GATE, GLOBE & CHECK VALVES

INSTALLATION, OPERATION AND MAINTENANCE

INDEX:

1 - SAFETY INFORMATION

The following general safety information should be taken into account in addition to the specific warnings and cautions specified in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered in this I.O.M.

To avoid injury, never attempt disassembly while there are pressures either upstream or downstream. Even when replacing gaskets, caution is necessary to avoid possible injury. Disassemble with caution in the event all pressures are not relieved.

To prevent valve bending, damage, inefficient operation, or early maintenance problems, support piping on each side of the valve. Warning, certain gases and fluids could cause damage to human health, the environment or property hence the necessary safety elements to prevent risk should be taken.

• A valve is a pressurized mechanism containing fluids under pressure and consequently should be handled with appropriate care.
• Valve surface temperature may be dangerously too hot or too cold for skin contact.
• Upon disassembly, attention should be paid to the possibility of releasing dangerous and or ignitable accumulated fluids.
• Ensure adequate ventilation is available for service.

This manual provides instructions for storing, general servicing, installation and removal of gate, globe & check valves.
Trust Valves refuses any liability for damage to people, property or plant as well as loss of production and loss of income under any circumstances but especially if caused by incorrect installation or utilization of the valve or if the valve installed is not fit for intended purpose. It is the sole responsibility of the user to ensure the valve type and materials are correctly specified.
DURING OPERATION, TAKE INTO ACCOUNT THE FOLLOWING WARNINGS:

- Graphite/Graphoil packing and body gaskets are very brittle, any compacting, twisting or bending should be avoided.
- The valve's internal parts (disc, stem, seat, seals, gasket, etc.) shall be handled with care avoiding scratches or surface damage.
- All tools and equipment for handling the soft seals shall be soft coated.
- Valves can be fitted with gaskets or seals in PTFE, Buna, Viton, etc., hence high temperatures will damage sealing components.
- Never part open or part close valves; valves must be full open or full closed to avoid seat damage.

For all operations, refer to position number on part list of the applicable drawing.

Packing leakage could result in personal injury. Valve packing is tightened prior to shipping, but may require readjustments to meet specific service conditions.

Personal injury may result from sudden release of any process pressure. Trust Valves recommends the use of protective clothing, gloves and eyewear when performing any installation or maintenance. Isolate the valve from the system and relieve pressure prior to performing maintenance. Disconnect any operating line providing air pressure, control signals or electrical power to actuators.

Check the packing box for pressurized process fluids even after the valve has been removed from the pipeline, particularly when removing packing hardware or packing rings or removing packing box pipe plug.

If a gasket seal is disturbed while removing or adjusting gasketed parts, Trust Valves recommends installing a new gasket while reassembling. A proper seal is required to ensure optimum operation.

2.0 - INSTALLATION

Piping should be properly aligned and supported to reduce mechanical loading on the end connections.

2.1 - INSTALLATION POSITIONS

a) Gate valves are usually bi-directional, and therefore may be installed in either direction. In some cases, gate valves may be uni-directional, in which case the direction of flow will be indicated on the valve body.
b) Globe valves are unidirectional and have the direction of flow indicated on the valve body.
Gate and globe valves should be installed with the stem in a vertical up position on horizontal lines. Other acceptable stem positions are at an angle between the vertical and horizontal axis which still allows for complete drainage. If installed with the stem below the horizontal axis, complete drainage is not possible and solids may accumulate in the valve bonnet, which will greatly affect the valve operation and service life. Valves may also be installed in vertical lines but in the case of cast valves please specify this at order stage where possible. See Figure 1 for details.

Horizontal Line Vertical Line

Figure 1 – Gate & Globe valves positioning
(For cast valves, specify at order stage if used in vertical lines)

c) Check valves are unidirectional and have the direction of flow indicated on the valve body. Piston and ball check valves are recommended for use in horizontal lines with cover facing up. Spring loaded ball check and y-type piston check valves can also be used in vertical lines.
Check valves must be fitted in horizontal pipe runs with the cover facing vertically upward. Variance to either side of the vertical axis must not exceed 5°. Swing check valves and spring loaded check valve can be positioned in vertical pipe runs with upward flow.

Check valves must not be installed in a vertical down flow pipe run or in an horizontal pipe run with the cover in the vertical down position Always install valves in the direction indicated by the flow arrow stamped on the body.

Flow disturbance caused by the system components (e.g. pipe fittings, discharge of pumps, etc.) can lead to valve chatter, which can cause rapid wear of seats and trim and ultimately lead to valve malfunction. A sufficient distance must be maintained between the check valve and any component that can cause flow disturbance as follows:

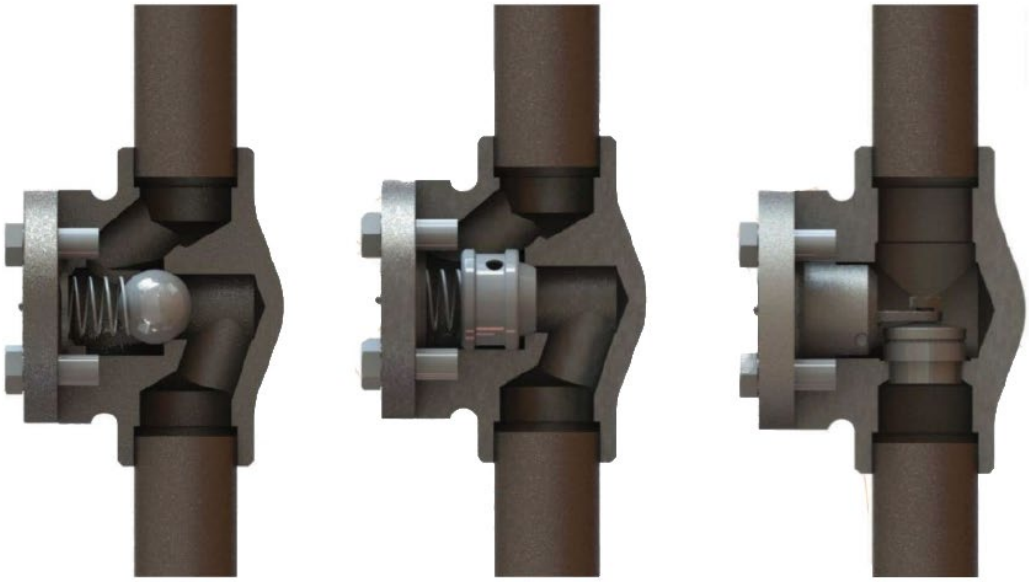
a) System components that create flow disturbance – examples are pumps, fittings and valves. When installing a check valve near system components, Trust Valves recommends a minimum of 10 pipe diameters of straight pipe between the upstream system component and the inlet of the check valve and a minimum of 2 pipe diameters of straight pipe between the downstream component and the outlet of the check valve.

b) Pipe bends and transitions – examples are elbows, tees, branch connections and reducers. Trust Valves recommends a minimum of 5 pipe diameters of straight pipe between the upstream system component and the inlet of the check valve and a minimum of 2 pipe diameters of straight pipe between the downstream and the outlet of the check valve.

Horizontal Line with Flow Arrow

Maximum Rotation

Flow Direction



Spring Loaded Ball Check | Spring Loaded Piston Check | Swing Check

Figure 2 – Check valves positioning

2.2 - PREPARATION FOR INSTALLATION

- Remove protective end caps and inspect valve ends for damage to threads, socket weld bores or flange faces.
- Thoroughly clean adjacent piping system to remove any foreign material that could cause damage to seating surfaces during valve operation.
- Verify that the space available for installation is adequate to allow the valve to be installed and to be operated.
- Ensure sufficient clearance for the stem in the full open position. Inadequate clearance for valves may add mechanical loading to the valve ends. Sufficient clearance should be allowed for the threaded end valves to be “screwed” during installation.

2.3 - END CONNECTIONS

Threaded Ends

Check conditions of threads or mating piping.
Apply joint compound to the male end of joint only; this will prevent compound from entering the valve flow path.

Flanged Ends

Check to see that mating flanges are dimensionally compatible with the flanges on the valve body and ensure sealing surfaces are free of debris.
Install correct studs and nuts for the application and place the gasket between flange facings.

Socket Weld Ends

Remove all debris, grease, oil, paint, etc. from the pipe that is to be welded into the valve and from the valve end connections.
Insert the pipe into the valve end connection until it bottoms out in the socket weld bore. Withdraw the pipe 1/16” so that a gap remains between the pipe and the bottom of the socket weld bore to prevent cracks (ASME B16.11). Tack the pipe into the strainer and complete the fillet weld.

Gate valves under DN65 (2.1/2”) should be lightly closed to prevent damage to the seating surfaces and stem caused by thermal expansion during the weld process.

Butt Weld Ends

Clean the weld ends as necessary and weld into the line using an approved weld procedure. Make sure the body and pipe material given on the nameplate is compatible with the welding procedure. Unless the valve contains PTFE packing and/or gasket, leave valves assembled and in the lightly closed position during installation, welding and post-weld heat treatment. This will prevent the valve seat from floating or distorting during the process. After welding completion, open the valve and flush line to clean out any foreign matter.

Valves under DN40 (1.1/2") containing PTFE packing and/or gasket must be dis-assembled for installation as the welding temperature can adversely affect the PTFE components. Remove the bonnet and bonnet gasket and match mark each component during dis-assembly for proper reassembly. If you do not disassemble valves, it will be the responsibility of the operator to ensure valves are kept cool during welding and then post-weld testing of the valve should be performed. Larger size valves over DN50 (2") are less likely to transmit heat to bonnet and stem packing during welding but still care should be taken.
The responsibility for welding of the valves into piping systems is that of those performing the welding. Refer to ASME B31.1, B31.3 etc. Written welding procedures covering all attributes of the process and materials to be welded shall be in accordance with Section IX of the ASME Boiler and Pressure Vessel Code and any additional requirements from the applicable piping code including any possible necessary localized post weld heat treatment depending on material specifications.

2.4 - POST-INSTALLATION PROCEDURES

After installation, the line should be cleaned by flushing to remove any foreign material. When caustics are used to flush the line, additional flushing with clean water is required. The valve should be opened and closed after installation to ensure proper operating function. With the line pressurized, check the valve end connections, body to bonnet/cover joints and stem packing area for leaks. The packing may have to be tighten to stop leaking.

3 – OPERATIONS

Gate valves should only be used in full open or fully closed position.
Forged globe valves should not be used continuously to openings less than 25% or Venturi effect will damage seat and disc. Any throttling will reduce the life of the seat and disc.

Gate & Globe valves should not be left in the fully ‘back seated’ position under normal operating conditions. The packing may dry out under these conditions and leak as the valve is closed.

A cool valve may leak through the gland when opened to hot fluid. Wait before tightening the packing as the problem may go away.

The check valve operation is automatic and requires no assistance. When the flow exerts sufficient pressure against the disc to overcome the disc's weight, the disc allows the flow to continue through the piping system. As pressure decreases, the disc lowers until its own weight forces it to seat. This prevents the possibility of a reversal in the flow. Piston and ball check valves should not be used in applications where rusting or rust particles are present or anticipated. Swing check valves are more tolerant for applications of this nature.

Metal seated check valves (piston, ball and swing) are not zero leak devices and may "seep" in service. This type of valve should always be backed up with an isolation valve (either gate or ball valve). Check valves are designed to prevent reverse flow. Leakage rates for check valves with metal-to-metal seats are dependent on the amount of back pressure and the viscosity of the flowing medium. Soft seat check valves can offer improved leak tightness provided there is sufficient back pressure. Check valves should not be used in gas or low back pressure liquid applications if zero leakage is desired.

4.0 – MAINTENANCE

Check valves: No periodic maintenance is necessary unless special external accessories are fitted.

Gate and globe valves: Proper safety equipment and apparel should be worn when preparing to service a valve. Observe the following general warnings:

- A valve is a pressurized mechanism containing energized fluids under pressure and consequently should be handled with appropriate care.
- Valve surface temperature may be dangerously too hot or too cold for skin contact.
- Upon disassembly, attention should be paid to the possibility of releasing dangerous and/or ignitable accumulated fluids.
- Ensure adequate ventilation is available for service.

Tools required: aside from standard wrenches (for bonnet cap screws and packing gland nuts), the only special tools needed for minor valve maintenance is a packing hook.

Packing: special care is to be placed in the tightening of the gland nuts during installation to ensure the proper packing adjustment and functionality. The packing gland should be checked periodically in service and tightened as necessary to stop leakage around the stem. Tighten in a manner to develop even loading on the gland. Tighten only enough to stop the leak.

Removal of packing rings and use of backseat: most valves are designed with the stem backseats. However, valve manufacturers in general do not recommend this practice due the inability of determining the effectiveness of the backseat seal. In addition, backseating is not designed to be absolutely drip tight. Due to the inherent risks, backseat should never be used to allow gland packing replacement or repair while the valve is pressurized. The primary reason for the backseating facility is to prevent wear of the packing rings.

When replacing a new valve into service, Trust Valves recommends a preliminary packing adjustment to verify proper packing load. Additionally, it is recommended that a leakage test be performed following installation, but prior to start-up.

During the packing life cycle, normal and routine maintenance of the packing arrangement must be administered. Normal cycle life will typically require 5 to 8 packing gland nut adjustments. Torque values vary depending upon valve size. Tighten the packing nuts clockwise to compress the packing.

Do not over tighten or the valve will become too tight to turn (see 6.2.1). Fugitive emission stem packing can be fitted to reduce leakage rate to 100 PPMv for 1,500 cycles. Removal of old packing should be done in an experienced workshop. Using a special flexible removal tool. The removal tools have special hooks, which screw into the packing ring. Removal of the packing ring is a difficult and time-consuming operation. Care has to be taken not to scratch the stem of the walls of the packing chamber during the removal of the packing rings.

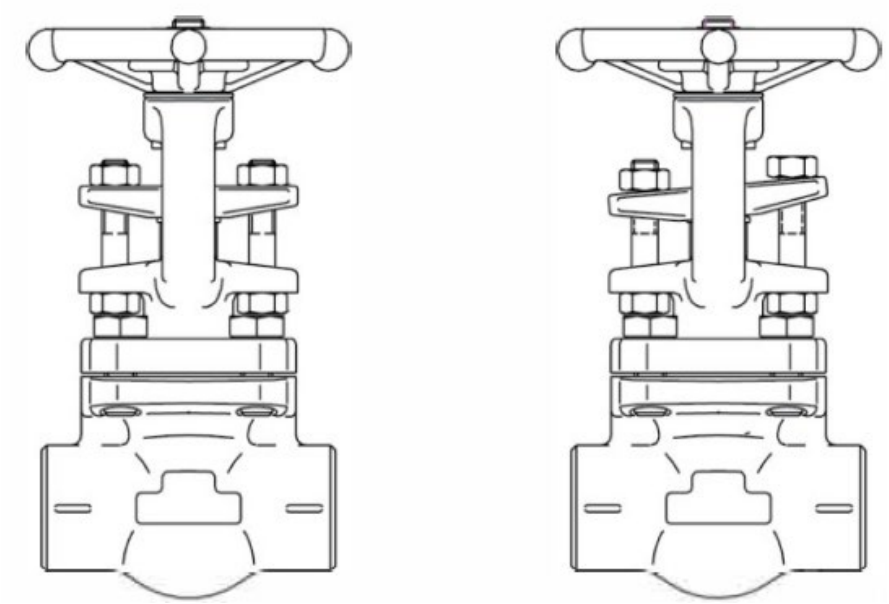


Figure 3

Over tightening will cause the packing to fail prematurely as well as increasing the force required to operate the valve.

If the leak cannot be stopped by tightening the gland nuts, it is necessary to add additional packing rings or completely repack the valve. Adding additional packing rings may damage the stem sealing system over a longer term. It is NOT RECOMMENDED TO REPACK THEM UNDER PRESSURE.
For normal operation in the open position, the stem should be backed off so that the backseat is not in contact. This permits the stem packing to assume its intended sealing function and not conceal unsatisfactory stem packing. In the event of stem packing leakage, the back seat can be used to stop stem leakage until circumstances permit a system shutdown and time for packing replacement.
Stem packing replacement with the valve under pressure and back seated represents a hazard and should not be undertaken. The hazard is magnified as fluid pressure or temperature increases or when the fluid is toxic.

Back seating the valve and attempting to repack under pressure is hazardous and is not recommended. Rather than attempting to repack under pressure, it is preferable to use the backseat to control the stem leakage until shutdown of the line provides safe repacking conditions.
Prior to replacing the packing rings, remove all pressure from the valve. If the backseat faces have been damaged by foreign material, the backseat may leak into the packing chamber.

The end rings (top and bottom) of some graphite or PTFE packing sets have a diagonal cut that will allow them to be installed around the stem of an assembled valve. However, the factory installed intermediate graphite packing rings are sometimes die formed and have no end cut. As a result, these rings cannot be replaced without removing the valve bonnet. If the valve is to be repacked without removing the bonnet (see repacking the valve in-line below), care must be taken when removing the original packing not to scratch the valve stem sealing surface. For fugitive emission service, proprietary fugitive emission packing must be used.
Note, PTFE has superior sealing properties compared to graphite, but is not firesafe.
Where it is necessary to repack the valve in-line, a compatible ribbon packing system or equivalent braided packing stock should be used. The joints in the packing rings should be diagonally cut. When installing the rings, care should be taken to stagger the ring joints. However, ensure the line pressure is totally isolated and no fluid remains, prior to attempting to repack valve in-line (refer 6.2). Wear anti-splash eye protection goggles.

Especially in the case of dangerous, hazardous, volatile, caustic or flammable liquids or gases, do not attempt to repack the valve in-line.

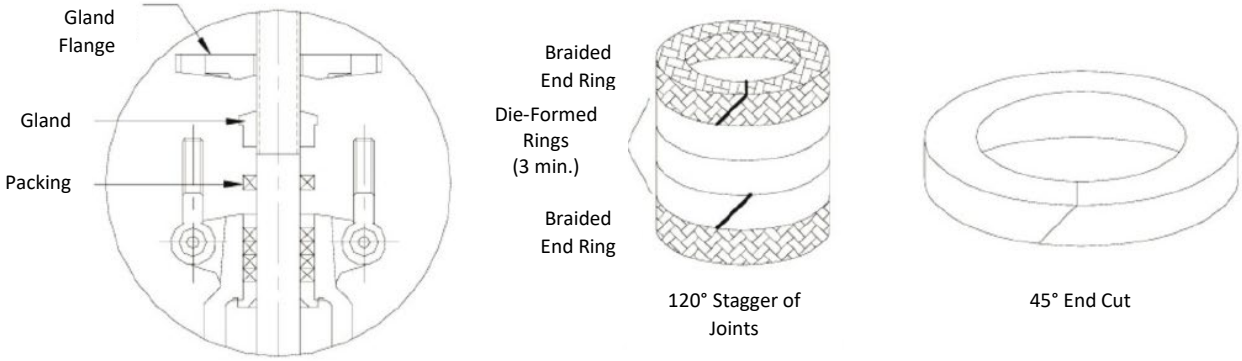


Figure 4

The stem packing style will vary according to valve size, type and class as well as the stem packing material specified.

4.1 - REPAIRS

Due to the relatively low replacement cast of small diameter standard carbon steel valves under DN80 (3”), it is usually less expensive to replace the complete valve than to have maintenance personnel carry out repairs. Additionally, in the case of gate valves, it must be removed from the line in order to replace or reface seat rings. Generally, the only justifiable repairs are replacement of packing and gaskets as previously described. However, see Section 5.0 and 6.0 for further extraordinary maintenance.
Always replace the bonnet gasket whenever a valve is disassembled. After removing valve from line, use adequate force to remove bonnet. Gasket seating surfaces should be scraped clean (avoid radial marks). Bonnet bolts should be tightened in a diagonal pattern at several different increasing torque settings until the final recommended torque value is attained. (See table A in Appendix A, including Figure 4.) 'Pressure seal' bonnets require a (usually soft metal) proprietary gasket; do not attempt to use non-genuine gaskets.

5.0 - MAINTENANCE PROCEDURES

5.1 - PERIODIC INSPECTIONS

1. The valve stem packing should be inspected monthly. If the stem packing shows signs of leakage, simply tighten the adjusting nuts to compress the packing. Do not over tighten the adjusting nuts, as this will make operation of the valve more difficult. If, after tightening the adjustment nuts to their fullest extent, the leakage does not stop, it is then necessary to replace the stem packing. It is not recommended that additional packing rings be added to the stuffing box as this may cause damage to the stem sealing system. For packing replacement, see Section 4.0 and 6.0.

2. The lubrication of the yoke nuts should be inspected monthly. A high-pressure grease gun should be used for valves supplied with ball type grease fittings.

3. Bonnet bolt tension should be checked periodically when valves are used in high temperature applications where creep may occur. Although leaks through bonnet ring or spiral gaskets are rare, erosion or corrosion could cause bonnet seal to fail. In these cases, a new gasket is required. Refer 4.1 for replacing bonnet gasket. Refer Appendix A & Appendix B for figures and tightening sequence.

4. With problematic service applications it is recommended that the valve be periodically at least partially stroked to ensure valve functions and to ensure there is no product deposits entering into seat or stem area which may render operating more difficult. Duration depends on service, criticality, etc. However, it also must be factored in that if there are impurities or particulates in the line which are likely to be built up in the seat area, each operation could reduce seat life proportionately.

6.0 - EXTRAORDINARY MAINTENANCE

6.1 - STEM

If the stem locks or "freezes", causes can generally be attributed to dry worn packing or a dry yoke nut. In either of these cases, the following service is required:

a) Unscrew gland nuts, remove the gland flange and bushing to expose stem packing and lantern ring (where applicable). Replace stem packing if it is damaged. If the lantern ring is seized, completely disassemble the stem and replace the lantern ring (where one is fitted).
b) Check lubrication of yoke nut. If it is dry, remove the yoke nut and determine if there is evidence of seizure marks. If so, replace it with a new yoke nut.

6.2 - GLAND DISASSEMBLY & REPLACEMENT OF STEM PACKING

In those cases where the valve cannot be removed from the piping system, it is important that prior to servicing, the valve be opened to its fullest extent and the valve be purged of any pressure and fluid (protective goggles should be worn). Partially unscrew nuts to reduce the compression load on the stuffing box. Next, if so equipped, remove the stem plug to check that there is no leakage. Remove the stem packing and, if so equipped, the lantern ring and bottom set of stem packing.

5.2.1 Stem Packing Replacement

First remove the valve from the line. To prevent injury ensure that all fluid and pressure is removed from the valve both upstream and downstream before removal and disassembly. When removing drain or stem plug, wear protective eye mask to avoid injuries.

1) Check tightness of valve operation to serve as a reference when re-tightening. Remove gland nuts and the hook. Lift the gland up the stem clear away from the packing chamber.
2) Remove the defective packing rings with a sharp tool or packing hook. Do not scratch or score the machined surfaces of the stem or packing chamber.
3) Examine the machined surfaces of the stem and packing chamber. Remove any scratches, scoring or burrs with an emery cloth or by hand filing. Clean the stem with a solvent soaked rag.
4) Count original number of rings and measure x-section thickness. If original packing cannot be counted or measured, follow the steps below:
   a) Measure the stem diameter (OD), stuffing box diameter (ID) and stuffing box depth (d).
   b) Packing x-section R=(ID – OD) / 2
   c) N° of rings= (1.25 x d) / R
5) Install new packing. Cut each ring at 45° angle and stagger the joints at 120 degrees, every fourth joint will be in the same position as the first. Install rings individually using a split ring spacer, compressing each ring by hand tightening + ¼ turns on each gland nut.
6) When packing chamber becomes filled with packing, reassemble gland and gland flange. Alternate tightening gland flange nuts ¼ turn at a time until eyebolts begin to get tight.

If gland travels more that the height of one packing ring into the packing chamber, insert one more ring and repeat step 6, until chamber is filled.

7) Compare valve operation to original tightness. If valve operation is considerably tighter than original operating tightness, back off ¼ turn on each gland nut and recheck tightness.
8) Several hours after a repacked valve has been returned to service, inspect the packing area to ensure full compression, tight bolting and no leakage. Should leakage occur, tighten gland nuts at ¼ turn increments until leakage stops. Do not over tighten or valve will become hard to turn.

6.3 - BONNET DISASSEMBLY & STEM REPLACEMENT

Before disassembly:

1. Check that the line is in a complete shutdown phase then remove the valve from the line.
2. Pre-order all necessary spare gland packings and jointing gaskets.
3. Open the valve slightly by turning the handwheel anti-clockwise and loosen the gland.
4. Put identification markings on valve body, bonnet, disc/wedge, yoke and actuator. This helps to avoid mismatching of parts at the time of re-assembly.
5. If the bolts and nuts are too tight, apply deep penetrating oil then unscrew.

Refer Section 6.9 for removing the bonnet.

To replace the stem when the valve is completely disassembled for general maintenance follow this procedure:

- Open valve half way then remove bonnet bolts and nuts.
- Lift up the bonnet to remove wedge.
- With the bonnet removed, unscrew the gland bolts then lift up gland flange exposing the stem packing.
- Remove stem packing above the lantern ring (if so required) and then turn the hand wheel to force down the stem.
- Remove the stem through the stuffing box. Turn the bonnet upside down and remove lantern ring.
- If so equipped, remove stem packing below the lantern ring.

Always be sure that the valve is de-pressurized and isolated prior to performing any maintenance work. Do not attempt to repair valve in-line if volatile, dangerous, hazardous or flammable service.

6.3.1 - PRESSURE SEAL BONNET REMOVAL

In 900 to 2500 class a ‘pressure seal’ bonnet may be specified. The bonnet bolts effect a seal on the pressure seal joint which forces the bonnet onto the seal ring soft metallic gasket which is forced up hard against the gasket, further tightening the seal. The thrust rings are embedded in the body. In smaller forged valves sometimes a ‘breech-lock’ threaded bonnet insert is used instead of a bolt energized bonnet.

In larger sizes and higher classes, the bonnet gasket is silver plated as silver provides a softer surface to flow the gasket metal into the mating flange surface. Flexible custom-made expanded graphite gaskets are also available.

Another superior option for larger sizes and higher classes is a 316 + graphite gasket. In very large sizes, graphite gaskets can be specified in conjunction with live loading bonnet bolt washers that can be tightened to ensure a constant force is applied to the bonnet gasket.

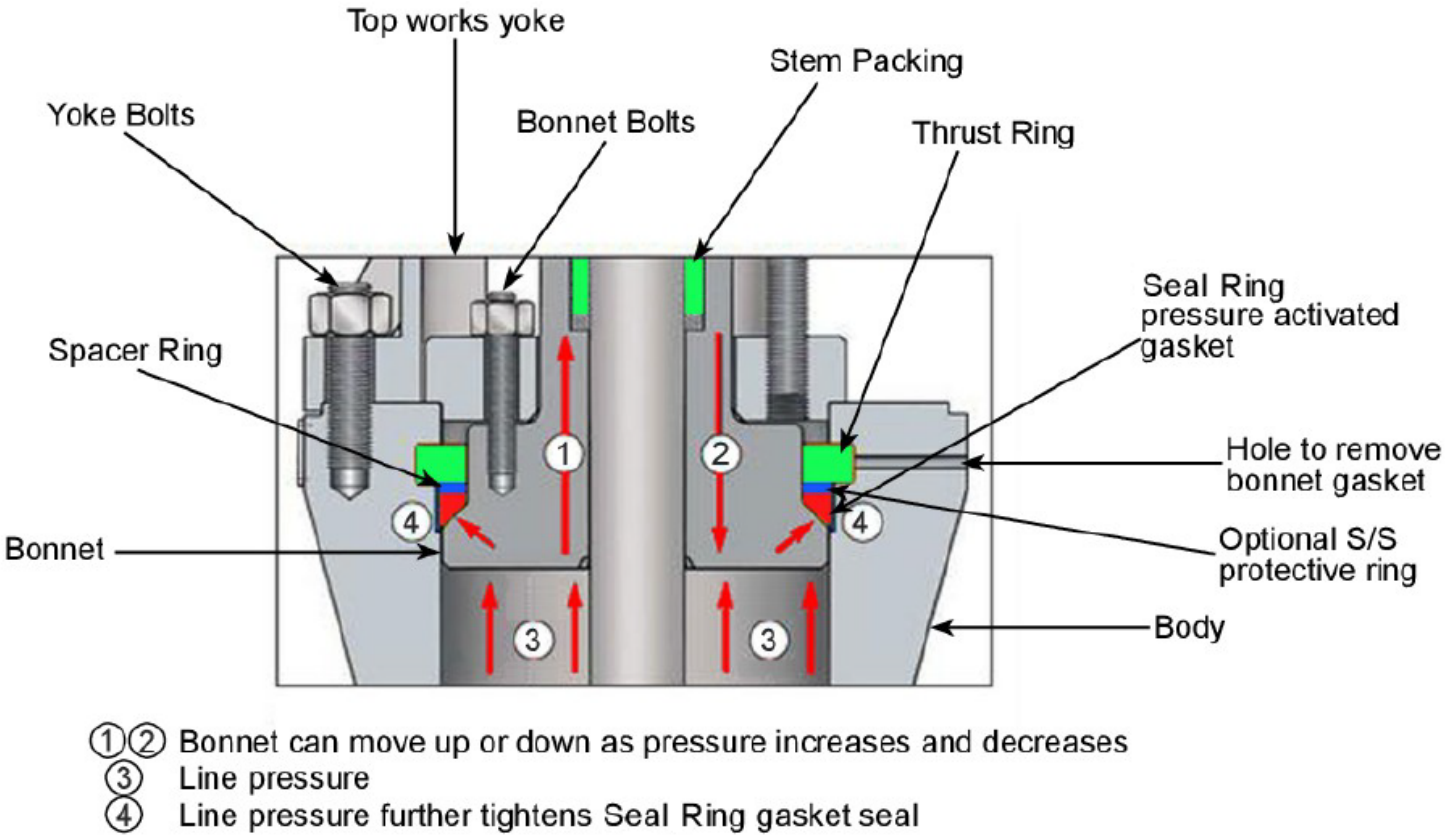


Figure 5

The procedure to remove a pressure seal bonnet is as follows (refer to Figure 5):
1. After disassembling the gland (refer 6.2) remove the bonnet bolts (or the threaded breech-lock bonnet).
2. Insert a knock-out pin into drilled hole so the segmented thrust ring can be driven out from the retaining groove.
3. The optional S/S protective ring and the seal ring gasket can then be removed.
4. Clean the gasket area and always fit a new gasket before reassembly.

Only an experienced valve repair professional should attempt disassembly of pressure seal bonnet valves.

6.3.2 - CHECK VALVES DISASSEMBLY & GASKET REPLACEMENT

Before disassembling:

1. Check that the line is in a complete shut down phase, then remove the valve from pipeline.
2. Pre-order all necessary spare parts and joining gaskets.
3. Put identification markings on valve body, disc and cover. This helps to avoid mismatching of parts at the time of re-assembly.
4. If the bolts and nuts are too tight, apply deep penetrating oil and then unscrew.

Disassembly:

1. Disassemble all cover bolts and nuts.
2. For check valves in sizes DN400 (16”) and larger (and in case of higher pressure classes in smaller sizes), lifting lugs are generally provided, lift up the cover using these lugs. For smaller and lower class valves, the cover should be easy to remove without the aid of a mechanical lifting device. In both cases, gently break the seal with a lever, gradually lifting the cover flange at intervals 360° around the cover.
3. Clean gasket surface areas, replace gasket and refit bonnet as detailed in 4.1 above.
4. 'Pressure seal' valves use a proprietary soft metal or composite graphite gasket.

6.3.3 - CHECK VALVES INTERNALS DISASSEMBLY INSPECTION AND REPAIR

1. Check that the (where applicable) hinge, nut and pin are in good condition and firmly connected. Replace damaged parts as necessary.

2. For swing check valves, lift and remove the disc hinge assembly. Movement should be free and not hindered by any malfunction of the hinge pin. Where disc travel is not sufficiently smooth, remove plugs or blind flanges and then remove hinge pin. Check surface for seizure or scraping marks.
If marks are deeper than 1.5mm (1/16"), re-machine hinge pin, reassemble hinge pin, and re-assemble. If defect depth is greater than 1.5mm (1/16"), a new hinge pin is necessary. When reassembling hinge pin, it is recommended that the disc be removed by loosening the nut. For piston check or ball check valves, if there is a spring, ensure it is functioning properly and is sufficiently energized. The spring should hold the disc/ball tightly against the seat no matter what position the valve is in.

3. When leakage is due to deterioration of seal surfaces caused by corrosion, erosion or foreign substances, it must be determined whether the disc or seal seat are the cause. Where special soft seat inserts are supplied, consult Trust Valves.

a) Deterioration of disc surfaces:
Swing check valves: - Disassemble disc by removing nut and washer. (Ball/Piston check valves have a free-floating disc). Repair surface by grinding and relapping using a fine grade abrasive paste.

b) Deterioration of seat seal surfaces:
When seal surfaces are damaged and defects are confined to a small area but are not deeper than 0.4mm the seal surface can be relapped. For smaller sizes, the recommended method is to use a cast iron strap with an outside diameter matching the valve's raceway.

If the seat surfaces cannot be relapped a Trust Valves approved repairer will decide if the surface has to be reground/re-machined or replaced.
When defects are deeper than 0.4mm and found on the entire surface, re-metallizing or a new seat is required. For threaded-in seats it is recommended that an anti-seizure compound be used when installing the replacement seat to make threading it in the body easier.

6.4 - VALVE REASSEMBLY

The procedure to reassemble the valve is as follows:
Re-insert the stem through the stuffing box taking special care to reassemble parts in sequence. If so equipped, avoid allowing the lantern ring to slide into the stuffing box.
If the valve is equipped with a lantern ring, first insert packing rings into the stuffing box followed by a lantern ring (where applicable).
Next, insert the remaining packing rings into the stuffing box and compress using the gland and flange. Then, reassemble nuts and tighten.
Note: the stem must slide freely through the stuffing box without applying excessive force. Finally, install the bonnet gasket making sure it is not damaged.
The gasket should be replaced if there is any doubt to its performance (refer 4.1).
Raise the bonnet, making sure the stem is in the half-open position, then connect disc to stem.
Lower bonnet on to the valve body making sure that the disc fits exactly into body guides and the bonnet is properly seated.
Align holes and tighten bonnet nuts taking care that excessive force is not used, to avoid damaging the gasket.
Hydrostatically test the valve to ensure that there is no leakage.

6.5 - DISASSEMBLY OF YOKE NUT

When necessary use the following procedure for disassembling and replacing yoke nut:
a) Handwheel operated valves:

- Remove set screw.
- Unscrew handwheel nut.
- Remove handwheel.
- Unscrew yoke but retaining nut, removing spot welds if necessary.

Reverse the procedure for reassembly.

b) Gear operated valves:

- To remove the gear from the valve, unscrew nuts and turn the handwheel in the open direction indicated by the arrow until the drive nuts are disengaged from the stem.
- To check the condition of the drive nut or bearing, unscrew the retainer ring and remove drive nut and bearing. If damaged, a new drive nut or bearing is necessary.

6.6 - DISASSEMBLY OF VALVE – WEDGE, DISC AND SEATS

An indication of valve leakage is a pressure loss in the high-pressure line side after a valve has been properly closed. In the case of hot water or steam lines, note whether the downstream pipe remains hot beyond the usual length of time.
This type of leak may be the result of a distorted seat caused by improper welding of the valve into the pipeline or seating damage caused by foreign particle matter or by stress relieving temperatures that may have been used during installation.
Leaks can also develop from failure to close the valve tightly, resulting in high-velocity flow through a small opening.
Trim materials like CR13 (410SS) and especially hardfacing materials like Stellite 6 are corrosion and erosion-resistant, but grooves, pit marks or other surface irregularities may still form on the mating surfaces. Valves, which leak, should be repaired as quickly as possible to prevent greater damage caused by high velocity.
Leakage through seats and wedges/discs cannot be verified when valve is in service (unless a downstream drain is fitted). However, when leaks are identified, immediate action is necessary.
Any delay can permanently damage the seat or wedge/disc seal surfaces.
Never leave gate valve part open when in service, as gate valves are not designed to throttle flow.
Leaving valve part open will result in damage to wedge/disc and seats due to Venturi action erosion.
To repair or replace disc or seats, the valve must be removed from the line then first follow the same procedure in 5.3 and then:

- Make sure that the valve is not under pressure before unscrewing bonnet nuts.
- Remove bonnet, being careful not to damage the gasket.
- Remove bonnet when wedge/disc is in half-open position.
- Lift up bonnet until wedge/disc is disconnected from guides.
- Release wedge/discs from stem.

If seat surfaces show signs of seizing, pitting, grooves or other defects not deeper than 0.8mm (1/32") (see 5.7, 5.8) it is possible to repair seating surfaces to its original condition by relapping the surface with line grain abrasive paste, creating perfect tightness once again. Refer to 6.7, 6.8.
Defects having a depth exceeding 0.8mm (1/32") (see 5.7, 5.8) cannot be repaired by lapping, in this case, parts must be replaced or professionally reconditioned by an approved reconditioner.
It is recommended that the face of the disc be blue metal tested to check for contact of seating surface after final lapping. For re-assembly of valves use the procedure outlined under paragraph 6.4.
If valve is custom fitted with special soft seat inserts - consult Trust Valves.
Note: if the valve was ordered to a higher level of shut-off class, then the seating surfaces will have to be blue metal matched until the required shut-off is attained.

6.7 - WEDGE AND DISC REPAIRS - WEDGE GATE AND PARALLEL SLIDE VALVES

a) After disassembling valve as described in 5.6, inspect the wedge or disc for scratches or damage.
b) If seating faces are scratched, the wedge or disc must be lapped. Slight pitting, grooving or indentions no deeper than 0.1mm (0.005") can be removed by lapping. If defects cannot be corrected by lapping, wedge or disc should be ground or machined by an approved valve reconditioning professional.
For Wedge Gate, manufacturers recommends that a maximum of 0.4mm (0.015") on each side be removed from a 10° seated wedge and 0.25mm (0.010") on each side for a 7° seated wedge.
For Parallel Slide Disc Gate manufacturers recommends maximum removal of 1mm (0.040") per disc. Note, if more than 0.89mm (0.035") total must be removed from both discs and seats of a parallel slide valve. Then the retainer plate and or disc groove must also be ground, milled or machined to compensate for gap allowance.
c) For the lapping, a flat plate, preferably cast iron, should be used and an abrasive lapping compound mixed with olive oil should be evenly distributed over the plate. Only light, even pressure should be applied to the plate, lifting the wedge or disc as often as possible to prevent accumulation of particles in one area and to follow for proper distribution of the lapping compound. The lapping plate should be turned slightly every few strokes to maintain a flat surface. The part should be lapped until seat faces are smooth. Manufacturers recommends the use of silicone carbide compound, medium coarse and fine grit compound for finishing.
d) Thoroughly clean off the lapping compound with a suitable cleaning fluid such as acetone or alcohol. Do not use solvents containing chloride or fluoride.

6.8 - SEAT REPAIRS - WEDGE GATE AND PARALLEL SLIDE VALVES

a) If seating faces are damaged, the body seat must be corrected by lapping. Slight pitting, scratches or indentations no deeper than 0.1mm (0.005") can be removed by lapping. If defects cannot be corrected by lapping, the seats should be ground using specialized automatic grinding/lapping equipment. Manufacturers recommends a maximum of 0.4mm (0.015") per side that can be removed from 10° seated valve, and 0.25mm (0.010") per side on a 7° seated valve.
For parallel slide valves, a maximum of 1mm (0.040") per seat can be removed. Consult a professional valve repairer. Grind the seat using automatic grinding equipment can save considerable time.
b) Where seat faces can be repaired using a lapping plate, the plate should be made of cast iron if possible and should be large enough to cover the face of the seat. Apply lapping compound mixed with olive oil and distribute over the plate.

6.9 - BONNET REMOVAL & GASKET REPLACEMENT

First, refer to section 6.3 for bonnet assembly. Always replace the bonnet gasket whenever a valve is disassembled. Gasket sealing surface should be scraped clean (avoid radial marks).
1. Disassemble all cover bolts and nuts.
2. For larger valves (and in the case of higher-pressure classes, in smaller sizes), lift up the bonnet using lifting lugs where provided.

For smaller and lower class valves gently and evenly break the bonnet seal with a lever if required before lifting the bonnet off (where required with a sling and mechanical lifting device).
3. Clean gasket surface areas, replace gasket and refit bonnet as detailed below.
4. Pressure seal valves use a proprietary soft metal or graphite composite gasket (refer to 6.3.1).

7 - REASSEMBLY

1. Re-assemble in reverse order of disassembly.
2. Bonnet bolts should be tightened in a diagonal pattern at several different increasing torque settings in accordance with the recommended torque value (see Table A, Appendix A & Appendix B).

For any technical request or assistance, feel free to contact Trust Valves Quality Department at:
quality@trust-valves.com – +39 02 9675 4324

Typical Forged (up to DN50) Bolted Bonnet Gate Valve Expanded View

1. Disc
Solid wedge is machined to the tightest tolerances to ensure trouble free shut off and cycling.
2. Stem
The stem is precision machined and inserts into the disc's horizontal channel.
3. Gland Packing
The packing creates a seal above the back seat, between the bonnet and stem.
4. Packing Gland
Compresses the packing to create a stem seal above the back seat, between the bonnet and stem.
5. Packing Gland Flange
Applies pressure to the gland for accurate packing adjustments.
6 & 13. Gland Bolts & Nuts
The gland bolt and nut allows for easy adjustments for packing compression.
7. Seats
To ensure a stable shut off, seat rings are aligned and swaged into the valve, then precision ground for optimal seating.
8. Body
Forged steel bodies provide low resistance flow and optimum strength and performance.
9. Gasket
The bonnet gasket creates a leak-proof seal between the body and bonnet.
10. Bonnet & Yoke
Bonnet assemblies are built to the same standards as the bodies. Larger size gate valve utilize a multi-piece bonnet design.
11. Bolts
The bonnet bolts secure the bonnet to the body.
12. Stuffing Box
The stuffing box contains the packing.
14. Stem Nut
The stem nut provides a precision guide for proper stem alignment.
15. Handwheel
The handwheel cycles the valve
16. Handwheel Nut
The handwheel nut secures the handwheel to the bonnet assembly.

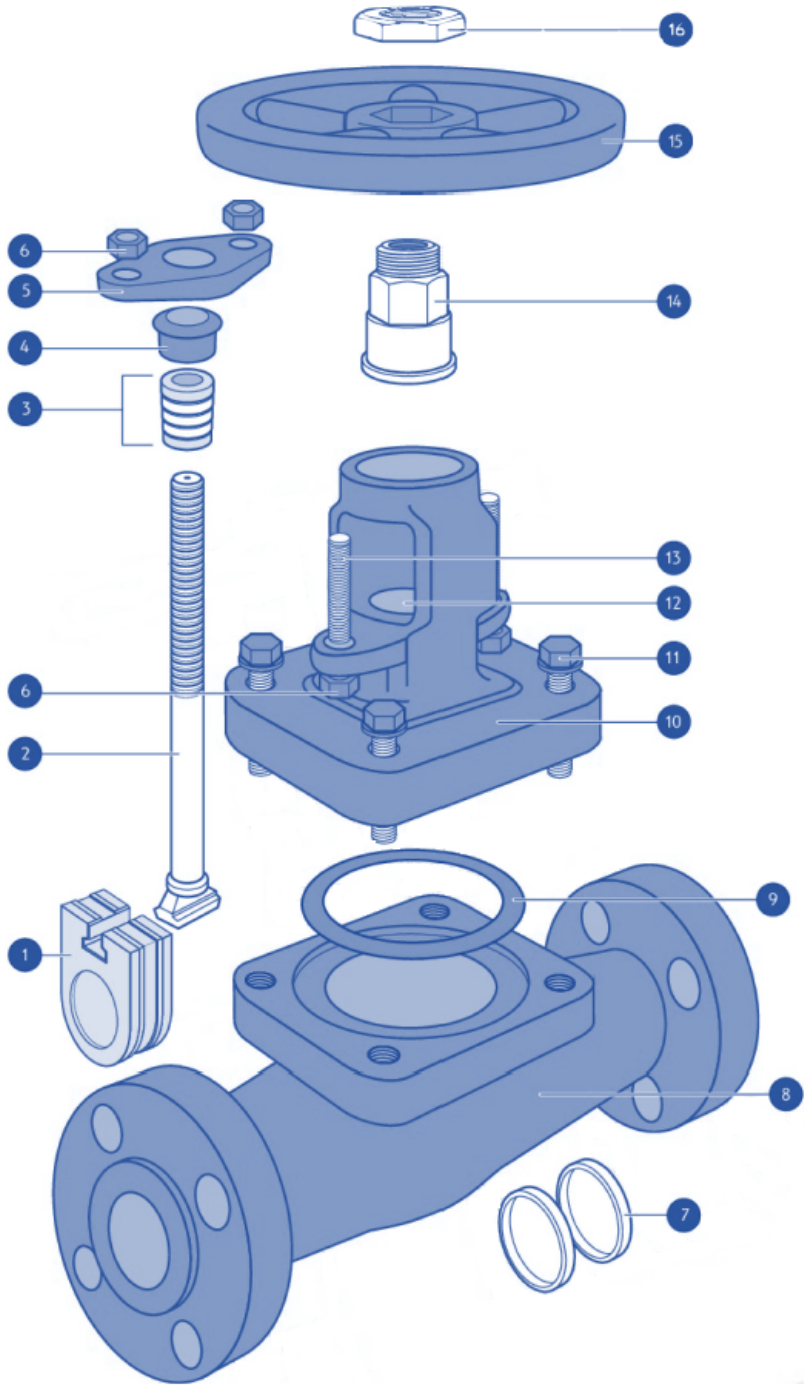


Figure 6

Typical Forged (up to DN50) Bolted Bonnet Globe Valve Expanded View

1. Disc
Plug type disc is machined to the tightest tolerances to ensure trouble free shut off and cycling.
2. Split Ring
The split ring allows the disc nut to lift the disc during cycling.
3. Disc Nut
The disc nut, in conjunction with the split lock ring, secures the disc to the stem.
4. Lock Groove
The lock groove receives the split lock ring which allows the disc nut to lift disc during cycling.
5. Stem
The stem insert vertically into the disc.
6 Stuffing Box
The stuffing box contains the packing.
7 & 17. Gland Bolts & Nuts
The gland bolts & nuts allows for easy adjustments for packing compression.
8. Stem Nut
The stem nut provides a precision guide for proper stem alignment.
9. Seat Ring
To ensure a stable shut off, the seat ring is aligned into the valve, then precision ground for optimal seating.
10. Body
Forged steel bodies provide a low resistance flow and optimum strength and performance.
11. Bonnet Gasket
The bonnet gasket creates a leak-proof seal between bonnet and body.
12. Bonnet
Bonnet assemblies are built to the same standards as the bodies.
13. Bonnet Bolts
The bonnet bolts secure the bonnet to the body.
14. Packing
The packing creates a seal above the back seat, between the bonnet and stem.
15. Gland
Compresses the packing to create a stem seal above the back seat, between the bonnet and stem.
16. Gland Flange
Applies pressure to the gland for accurate packing compression
18. Handwheel
The handwheel cycles the valve
19. Handwheel Washer
The washer helps to prevent loosening.
19. Handwheel Nut
The handwheel nut secures the handwheel to the bonnet assembly.

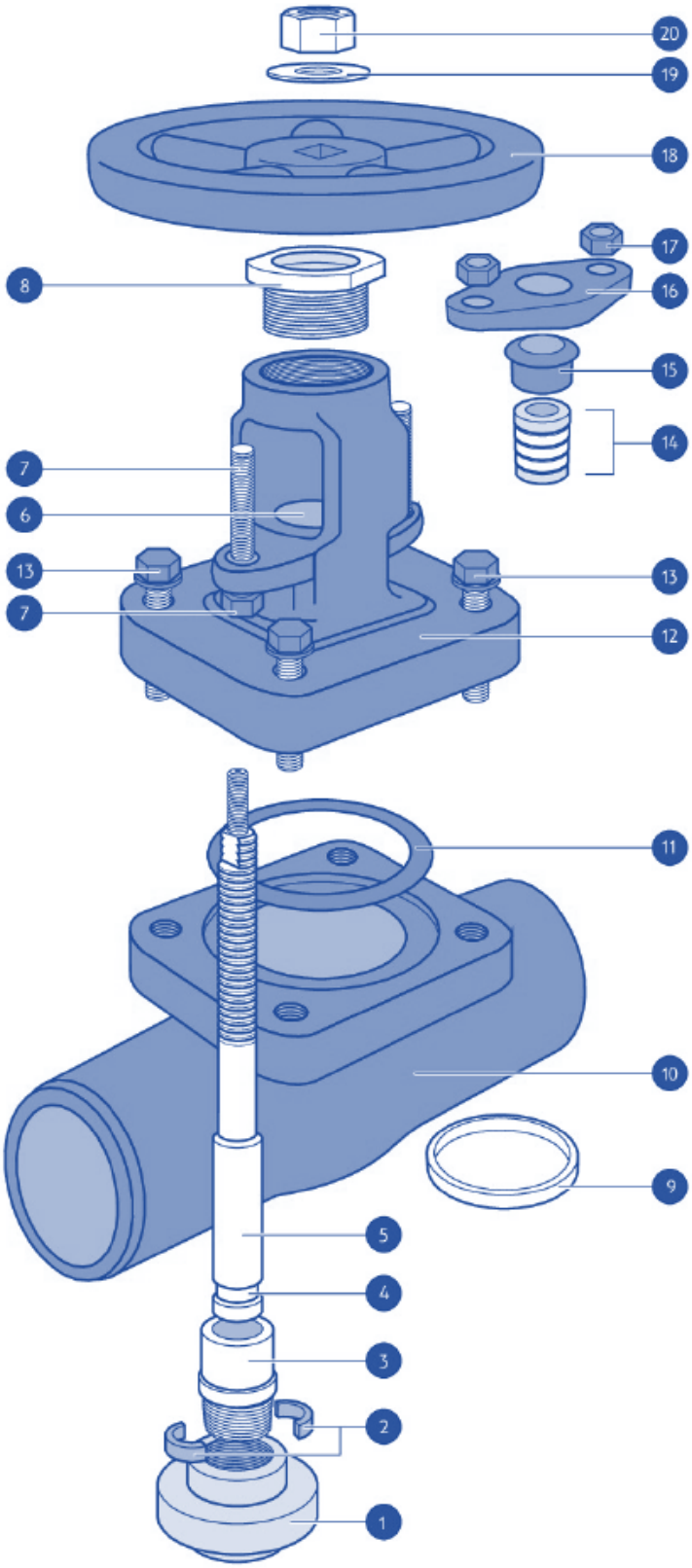


Figure 7

Typical Forged (up to DN50) Bolted Cover Piston Check Valve Expanded View

1. Seat
The seat ensures a stable shut off. The seat is precision ground for optimal seating.
2. Cover Gasket
The cover gasket creates a leak-proof seal between cover and body.
3. Piston
Piston is machined to the tightest tolerances to ensure trouble free shut off and cycling.
4. Spring
The spring is precision made and loaded for precise pressures.
5. Cover
The cover allows access to internal components.
6. Cover Studs
The cover studs secure the cover to the body.
7. Body
Forged steel bodies provide a low resistance flow and optimum strength and performance.

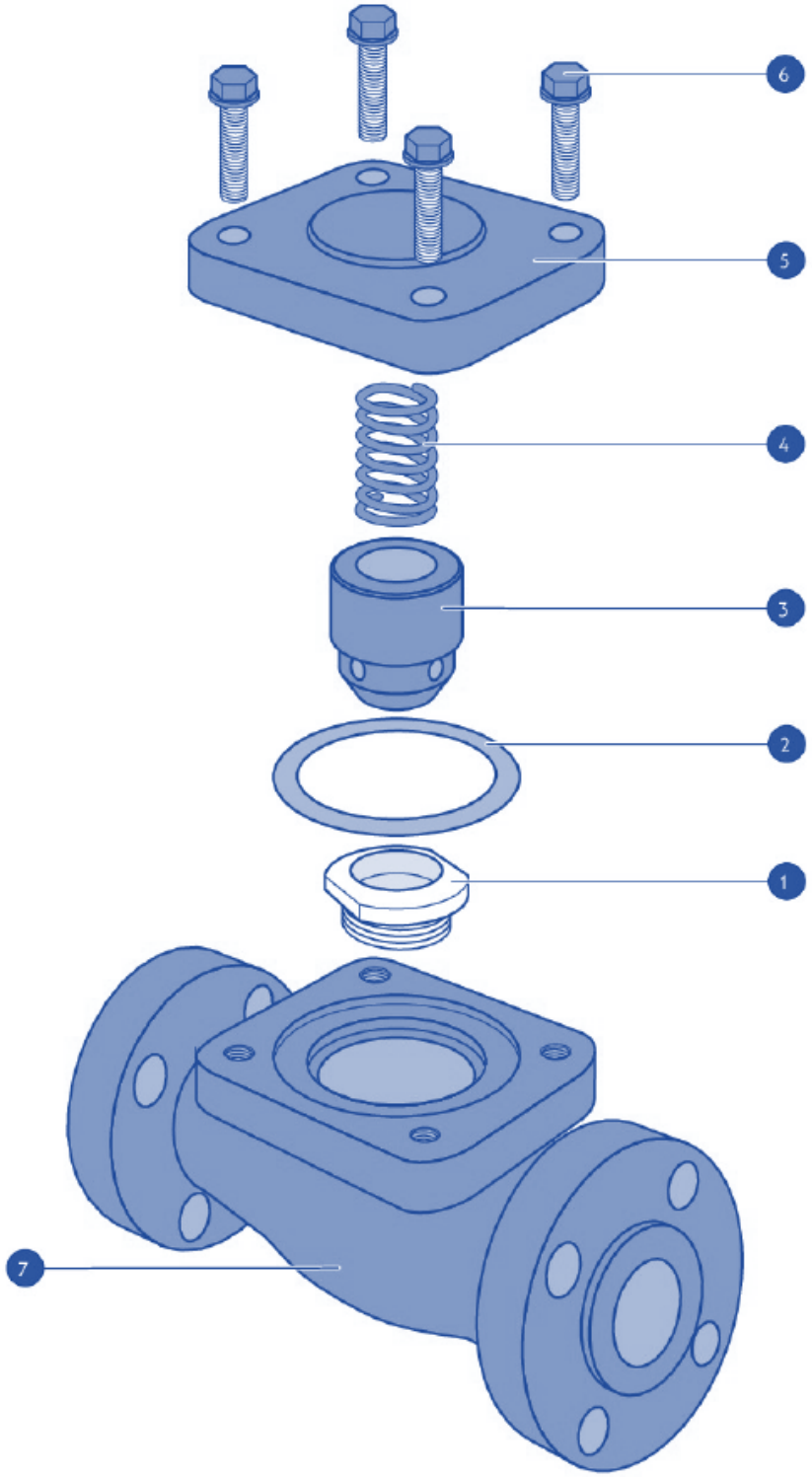


Figure 8

TABLE A

Indicative Bonnet Bolting (Bolted Bonnet) Torque ft·lb (N·m)

Stud Size	Bolting Material			
	B7M / L7M	B7 / B16 / L7	B8 / B8M CL.1	B8 / B8M CL.2
3/8 – 16 UNC	15 (20)	20 (27)	15 (20)	20 (27)
7/16 – 14 UNC	25 (34)	30 (41)	22 (30)	25 (34)
1/2 – 13 UNC	40 (54)	50 (68)	35 (47)	45 (61)
9/16 – 12 UNC	55 (75)	70 (95)	55 (75)	65 (88)
5/8 – 11 UNC	75 (102)	100 (136)	70 (95)	85 (115)
3/4 – 10 UNC	135 (183)	170 (231)	125 (170)	150 (203)
7/8 – 9 UNC	200 (271)	270 (366)	170 (230)	200 (271)
1 – 8 UNC	350 (475)	400 (542)	219 (298)	350 (475)
1 1/8 – 8 UN	500 (678)	520 (705)	256 (398)	450 (610)
1 1/4 – 8 UN	675 (915)	850 (915)	321 (498)	650 (881)
1 3/8 – 8 UN	900 (1220)	1200 (1627)	384 (598)	900 (1220)
1 1/2 – 8 UN	1200 (1627)	1500 (2034)		1200 (1627)
1 5/8 – 8 UN	1600 (2170)	2000 (2712)		1501 (2035)
1 3/4 – 8 UN	2000 (2712)	2500 (3390)		1907 (2585)
1 7/8 – 8 UN	2500 (3390)	3100 (4204)		2357 (3195)
2 – 8 UN	3000 (4068)	3800 (5153)		2876 (3898)
2 1/8 – 8 UN	3600 (4882)	4500 (6102)		
2 1/4 – 8 UN	4400 (5966)	5400 (7322)		
2 1/2 – 8 UN	6000 (8136)	7500 (10170)		

Note:

(1) Torques shown are for A193 B7/B16/B7M/B8/B8M and A320 L7/L7M/B8/B8M.

(2) Torque tolerance ±10%.

(3) For temperatures above 750°F (400°C) use 75% of the torque values.

(4) Above torque values are with the bolts lubricated.

(5) Values above are based on 30,000 psi (206.85 Mpa) bolting stress and lubricated with heavy graphite and oil mixture or a copper based anti-seize grease.

(6) Do not exceed by more than 25% of values stated when emergency torqueing is required.

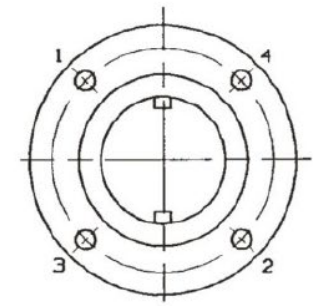
(7) All bolts shall be torqued in the pattern as shown in Appendix A (for Gate valves) or Appendix B (for Globe & check valves) to ensure uniform gasket loading.

(8) Optimum torque can vary depending on type of body gasket but do not increase torque more than 10% above those shown.

(9) Consult Trust Valves for other bolt material.

(10) Most B8M and B8 bolts are class 1 so do not assume class 2 unless you are sure.

APPENDIX A
Bolt Tightening Sequence for Gate Valves



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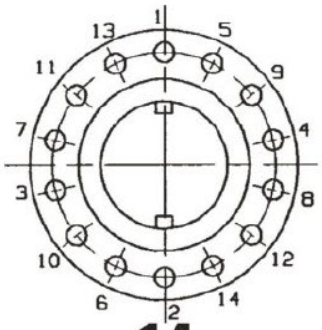

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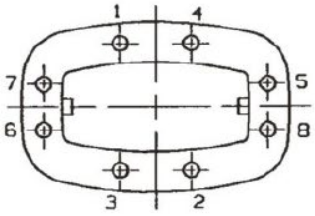

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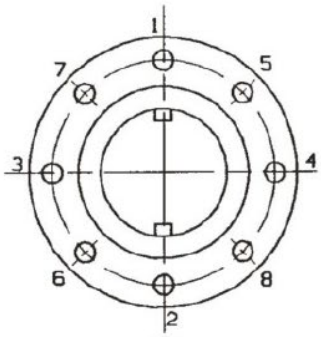

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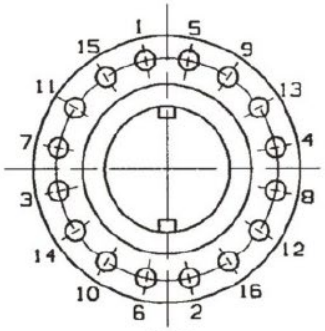

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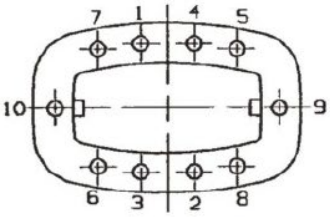

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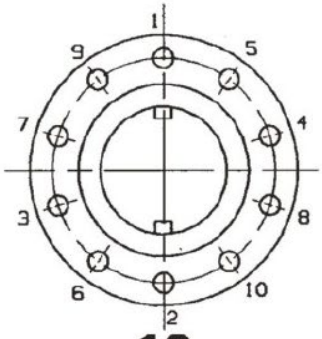

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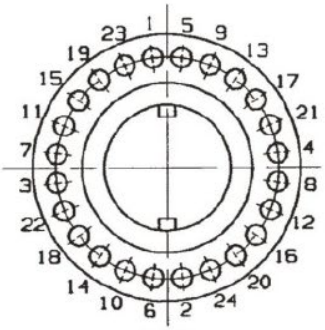

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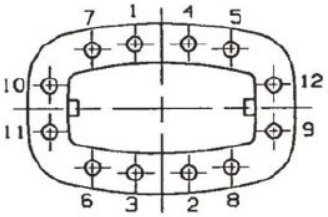

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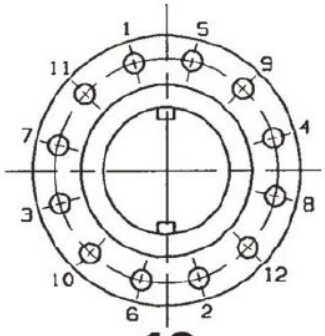

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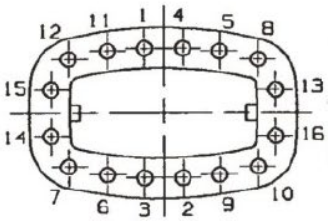

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APPENDIX B
Bolt Tightening Sequence for Globe & Check Valves