belleville spring washers to achieve sufficient sealing when the system undergoes frequent temperature and/or pressure cycling.

**IMPORTANT NOTICE!**

**RE-TIGHTENING BOLTS IN INITIAL HOT CONDITION**

Retightening the bolts of packing gland and pressure sealed bonnet is essential in the first hot condition (generally during start-up or the initial operating stage) to prevent malfunctioning of the valve and damage to the valve sealing mechanism.
C. GENERAL MAINTENANCE SUMMARY

PRECAUTION:

1. If the tightening sequence is not followed, it is possible that the gasket will not be compressed evenly, and may result in Gasket leakage.

2. Over-torquing can cause deformation of the body/bonnet clamp retainer and/or gasket retaining ring, causing the valve to leak.

3. Do not use impacting devices to tighten up the bolting onto the body/bonnet (bonnet clamp). Use suitable mechanical devices for tightening.

4. When the valve is positioned such that the stem is horizontal, care should be taken to prevent the bonnet from tilting to one side by gravity. To maintain concentricity, first open the valve fully, backseat firmly and repack. Torque in steps of 20% of the final torque value and ensure that the gland bushing slides smoothly into the packing chamber.

5. Use hand torque wrenches. If torque wrenches are not suitable, use standard wrenches and the following guidelines will apply:

<table>
<thead>
<tr>
<th>Bolt Size</th>
<th>Length of Wrench</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>inches</td>
</tr>
<tr>
<td>M10 (3/8” – 16UNC)</td>
<td>5”</td>
</tr>
<tr>
<td>M12 (1/2” - 13UNC)</td>
<td>6”</td>
</tr>
<tr>
<td>M14 (9/16” - 12UNC)</td>
<td>9”</td>
</tr>
<tr>
<td>M16 (5/8” - 11UNC)</td>
<td>12”</td>
</tr>
<tr>
<td>M18 (3/4” - 10UNC)</td>
<td>18”</td>
</tr>
<tr>
<td>M22 (7/8” – 9UNC)</td>
<td>24”</td>
</tr>
<tr>
<td>M25 (1” – 8UN)</td>
<td>30”</td>
</tr>
<tr>
<td>M28 (1-1/8” – 8UN)</td>
<td>36”</td>
</tr>
</tbody>
</table>

For sizes of bolts larger than M28(1-1/8”), special torque multipliers with ratios 1:7 or 1:6 should be used for torquing.
D. DETAILED MAINTENANCE

Body/Bonnet (Gasket) Leakage

D.1 General

To maintain the tightness of a factory-tested pressure seal valve, it is essential to apply sufficient bolt tension at all times by having the proper torque on the nuts. The original torque might have changed due to vibration, relaxation of material caused by frequent temperature and pressure fluctuations, or by creep in high-temperature applications. Joint bolt tension should be checked at approximately one-year intervals and, if necessary, bolts retightened in accordance with Section A.6 Rechecking Bolt Tightness.

D.2 Leakage of Body–Bonnet Joint

Whenever possible, begin by opening the valve fully and backseat it firmly. With the line pressure and temperature under operational conditions, in accordance with Section A.6 “Rechecking Bolt Tightness”, tighten the screwed bonnet retaining ring – stud and nut – style, to the values shown in Table A.1. Wait three to five minute before determining if the leak has stopped. The parts could have been loosened during transportation or storage. If tightening does not stop the leak, the pressure seal gasket is probably damaged and the valve must be opened for examination. Such a leak can be caused by any of the following:

1. Imperfect seal between bonnet and gasket

An incomplete seal can be caused by corrosion or dirt or other foreign objects which have got between the seating surfaces of the body or bonnet and the seating faces of the pressure seal gasket. An imperfect seal between the seal ring and the inside contact surface of the body can be caused by an imperfect surface caused by metal failure, sometimes after valve installation and use.

All KVT bodies and bonnets are made off high quality forged steel, eliminating the possibility of surface porosity. The contact area of pressure seal bodies has been subjected to specific finishing processing. Although the surface has a smooth finish and is liquid die-penetrant (LPT) inspected, surface indications can develop in service which can cause
subsequent leakage.

2. **Seal ring leakage**

   This may be caused by external flow on the sealing edge of the ring.

3. **Reusing the pressure seal ring**

   KVT recommends the pressure seal ring and retainer are not reused. Spare rings should be kept on hand before opening the valve. If the pressure seal ring is removed from the body, it must be carefully examined for imperfections and score marks. These marks, usually made during the removal operation, may cause leaks if the ring is reused. The seal ring, made of graphite wrapped by stainless steel plate, must be handled with great care to prevent scoring of internal and external surfaces.

**D.3 Body-Bonnet Sealing Face Repairs**

1. First, it is necessary to make a visual inspection of the body and bonnet gasket contact area. Wash the two contact areas with a suitable solvent and dry with a clean rag. Leak indications can be discovered by correlating marks on the body or bonnet seating areas with any corresponding marks on the OD and ID of the pressure seal gasket which has been removed from the valve.

![Critical Area on Body-Bonnet Gasket Contact Area](image)

2. Very small imperfections, no larger than 0.4mm on the sealing faces, can be removed by polishing with a 60 to 120 grit buffing wheel or by honing. If imperfections are greater than 0.5mm, it may be necessary to machine the complete inside diameter of the contact area in the body, then
requiring a new oversized gasket.

**NOTE:** All KVT pressure seal bodies are supplied with a 1 degree or 3 degrees taper to ensure easy sliding of the gasket. If refinishing of the body gasket seating area is necessary, refinish as much as possible with the same taper.

3. You may also discover that the gasket seal is broken between the outer angular sealing surface of the gasket. Therefore, any impression on the bonnet must be removed completely before reassembly. This can be done by polishing, using a 60-120 grit buffing wheel or by taking a shaving or skim cut on the angular surface of the bonnet. The bonnet must be chucked concentrically and squarely to all existing diameters and surfaces so that the angle to be re-machined remains at KVT’s standard angle of 30°, plus 1/2°, minus 0°.

**NOTE:** Some pressure seal designs may have a different angular surface for the bonnet than the KVT standard. Verify the bonnet surface angle before machining or contact KVT Engineering Dept for more information.

4. When the valve has been reassembled, it is critical that the gasket fits concentrically in the body and on the bonnet. The following points should be considered:

   a) The new standard gasket should not fall below the bottom edge of the 1° or 3° body taper. If it does, a new oversize gasket is required, in which case, measure the height of the gasket and retainer. From the bottom edge of the gasket retainer groove mark-up the height dimension with a line, do the same on the opposite side. At this point the dimension is measured with an inside micrometer for a new gasket oversize diameter.

   b) If the gasket does not fall below the 1° or 3° body taper, but the gap between the top of the gasket and the bottom edge of the gasket retainer groove measures an additional retainer thickness plus 1.5mm max., then new standard gasket plus retainers should be used. However, if the gap measures more than the additional retainer thickness plus 1.5mm, then follow step 4.a) to find out gasket oversized diameter required.

   c) The gasket should fit over the corner edge of the bonnet.

   d) The body and bonnet should be round and not oval.

   e) Body, bonnet and gasket should be free from oil, grease, rust or dirt and should be cleaned with a suitable solvent such as acetone or alcohol. Do not use solvents containing chloride or fluoride.
E. Types of Globe Valves

Fig E.1  Y-Globe Valve – Pressure Sealed Bonnet Type-High Pressure  
(Clamping Yoke Type, ANSI 600Lbs & Above Class)
Fig E.2  Y-Globe Valve – Pressure Sealed Bonnet Type-High Pressure
(Yoke Bar Type, ANSI 600Lbs & Above Class)
Fig E.3  Y-Globe Valve – Pressure Sealed Bonnet Type-High Pressure  
(Yoke Bar Type, ANSI 600Lbs & Above Class, 4” & Smaller Size)
Fig E.4  T-Globe Valve – Pressure Sealed Bonnet Type-High Pressure
(Yoke Bar Type, ANSI 600Lbs & Above Class, 4” & lager Size)
Fig E.5  T-Globe Valve – Pressure Sealed Bonnet Type-High Pressure
(Yoke Bar Type, ANSI 600Lbs & Above Class, 4’’ & Smaller Size)
Fig E.6  Angle Globe Valve – Pressure Sealed Bonnet Type-High Pressure  
(Yoke Bar Type, ANSI 600Lbs & Above Class, 4” & Larger Size)
F. Disassembly & Reassembly

F.1 PARTIAL DISASSEMBLY – GASKET REPLACEMENT

Follow the safety warning instructions in A.7 before beginning disassembly. For general disassembly purposes, place matching marks on parts so that the same alignment of parts can be maintained when reassembling.

CAUTION: Do not attempt to force out the pressure seal gasket by using a crane, hoist, chain-block, etc. The gasket may be tight inside the valve body and if pulled using a crane, jack, or other means, it may suddenly release causing personal injury and/or extensive damage.

1. Remove the gear box from yoke flange – gear box (actuator) H.S.H bolts. Carefully remove the gear box with a sling of a crane or otherwise.
2. Remove the yoke flange and yoke bars using a wrench. In case of clamping yoke type valve, first remove the yoke bolts and yoke nuts (01P & 02P) on the yoke clamp (165) before removing the yoke flange.
3. Remove the guide bearing (188) for clamping the yoke type valve. Remove the stopper assembly from yoke bar type valve.
4. Remove the two opposite bonnet retaining nuts (Bonnet Nut, 02A) and bonnet retaining studs (Bonnet Bolt, 01A) from bonnet (102) for pressure sealed bonnet. Also remove the bonnet bolts & nuts (01A & 02A) for the bolted bonnet.
5. Screw two eye-bolts twice the length of original studs into the tapped holes in the bonnet (102). Fasten a chain hoist to the eye-bolts, pulling just enough to eliminate any slack in the hoist. In case of the bolt bonnet type, check the internals. Also, eye-nuts can be used with a bonnet retaining stud for this work. The manufacturer has not supplied an eye-bolt or eye-nut.
6. Remove all remaining bonnet nuts and any two adjacent studs for valves with eight studs or more (for valves with fewer than eight studs, remove any one stud). Slacken chain hoist to lower bonnet until it rests on the stops in the body.

NOTE: If the bonnet does not lower when the hoist is slackened, tap on the eye bolts to free the bonnet.
7. Remove eyebolts and place one eyebolt in the tapped hole in the bonnet clamp (118). Lift the bonnet clamp and remove.
8. Insert a drive pin into the holes provided in the top flange of the body. Tap lightly to remove the four-segment gasket retainer (117).

NOTE: If the valve has been in high-pressure service for a long period of time, it may be necessary to tap lightly on the gasket retainer inside the body first so
that the drive pin will be able to push the gasket retainer out easily. Remove the two small portions of the four-segment retainer and then the larger portion. Remove pressure seal retainer.

9. Place three 25mm (minimum) shims on the body. Replace the bonnet clamp and align the holes so that the eyebolts can be replaced in the bonnet.

10. Reattach the hoist to the eyebolts and raise the bonnet until it contacts the gasket. For valves with fewer than eight studs, use two opposite nuts to pull up the gasket. For valves with eight studs or more, use four nuts to pull up the gasket.

    **NOTE:** Nuts or screws should be turned uniformly fractionally each time because valve parts could be damaged by locking the pressure seal gasket ring. This uniform turning is important.

11. Before installing the new pressure seal gasket ensure that the body/bonnet gasket surface is free from any damage such as scratch marks, indentations, etc. Install the new pressure seal gasket (114) and the gasket ring (114) on the bonnet (102).

12. Remove two opposite bonnet retaining studs and replace with 200-250mm long eyebolts.

13. Using a hoist, lower the bonnet (102) into the body (101) and remove the eyebolts.
14. Install the new pressure seal gasket (114), retainer (117) and gasket retainer (114).
15. Install an eyebolt in the bonnet clamp (118), lift on top of the body (101) using a hoist. Align the bonnet clamp with the bonnet retaining studs.
16. Re-install the two 200-250mm long eyebolts and lift with a hoist until the bonnet contacts the gasket and the bonnet studs have protruded the bonnet clamp holes.
17. Lubricate the threads on the bonnet studs and nuts and nut flats. Tighten manually.
18. Remove the eyebolts and replace with the bonnet studs and bonnet nuts.
19. Tighten the bonnet (102) by torquing the bonnet-bonnet clamp nuts (01A) uniformly. Perform this operation with great care to avoid cocking the bonnet (102) and damaging internal parts.
20. Torque bonnet-bonnet clamp nuts in strict accordance with Section A.

F.2 FULL DISASSEMBLY
Follow the warning instructions in Section A.7 before commencing disassembly. As a general disassembly progress, place matching marks on parts so that the same alignment of parts can be retained for reassembly.

F.3 DETAILED MAINTENANCE

F.3.1 Body/Bonnet (Gasket) Leakage
F.3.1.1 General
To maintain the tightness of a factory-tested pressure seal valve, it is essential to apply sufficient bolt tension at all times by having the proper torque on the nuts or cap screws. The original torque might have changed due to vibration, relaxation of material caused by frequent temperature and pressure fluctuations, or by creep in high-temperature applications. Joint bolt tension should be checked at approximately one-year intervals and if necessary retightened in accordance with Section A, Rechecking Bolt Tightness.

F.3.1.2 Leakage of Body/Bonnet Joint
Tighten under line pressure the stud and nut to values shown in Table A.1 + 10%. Wait three to five minutes before determining if the leak has stopped. The parts could have loosened during transportation or storage.
If tightening does not stop the leak, the pressure seal gasket is probably damaged and the valve must be opened for examination. Such a leak can be caused by any of the following:

1. **Imperfect seal between bonnet and gasket**
   An incomplete seal can be caused by corrosion or dirt or other foreign objects getting between the seating surfaces of the body or bonnet and the seating faces of the pressure seal gasket. An
imperfect seal between the seal ring and the inside contact surface of the body can be caused by an imperfect surface caused by metal failure, sometimes after valve installation and use. All KVT bodies and bonnets are made off high quality forged steel, eliminating the possibility of surface porosity. The contact area of pressure seal bodies has been subjected to specific finishing processing. Although the surface has a smooth finish and is die-penetrant (LPE) inspected, surface indications can develop in service which can cause subsequent leakage.

2. **Seal ring leakage**
   This may be caused by external flow in the sealing edge of the ring.

3. **Reusing the pressure seal ring**
   KVT recommends that the pressure seal ring is not reused. Spare rings should be kept on hand before opening the valve. If the pressure seal ring is removed from the body, it must be carefully examined for imperfections and score marks. These marks, usually made during the removal operation, may cause leaks if the ring is reused. The seal ring, made of graphite, must be handled with great care to prevent scoring of internal and external surfaces.

**F.4 Seat Leakage**

**F.4.1 Seat Disc Repairs**

1. Disassemble the valve as described in Section F.3, and inspect the disc and seat for scratches, pitting marks or other damage.
2. If the seating face of the disc is scratched, it must be lapped. Slight pitting, grooving, or indentations no deeper than 0.1mm can be removed by lapping. If defects cannot be corrected by lapping, the disc can be ground and/or machined. KVT recommends that no more than 0.80mm be removed. After grinding is completed, lap the disc.
3. For lapping, a flat plate (preferably made of cast iron) should be used. An abrasive lapping compound should be mixed together with olive oil and evenly distributed over the plate. Only light, even pressure should be applied and the disc should be moved in a circular motion on the plate. Lift the disc as often as possible to prevent accumulation of particles in one area and to allow for proper distribution of the lapping compound. The lapping plate should maintain a flat surface. The part should be lapped until seating faces are smooth.
4. Thoroughly clean off the lapping compound with a suitable cleaning fluid such as acetone or alcohol. **Do not use solvents containing chloride or fluoride.**
5. A valve seat joint will require repairing in any instance where the seating surface permits a leak because it has been altered from the original state in which it was shipped from the factory; where
corrosion has set in to cause pit marks on the seating surfaces of either the body or Disc; where the seat has become distorted because of an abnormal heating condition; or, where a groove has been formed on the seat or Disc by closing the valve against a foreign body. Verification of such a faulty condition may be obtained by a seat bluing test or by careful visual examination. The stellited hard faced seats in these pressure-seal valves are not easily scored, but where reconditioning is necessary, the following points should be observed: Where an indentation or pit marks on the valve seat joint are deep (0.12mm (0.005inch) or greater), a cast iron lap with suitable lapping compound will speed up repair. The angle of the valve seat is 90° and the cast iron lap included should be closely guided in the body bore during the lapping.

6. Lap first with the cast iron lap and finish with the valve Disc, which has been reground or re-lapped, if necessary. For initial lapping, use Clover compound “A.” Norton 320# mixed with olive oil or sperm oil to a molasses consistency which is also recommended for finish lapping. For rough lapping, a coarse lapping compound is recommended. When lapping, lap against the seat with a small quantity of the lapping compound placed between the mating surfaces. It is important that not too much pressure be applied on the lap or Disc against the seat. With the lapping compound in place between the mating surface, the lap or Disc should be reciprocally rotated as far as arm movements will permit while standing in one position; the strokes should be light, and the lap or Disc should be lifted frequently and turned to a new position in a circular fashion around the valve body so that lapping is rotated over a new area. To make certain the pressure strokes are light, on large valves it is necessary to suspend the Disc and stem assembly from a coil spring in such a manner as to allow the Disc to bear, but lightly, against the seat.

7. The Disc of stop valves will also require refinishing. When the only defects that can be found on the Disc-stem assembly are on the seating surface, it becomes extremely convenient to push the stem into a lathe spindle and chuck on the Disc nut diameter without taking the assembly apart. (However, if the stem is too large to fit through the lathe spindle, it will have to be taken apart as described in the following paragraph).

8. Hold the Disc using a four-jaw chuck so that the large O.D. and seating surface run true. Grind the seating surface using a tool post grinder. Just go deep enough to clean the surface. Polish the seating surface with a fine emery cloth.

9. If, when checking the Disc-stem assembly, it is found that the assembly is tight or does not swivel freely, it will be necessary to disassemble. Occasionally it is possible to cut the lock welds with a hack saw and unscrew the Disc from the Disc nut. However, it will usually be appropriate to chuck the Disc O.D. in a lathe and cut the lock welds, including the weld that penetrates the first thread. After this weld metal has been cleaned away, the Disc nut will readily unscrew. Repair any damaged surfaces on the stem, Disc nut, stem collars or Disc. Then proceed to repair the Disc seating surface as described above. When finishing the Disc in this manner, it will not be necessary to lap it to the seat.
NOTE: Fitting of New Disc
When damage to the disc seating face cannot be removed by grinding or lapping, the disc must be replaced. All new discs coming from the factory are already ground and should be lapped before installation.

F.4.2 Seat Repairs
After the seating faces of the disc have been re-lapped and cleaned with a suitable cleaning fluid such as acetone or alcohol, it is essential that the results be verified using a blue ink test - check for full circumferential contact. A light coating of blue ink should be distributed smoothly and equally over the seating diameter of the disc. Refer to F.4.1.5.

F.5 Assembly
It is important to establish that the new composite pressure-seal gasket, the bonnet and the body sealing area are in a satisfactory condition before installation. The following steps will help ensure superior performance of the gasket.

1. Carefully inspect the body bore and bonnet O.D. sealing surfaces. Remove any raised metal from the entry chambers and gasket chamber regions. Repair any gouges in the sealing region in accordance with the instructions.
2. Inspect the new composite gasket. Note: All composite gaskets have cracks and wrinkles in the flexible graphite. This is a normal result of the forming process and will not affect gasket
performance.
3. Be sure the anti-extrusion rings (an anti-extrusion ring is a stainless steel plate to wrap gasket in upper & bottom side to prevent extrusion of the graphite) are tightly bonded to the graphitic gasket, so they will not touch the body during assembly. If any of the anti-extrusion rings are loose, carefully scrape away all flexible graphite left on the anti-extrusion ring surface and re-bond to the graphite surface using suitable contact cement. The ends of the outer rings should touch after bonding. There should be an approximate 0.5±0.012mm (0.020 ±.005") gap at the ends of the inner ring.
4. Place the gasket on the bonnet with the two anti-extrusion rings facing up as shown in the illustration. The gasket should fit snugly around the bonnet, and the gasket O.D. should not exceed the O.D. of the bonnet. This will ensure that the gasket does not catch on the body and “energize” prematurely.
5. Install the spacer ring on the bonnet as shown with the wide end toward the gasket. Now the valve may be reassembled using the assembly procedures described in the following sections for different types of bonnets, except that special torquing procedures are required as described in the following:

**IMPORTANT: The composite pressure-seal must remain dry until fully compacted for proper sealing!**

6. Once the bonnet and bonnet retainer holes have been aligned, lightly lubricate the fasteners with high-temperature anti-seize lubricant. Assemble the washers under the nuts or cap-screws. Assemble the remaining parts as described in previous sections.
7. Preload the bonnet by pulling up with a well-centered crane load.
8. Initially compress the pressure-seal gasket, making sure that the bonnet does not cock in the body.
9. While maintaining the pull-up load, torque the bonnet/cover bolts evenly using a varying star pattern, until the fastener torques reach a value of 2/3 or the torque given.
10. After reaching 2/3 of the torque value given in the table on page 6, torque the bonnet nuts in small torque increments, with no more than 1/16 turn for each tightening movement, using a varying star pattern, until the full torque value given in the table on page 6, is reached.
11. Re-torque the bolts at the final torque value several times, until the gasket no longer compresses. This step is necessary due to the high resilience of the graphite gasket.
12. Complete the remaining valve assembly in accordance with the appropriate preceding section of this manual.
13. When the valve is next under pressure, either during system hydrostatic test or when in service, re-torque the bolts to the torque values given.
G. PREVENTIVE MEASURES

Transport: During transport and installation, valves can be subject to sudden knocks. Therefore check and rectify mis-aligned glands and bonnets. Damaged coatings should be touched-up as soon as possible to prevent corrosion.

Site storage: Always store valves indoors and preferably in their original packing to prevent damage and the ingress of dirt or moisture. Make sure the position of the valves during site storage is “as supplied”.

Installation: After storage, check valves for internal cleanliness. Any foreign objects should be removed. Install the valves in the pipe according to the arrow of flow direction indicated on the valve body. When no arrow is shown the valves can be used bi-directionally.

Welding: For welding do not disassemble the valve, but place it in its fully opened or closed position. If electric arc welding processes are used, make sure not to connect any poles the other parts of the valve than the valve body (as close as possible to the welding area) or preferably to the connecting pipe.

PWHT: Post weld heat treatment should be executed inductively and with the valves in the fully assembled condition and in the fully closed position.

Blasting: If for any reason valves are shot blasted, please prevent the ingress of blasting grit to the gland and the internals and thoroughly clean the valves afterwards. Before starting to shot blast make sure the valves are in the fully closed position and stems are fully protected. For pressure sealed valves also protect the area between the bonnet and support for ingress of grid.

Painting: Make sure valves are in the fully closed position and stems and identification plates are fully protected. Before applying additional layers of painting, check their compatibility with the existing coating systems.

Insulation: Make sure gland bolting and (if possible) bonnet bolting are accessible after insulation and make sure the tightness of the stem packing can be checked without removing the insulation. For pressure sealed valves, the accessibility of bonnet-bolting is mandatory.

Flushing: When flushing, all valves should be in the fully opened position to enable foreign objects to pass and to prevent these objects being trapped between stem and backseat or disc and seat. Therefore electrically operated valves should be fully opened by hand.
Pickling: Applying the correct pickling process is the sole responsibility of the subject contractor. In case of doubts, HP valves should be contacted. Before the start of any pickling process, the valves should be in the fully opened position to prevent ingress of pickling medium in the packing area, while after pickling the system should be thoroughly flushed.

Operating: Valves close when rotating the hand wheels clockwise. The use of spanners or pipes to increase leverage can damage the valves and therefore is not permitted. If valves do not seal using the normal operating mechanism, spanners will often not solve this because reasons (such as foreign objects, misaligned glands, scoring stems) other than insufficiently sized operating mechanisms prevent the valve from fully closing.

During commissioning and operationalization, check all stem packings for leakage. If a leak is identified, immediately tighten the gland bolting to stop the leak and to prevent erosion of the stem packing.

During commissioning and operationalization, check all gaskets for leakage. If a leak is identified, immediately check the alignment of the bonnet and rectify any misalignments. Make sure the bonnet-bolting is sufficiently tightened.

Medium and high pressure valves vents and drains are usually placed in tandem, whereas the upstream valve is used as the “isolator” and the downstream valve as the “regulator”. To prevent damage to the seat of the isolator, both valves always should be used in the following sequence at opening: 1) open isolator, 2) open regulator. At closing the sequence is as follows: 1) close regulator, 2) close isolator.

Maintenance: Carefully read the manufacturer’s IO&M manual before (dis)assembling valves. Regularly check stem packings, gaskets and lubrication. At re-assembly of valves always install new packings and glands. Only use genuine spare parts.
## H. TROUBLESHOOTING

<table>
<thead>
<tr>
<th>Indication</th>
<th>Probable cause</th>
<th>Rectification</th>
</tr>
</thead>
<tbody>
<tr>
<td>High operating force</td>
<td>Misalignment of gland flange causing the gland flange to come into contact with the stem.</td>
<td>Re-align gland flange and check stem for damage. If the stem is damaged it should be replaced.</td>
</tr>
<tr>
<td></td>
<td>Overstressed gland-bolting</td>
<td>Loosen the gland bolting to reduce the packing-friction. Make sure no leakage occurs during operation.</td>
</tr>
<tr>
<td></td>
<td>Foreign objects between stem and gland flange</td>
<td>Unscrew gland bolting and remove foreign objects. If stems are severely damaged they should be replaced.</td>
</tr>
<tr>
<td></td>
<td>Original stem packing has not been used increasing stem friction.</td>
<td>Replace with genuine parts.</td>
</tr>
<tr>
<td>Valve will not close completely / passing valves</td>
<td>Foreign objects inside the valve prevent it from fully closing.</td>
<td>Open the valve (according to manufacturer's maintenance instructions) as quickly as possible (to prevent erosion) and remove foreign objects.</td>
</tr>
<tr>
<td></td>
<td>Due to foreign objects, the valve-stem and/or seating surfaces have got damaged.</td>
<td>Disassemble the valve and remove foreign objects, as quickly as possible (to prevent erosion), and relap seating areas according the manufacturer's instructions.</td>
</tr>
<tr>
<td></td>
<td>Limit switches on electrically operated valves are malfunctioning or are incorrectly adjusted; preventing the valve from reaching its fully closed position.</td>
<td>Operate the valve manually and re-adjust the limit switches. If limit switches are malfunctioning, these should be replaced.</td>
</tr>
<tr>
<td></td>
<td>Torque switches on electrically operated valves are malfunctioning or are incorrectly adjusted.</td>
<td>Reset the switches according to the valve manufacturer's recommendations with respect to value and disconnection method.</td>
</tr>
<tr>
<td></td>
<td>Adjustment of coupling on pneumatic operated valves is incorrectly preventing the valve from fully closing.</td>
<td>Re-adjust the coupling according to the manufacturer's instructions.</td>
</tr>
<tr>
<td>Valve will not open completely</td>
<td>Foreign objects inside the valve (between stem and backseat) are scoring the stem and preventing it from fully opening.</td>
<td>Open the valve (according to manufacturer's maintenance instructions), remove foreign objects and replace the stem.</td>
</tr>
<tr>
<td></td>
<td>Limit switches on electrically operated valves are malfunctioning or are incorrectly adjusted, so preventing the valve from reaching its fully opened position.</td>
<td>Operate the valve manually and reset the limit switches. If the limit switches are malfunctioning these should be replaced.</td>
</tr>
<tr>
<td></td>
<td>Torque switches on electrically operated valves are malfunctioning or are incorrectly adjusted.</td>
<td>Reset the switches according to the valve manufacturer's recommendations with respect to value and disconnection method.</td>
</tr>
<tr>
<td></td>
<td>Adjustment of coupling on pneumatic operated valves is incorrectly preventing the valve from fully opening.</td>
<td>Re-adjust the coupling according to the manufacturer's instructions.</td>
</tr>
<tr>
<td>Gate valve will not open</td>
<td>Valve has been closed with excessive force.</td>
<td>Dismantle valve to open it while preventing damage.</td>
</tr>
<tr>
<td></td>
<td>Torque/limit switches have been adjusted incorrectly</td>
<td>Reset switches to manufacturer's instructions.</td>
</tr>
<tr>
<td></td>
<td>The force required to unseat the wedge or discs has increased due to pressure locking (high pressure water captured in the inter-disc space) or over-pressurization (heating up water captured in the inter-disc space).</td>
<td>Make sure not to apply excessive force when opening the valve since this will cause damages to the internals. In case of a pressure equalizing line, make sure the equalizing valve is opened. If a pressure equalizing line is non-existent, carefully loosen the gland bolting to allow water or steam passing the stem-packing. Be careful not to cause packing blow-out. Consult the valve manufacturer for more detailed instructions on how to proceed as well as for recommended accessories for pressure equalizing.</td>
</tr>
<tr>
<td>Problem Description</td>
<td>Possible Causes</td>
<td>Recommended Action</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Leaking stem packing</td>
<td>Misaligned gland or insufficiently tightened gland bolting.</td>
<td>With due care, immediately tighten the gland bolting until the leak stops.</td>
</tr>
<tr>
<td></td>
<td>Valve has been a long-term storage item with the user before being installed.</td>
<td>Replace stem packing.</td>
</tr>
<tr>
<td></td>
<td>Damage to the valve-stem or stuffing box</td>
<td>Replace with genuine parts</td>
</tr>
<tr>
<td></td>
<td>Non-original stem packing has been used leading to leakage.</td>
<td>Replace with genuine parts.</td>
</tr>
<tr>
<td>Leaking gasket</td>
<td>Misaligned bonnet (for bolted bonnet valves) due to transportation or incorrect maintenance.</td>
<td>Re-align bonnet and replace gasket if required.</td>
</tr>
<tr>
<td></td>
<td>Bonnet bolting has not been tightened immediately after the valve first reached its service conditions (after installation or re-assembly), preventing the gasket to seal optimum.</td>
<td>Tighten the bonnet-bolting immediately. If the leak doesn't stop the gasket and/or valve body sealing area has been damaged due to erosion and should be replace/repair in line with the manufacturer's recommendations.</td>
</tr>
<tr>
<td></td>
<td>Gasket is worn or damaged</td>
<td>Replace with genuine parts</td>
</tr>
<tr>
<td></td>
<td>Non-genuine gaskets have been used leading to leakage.</td>
<td>Replace with genuine parts.</td>
</tr>
<tr>
<td>Leakage through valve body or bonnet</td>
<td>Long-term leakage across seat has eroded through the valve body.</td>
<td>Replace valve. To prevent future problems, repair passing valves as quickly as possible</td>
</tr>
<tr>
<td></td>
<td>Imperfection in casting.</td>
<td>Replace valve. To prevent future problems, review minimum NDE specifications.</td>
</tr>
<tr>
<td>Hand wheels and stems are bent</td>
<td>Damaged during transportation or installation or excessive force has been applied to the valve while using spanners or other leveraging devices.</td>
<td>Replace damaged parts and prevent future damage.</td>
</tr>
<tr>
<td>Corrosion on valve parts</td>
<td>This can be caused by incorrect selection of coating systems, incorrect application or due to damage during transportation and installation.</td>
<td>Touch-up the damage immediately in line with the manufacturer's instructions. If result is insufficient contact the manufacturer.</td>
</tr>
<tr>
<td>Damaged membrane on pneumatic operated valves</td>
<td>Excessive air pressure damaging the membrane.</td>
<td>Replace the membrane and re-adjust the air filter/regulator to 6bar maximum.</td>
</tr>
</tbody>
</table>