INSTALLATION, OPERATING, AND MAINTENANCE INSTRUCTIONS

FIGURE 561
CAST STEEL FLANGED GATE, GLOBE & CHECK VALVES

FNW®

This instruction manual includes storage, installation, operation, and maintenance information for cast steel flanged gate, globe, and check valves. This manual addresses class 150- and 300-pound bolted bonnet, outside screw and yoke, carbon, and stainless steel valves. Only standard manual valves are addressed. For other options and accessories, consult their individual manuals.



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NOTE:

Be careful not to damage the valve stems during handling. In case the valves are rack-mounted for storage, their packing chambers should not come into direct contact with the racks. Placing valves directly on the ground or on concrete floors is not recommended.

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INSTALLATION

WARNING:
To avoid personal injury to yourself, fellow workers, or damage to property from release of process fluid, before installation:
- Shut off all operating lines to the valve site.
- Isolate the valve site completely from the process.
- Release process pressure.
- Drain the process fluid from the valve site.

1. If the valve was supplied with an actuator, secondary support may be necessary. Contact FNW for recommendations.
2. Remove the valve end protectors.
3. Before installing the valve, inspect the valve body port and associated equipment for any damage that may have occurred and for any foreign matter that may have collected in shipping or storage. Make certain the body interior is clean by blowing compressed air into the valve.
4. Before installing the valve, inspect the pipe line and mating flanges, making sure the pipe is free of foreign material and the flanges are clean and have no burrs or pits that could cause leakage.
5. A preservative may have been applied to the interior of the valve prior to shipment. If necessary, this preservative can be removed with a solvent.
6. Ensure that the connecting pipe has adequate support. Improper support can lead to valve distortion, inefficient operation, or early maintenance problems.
7. When installing globe and check valves, ensure that the flow indicator arrow on the valve is pointing in the correct direction of pipe flow.
8. When installing gate and globe valves, make sure there is sufficient space around the handwheel to easily and safely operate the valve and there is adequate space for the stem to rise when the valve is opened.
9. Make sure that the bolting and gasket materials are compatible with the valve's body material and pressure rating.
10. With proper support, align the valve flange holes with the pipe flange holes.
11. For ring gaskets, insert two to four bolts through the lowest bolt holes.
12. Insert and center the appropriate gasket between the flanges. For ring gaskets, use the inserted bolts to center the gasket.
13. Insert all bolts and nuts and hand tighten. Care should be taken to ensure flanges are parallel.
14. Using the cross-over pattern (star pattern), evenly tighten each bolt to ensure uniform gasket loading. The ends of the tightened bolts should protrude equally beyond each nut (see Figure 5).
15. After installing the valve, recheck all bolts and nuts of the coupled flanges and retighten them if found loose.

Temporary Storage

If valves are to be temporarily stored prior to installation, the following should be observed:
- Keep the valves wrapped and protected at all times.
- Preferably, store the valves in a dust-free and well ventilated place with low humidity.
- If stored outside, make sure the valves are well protected from the environment and positioned so that water does not accumulate on or in the valve.
- Protective end coverings are shipped with the valve to protect against mechanical damage and prevention of dust and foreign object intrusion. If the end covers are found missing during transit, apply an adequate type of end protector immediately.
- Valves should be kept in the closed position.

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Long-Term Storage

If the valves are to be stored for more than one year, they should be prepared as above and include the following:

- Do not store the valves outdoors.
- Remove the packing and apply a preservative to the packing well.
- Annually, perform the following:
  - Lubricant may be lost or reduced from the stem threads or grease nipples. Apply lubricant to these exposed areas.
  - Remove the end protectors and apply a rust prevention spray to the valve interior. Reinstall the end protectors.
  - As needed, apply a protective surface coating to the valve exterior. Be sure the surface area is clean before applying protective spray.

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OPERATION

- Gate valves are not designed for throttling (modulating) service and should be used in the fully opened or fully closed position. Prolonged use in the partially open or closed position may result in the erosion of the wedge and/or seat. This position may also cause a “chatter” noise in the line or cause damage to the valve.
- For gate and globe valves, turn the handwheel counterclockwise to open the valve. Turn the handwheel clockwise to close the valve. Do not use pipe extensions (cheater bars) to operate the valve as this may damage seat surfaces, yoke, or stem. For larger valves, consider gear operators or other means of actuation.
- For gate and globe valves, on a new valve or a valve that has had new packing installed, the handwheel torque may be relatively high. This high torque will diminish to a reasonable level after the valve has been operated several times. Handwheel operating torque also depends on the type and size of each valve and its position. Note that the operating torque is high when opening a fully closed valve or when closing the valve and near the end of valve travel.
- For gate valves, after closing a valve completely, it is recommended that the handwheel be turned back about 90°. This turn back is particularly important in high temperature services where stress can build up due to thermal expansion. It also makes the valve opening easier and smoother.
- For gate and globe valves, sometimes material in the line can get stuck between the disc and seating area. Should this happen, reopen the valve to allow the process fluid to clear the material. If the condition persists, it may be necessary to shut down the line and inspect the interior of the valve.
- Check valves are process-operated devices. The valve will begin opening when upstream pressure is appropriately higher than downstream pressure. When upstream and downstream pressures equalize, or when downstream pressure is higher than upstream pressure, the valve will close.

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TROUBLESHOOTING

The following is intended as a guide only.

TABLE 1

Trouble	Probable Cause	Remedy
Leakage through the stem packing	Gland nuts are loose	Tighten gland nuts
	Gland is binding against the stem or packing well wall	Check to ensure that the gland is centered and evenly tightened
	Inadequate amount of packing rings	Install additional packing rings
	Packing is hard and dry	Replace with new packing
	Packing was not properly cut and staggered	Replace with new packing
	Stem is damaged	Repair or replace as required
Handwheel is difficult to turn	Stem is binding during travel	Remove dirt and lubricate stem with grease
	Stem packing is exerting excessive force on stem	Check torque on gland nuts
	Stem is damaged	Examine stem through full open and close action. Repair or replace as required.
	Internal components may be damaged	Disassemble the valve. Inspect and repair as needed.
Leakage from the bonnet	Bonnet nuts are loose	Tighten to values listed in Table 2
	Bonnet gasket is damaged	Disassemble valve and install a new gasket
	Bonnet flange faces are damaged	Repair damaged area and install a new gasket
Leakage past the seat	Valve is not properly seated	Check with handwheel to see if the valve is tightly closed
	There is an obstruction between the seat and disc	Open and close the valve a few times to see if the obstruction clears
	Internal components are damaged or worn	Disassemble the valve, inspect internal components, and repair or replace as required

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INSPECTION

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of the service conditions.

Frequent Inspection

For safe, uninterrupted operation of valves, frequent inspection is recommended.

Frequent inspection should include:

1. Inspect for process fluid leakage from the packing gland area, flange connection, bonnet flange, threaded area, through the valve body surface, and any welded areas. Packing gland, flange, and bonnet flange leaks should be addressed as outlined in the maintenance section. For leakage through the body surface or welded areas, consult a valve repair specialist.
2. Listen for the presence of abnormal noise from the valve, possible loosened bolts, or pipeline vibration. With frequent inspection, abnormal noise can better be distinguished by familiarity. Loosened bolts should be tightened immediately. Abnormal noise or pipeline vibration should be brought to the attention of the pipeline engineer.
3. Visually confirm the valve's correct operating position, that bolts are secure, and that there is adequate lubrication around the stem. As stated in the operation section, the valve should be operated in the full opened or closed position. Intermediate positioning is not recommended. Tighten any loose bolts immediately and apply grease around stem if needed.

Periodic Inspection

Inspection of the valve should be made periodically to detect wear of the body seats, disc or stem, corrosion of the valve body or bonnet interior, and wear of the threads. Usually, packing and gaskets are replaced during periodic inspections as part of a basic maintenance program. Periodic inspection should include the following which are described in greater detail in the maintenance section:

- Valve disassembly
- Examination of valve components
- Component repair and/or replacement
- Valve reassembly
- Test and inspections

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MAINTENANCE

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of the service conditions.

WARNING:

To avoid personal injury to yourself, fellow workers, or damage to property from release of process fluids, before performing any maintenance:

- Shut off all operating lines to the valve.
- Isolate the valve completely from the process.
- Release process pressure.
- Drain the process fluid from the valve.

Preliminary

Prior to removal from the pipeline, mark the edges of the valve and pipeline flanges so that the valve can be returned to its original position. If multiple valves are to be inspected and they are not already tagged, number the valve and flange for proper match-up after maintenance. Remove and collect residual objects from the valve, if any, and note their location so that they may be returned to their proper position.

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DISASSEMBLY AND ASSEMBLY

Gate Valves

For the following disassembly and assembly instructions, refer to Figure 6.

Disassembly

NOTE:
All gate valves may not have the same components listed below. Consult the drawing for the specific valve series for correct bill of materials. These steps assume the valve has already been removed from the pipeline.

1. Close the valve and then open the valve two full handwheel turns.
2. Remove the bonnet nuts (7) and bolts (8).
3. Mark the body (1) and bonnet (6) flanges so they can be matched up during assembly.
4. Lift the bonnet (6), stem (4), and disc (3) assembly out of the body (1) using care not to scratch any of the seating surfaces. Mark the disc (3) and body (1) so that the disc can be returned in the same position.
5. Remove the bonnet gasket (5) from the valve.
6. Remove the disc (3) from the T-head of the stem (4). Be careful to protect the seating surfaces of the disc.
7. Unfasten the handwheel nut (20). Remove the handwheel (19) from the valve.
8. Unfasten the eye bolt nuts (15) to loosen the gland flange (14). Pulling from below, remove the stem (4), turning it counterclockwise. Be careful not to score or scratch the stem's machined surface.
9. Remove the packing (10) using appropriate tools. Do not score or scratch the packing well.

Assembly

1. Thoroughly clean the valve interior and all components. Remove all scale, oil, grease, or other foreign material. Wipe the seating surface of the disc (3) and valve seat (2) with a solvent-soaked cloth. Clean the body (1) and bonnet (6) flange surfaces and all nuts and bolts.
2. Install the stem (4) carefully, sliding it through the bonnet (6) packing well, gland (13), and gland flange (14) until the threads are engaged with the yoke sleeve (17). Slowly rotate the stem clockwise until it extends beyond the bonnet (6).
3. Place the handwheel (19) onto the valve and secure with the handwheel nut (20).
4. Position a new bonnet gasket (5) on the body's (1) bonnet flange, aligning the holes of the gasket and body. The gasket should not extend over the open body cavity. The gasket may be coated with light oil. **DO NOT REUSE GASKETS.**

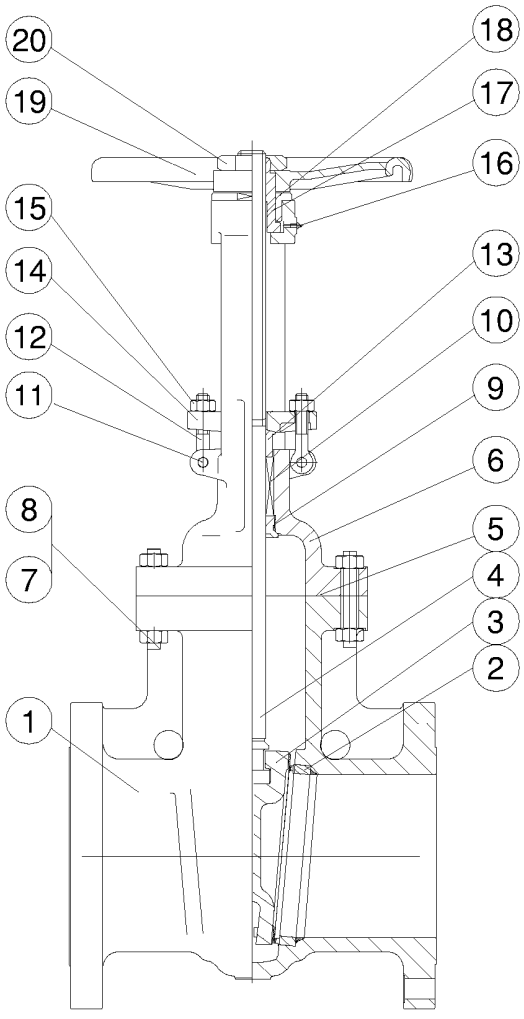


Figure 6

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5. Install the disc (3) on to the T-head of the stem (4).
6. Lift the bonnet (6), stem (4), and disc (3) assembly up and over the body. Check the location marks previously made to align the bonnet (6) and body (1) and the disc (3) and body (1) properly. Carefully lower the assembly until the body (1) and bonnet (6) flange marks meet. Again, caution must be used to prevent scoring or scratching of the seating surfaces. Keeping the bonnet (6) stationary, open the valve a few turns to ensure the disc (3) is not touching the seat (2).
7. Line up the body (1) and bonnet (6) holes. Make sure the gasket (5) does not extend into any of the bolt holes.
8. Install the bonnet bolting (8) and nuts (7) and tighten in a cross-over pattern (see Figure 5) to evenly load the gasket (5) to the appropriate torque value listed in Table 2.
9. Install new packing (10) per instructions in section “Stem Packing Replacement”.

BONNET BOLTING TORQUES (FT-LBS)

Bolt Diameter	Alloy Steel	Stainless Steel
1/4	4	1.5
5/6	8	3
3/8	12	5
7/16	20	8
1/2	30	12
9/16	45	18
5/8	60	24
3/4	110	44
7/8	170	68
1	260	104
1-1/8	375	150
1-1/4	525	210
1-3/8	715	286
1-1/2	925	370
1-5/8	1200	480
1-3/4	1500	600
1-7/8	1850	740
2	2260	904

Table 2

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Globe Valves

For the following disassembly and assembly instructions, refer to Figure 7.

> **NOTE:**
> All globe valves may not have the same components listed below. Consult the drawing for the specific valve series for correct bill of materials. These steps assume the valve has already been removed from the pipeline.

Disassembly

1. Close the valve and then open the valve two full handwheel turns.
2. Remove the bonnet nuts (8) and bolts (7).
3. Mark the body (1) and bonnet (13) flanges so they can be matched up during assembly.
4. Lift the bonnet (13), stem (6), and disc (3) assembly out of the body (1) using care not to scratch any of the seating surfaces.
5. Remove the bonnet gasket (9) from the valve.
6. Remove the disc (3) from the stem (6) by cutting tack welds and unthreading the disc nut (5). Note the location and quantity by marking the disc nut. This information will be used during assembly. Be careful to protect the seating surfaces of the disc.
7. Unfasten the handwheel nut (22). Remove the backing ring (23) and handwheel (21) from the valve.
8. Unfasten the eye bolt nuts (18) to loosen the gland flange (16). Pulling from below, remove the stem (6), turning it counterclockwise. Be careful not to score or scratch the stem's machined surface.
9. Remove the packing (12) using appropriate tools. Do not score or scratch the packing well.

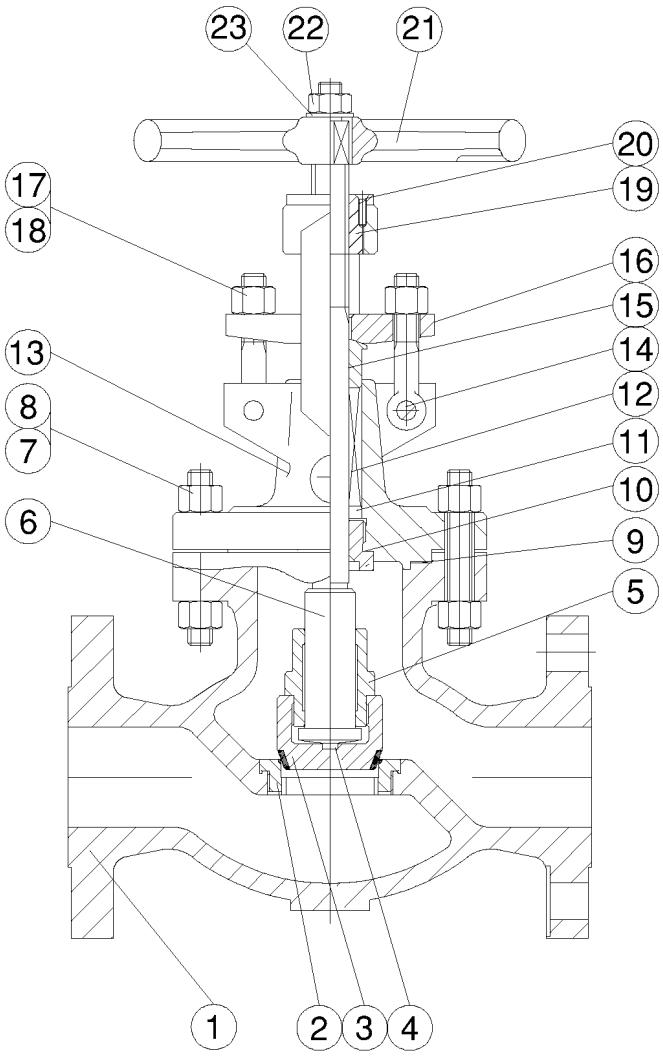


Figure 7

Assembly

1. Thoroughly clean the valve interior and all components. Remove all scale, oil, grease or other foreign material. Wipe the seating surface of the disc (3) and valve seat (2) with a solvent soaked cloth. Clean the body (1) and bonnet (13) flange surfaces and all nuts and bolts.
2. Install the stem (6) carefully, sliding it through the bonnet (13) packing well, gland (15), and gland flange (16) until the threads are engaged with the yoke sleeve (19). Slowly rotate the stem clockwise until it extends beyond the bonnet (13).
3. Place the handwheel backing ring (23) and handwheel (21) onto the valve and secure with the handwheel nut (22).
4. Position a new bonnet gasket (9) on the body's (1) bonnet flange, aligning the holes in gasket and body. The gasket should not extend over the open body cavity. The gasket may be coated with light oil. **DO NOT REUSE GASKETS.**

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5. Install the disc (3) on to the stem (6) by screwing the disc nut (5) down. Using the marked information on the disc nut from disassembly, tack weld the disc and disc nut assembly to secure it.
6. Lift the bonnet (13), stem (6), and disc (3) assembly up and over the body. Check the location marks previously made to align the bonnet (13) and body (1) properly. Carefully lower the assembly until the body (1) and bonnet (13) flange marks meet. Again, caution must be used to prevent scoring or scratching of the seating surfaces. Keeping the bonnet (13) stationary, open the valve a few turns to ensure the disc (3) is not touching the seat (2).
7. Line up the body (1) and bonnet (13) holes. Make sure the gasket (9) does not extend into any of the bolt holes.
8. Install the bonnet bolting (7) and nuts (8) and tighten in a cross-over pattern (see Figure 5) to evenly load the gasket (9) to the appropriate torque value listed in Table 2.
9. Install new packing (12) per instructions in section “Stem Packing Replacement”.
10. Align and center the packing gland (15) in the packing well.
11. Holding the eye bolts (17) up, lower the gland flange (16) over the packing gland (15).
12. Install the eye bolt nuts (18) and alternate tightening with no more than a 1/4 turn on each until hand tight. With a wrench, tighten the eye bolt nuts at least 1/2 to 3/4 turns more.
13. Open and close the valve using the handwheel (21). The action should be smooth and regular through full stem travel.

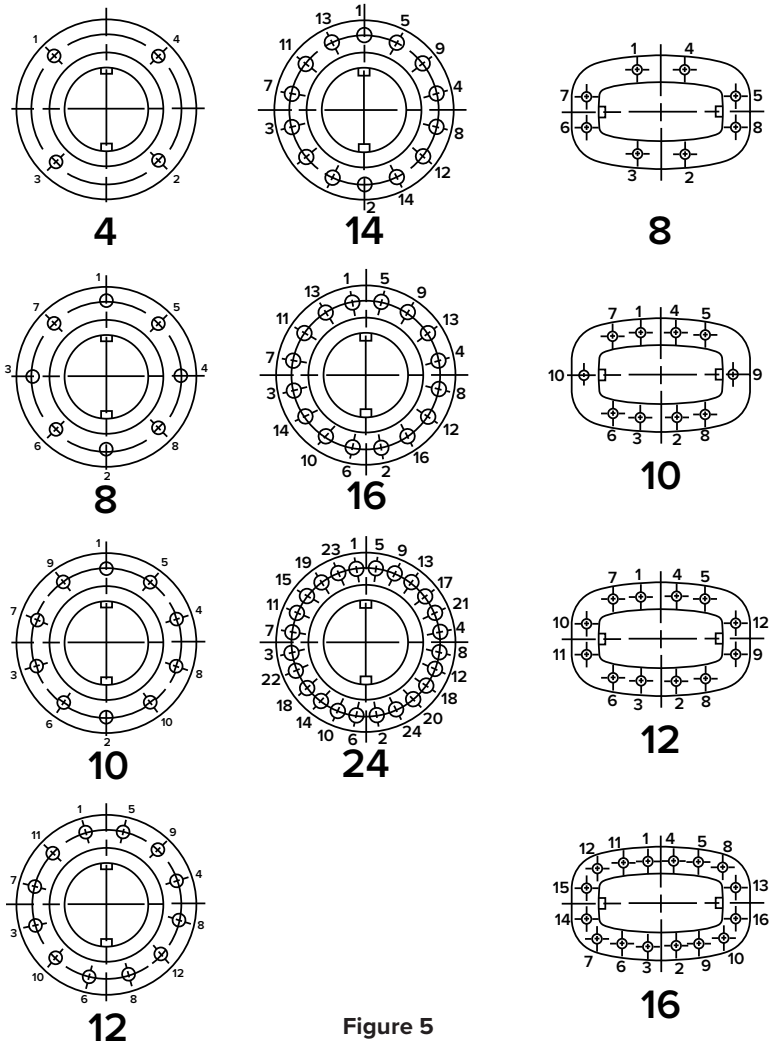


Figure 5

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Bolted Cover Swing Check Valves

For the following disassembly and assembly instructions, refer to Figure 8.

> **NOTE:**
> All swing check valves may not have the same components listed below. Consult the drawing for the specific valve series for correct bill of materials. These steps assume the valve has already been removed from the pipeline.

Disassembly

1. Unfasten the cover nuts (14) and remove the cover bolts (13).
2. Lift the cover (15) off the body (1).
3. Remove the gasket (12) from the valve body (1).
4. If the disc (3) is internally hung, remove hex bolt (11) and washer (10) by cutting tack weld. For valves with a side plug, remove the plug (17) and spring washer (18).
5. While supporting the disc (3) and hinge arm (7), remove the hinge pin (8).
6. Lift the disc (3) assembly out of the body (1). Be careful not to scratch any of the seating surfaces.
7. To remove the hinge arm (7) from the disc (3), remove the cotter pin (5) and unfasten the disc nut (6).

Assembly

1. Thoroughly clean the valve interior and all components. Remove all scale, oil, grease, or other foreign material. Wipe the seating surface of the disc (3) and valve seat (2) with a solvent-soaked cloth. Clean the body (1) and cover (15) flange surfaces and all nuts and bolts.
2. Attach the hinge arm (7) to the disc (3) securing it with the disc nut (6). Secure the disc nut with a new cotter pin (5). If the old pin is in good condition, it can be reused; however, a new pin is always recommended.
3. Place the disc (3) assembly into the body (1), again, being careful not to scratch the seating surfaces. While supporting the assembly, insert the hinge pin (8).
4. If the disc (3) is internally hung, install washer (10) and bolt (11) and secure with tack weld. For valves with a side plug, install the spring washer (18) and plug (17).
5. Open the valve by lifting the hinge arm (7). The action should be smooth and regular through the full hinge pin (8) rotation.
6. Position a new gasket (12) on the body's (1) cover flange, aligning the holes in gasket and body. The gasket should not extend over the open body cavity. The gasket may be coated with light oil. **DO NOT REUSE GASKETS.**
7. Line up the body (1) and cover (15) holes. Make sure the gasket (12) does not extend into any of the bolt holes.
8. Install the cover bolts (13) and nuts (14) and tighten in a cross-over pattern (see Figure 5) to evenly load the gasket (12) to the appropriate torque value listed in Table 2.

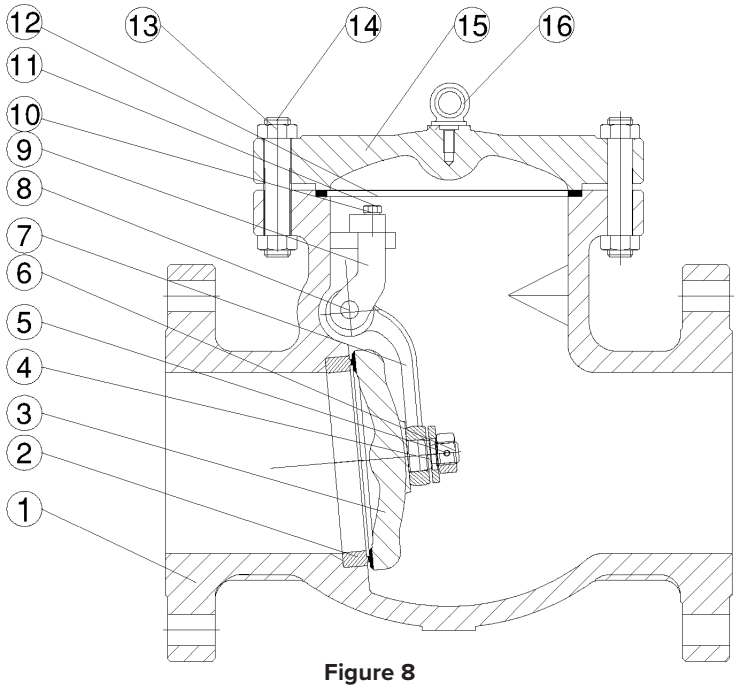


Figure 8

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STEM PACKING REPLACEMENT

WARNING:
To avoid personal injury to yourself, fellow workers, or damage to property from release of process fluids, ensure that all pressure is removed from the valve both upstream and downstream before disassembly.

1. Check the original tightness of the valve operation. Remove the eye bolt nuts. Lift the gland flange and gland up the stem, clear of the packing well, and loosely tie them off with string or wire (see Figure 1).
2. Remove the existing packing rings with a sharp tool or packing remover such as a flexible corkscrew tool. **Do not scratch or score the machined surface of the stem or packing well with the tool.**
3. Examine the stem and packing well. Any burrs, scoring, or scratches should be removed with emery cloth or hand filing. Clean the stem with a solvent-soaked rag.
4. Count the original number of packing rings and measure their cross-section thickness. If the original packing cannot be counted or measured, use the following calculation. If no such packing is available, slightly thicker packing can be used. **Do not use thinner packing:**
   - Measure the stem diameter (OD), packing well diameter (ID), and packing well depth (d).
   - The packing's cross-section thickness (R) = (ID – OD)/2
   - The quantity of packing rings # = (1.25 x d)/R
5. Install the new packing. Cut each ring at a 45° angle (see Figure 2) and proper length so that the ends meet each other. Stagger the joints at 120°. Every fourth joint will be in the same position as the first. Install rings individually (see Figure 3). Tamp each ring when installed.
6. When the packing well is full, reassemble the gland, gland flange, and eye bolt nuts. Alternate tightening of the eye bolt nuts a quarter turn at a time until the eye bolts begin to get tight. If the gland travels more than the height of one packing ring into the packing well, insert one more ring and repeat step 6 until the packing well is full. Ideally, the gland should be 3 to 4 mm below the top of the packing well.
7. Compare the valve operation to the original tightness. If the valve operation is considerably tighter than the original tightness, back the eye bolt nuts off a quarter turn and recheck tightness.
8. Several hours after the repacked valve is returned to service, inspect the packing area to ensure full compression, tight bolting, and no leakage.
9. Should there be a packing leak, turn the eye bolt nuts evenly at 1/4 turn increments until the leakage stops.

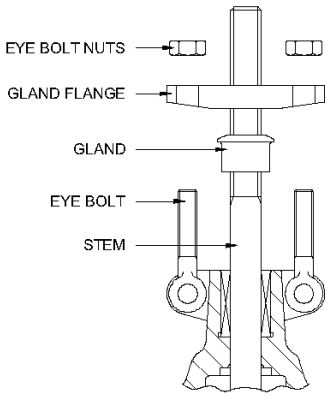
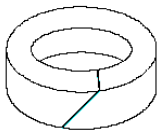


Figure 1


45° END CUT
Figure 2

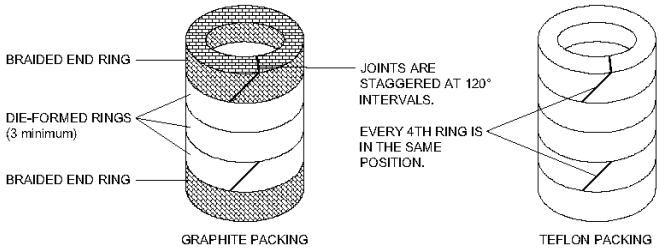


Figure 3

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LAPPING PROCEDURES

Though valves may be lapped either in or out of the pipelines, we recommend valves be disassembled out of line so lapping is easier and gives better service.

1. Carefully and thoroughly clean the part to be lapped.
2. Apply an adequate amount of lapping powder and vegetable oil mixture to the surfaces to be lapped.
3. While lapping, apply a pressure of 1 kgF/cm2 to the lapping plate. Excessive surface pressure will make lapping too fast and cause galling.
4. Lapping should be carried out until the whole surface is flat, showing even and tight contact. Do not keep lapping the same place too long, as it may affect the flatness of the lapping plate.
5. After lapping, wipe the lapped area clean with a piece of cloth and carefully check the surface finish.
6. Apply inspection paste to a precision surface plate or a new lapping plate. Press and gently move it left and right a few times against the lapped surface by 10 to 15 degrees and check the result of the lapping work.
7. Figure 4 shows the various methods for how the lapping plate should contact the valve parts for proper lapping.

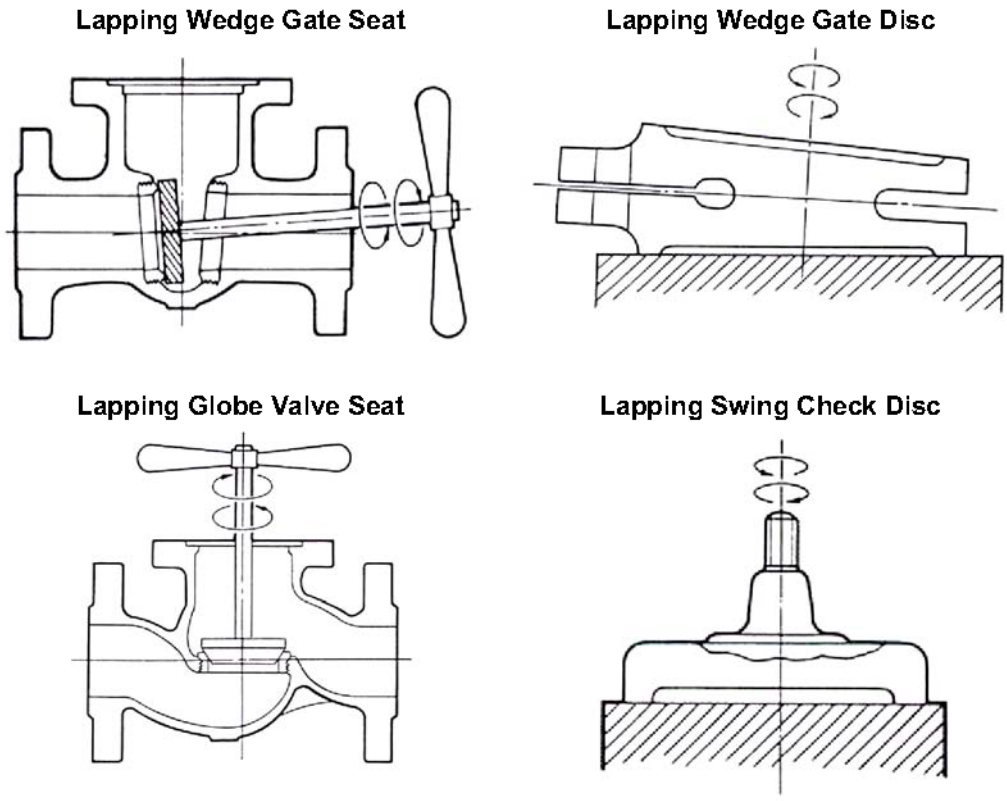


Figure 4

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WARRANTY

Limited Warranty

Subject to the limitations expressed herein, Seller warrants that products manufactured by Seller shall be free from defects in design, material and workmanship under normal use for a period of one (1) year from installation but in no case shall the warranty period extend longer than eighteen months from the date of sale. This warranty is void for any damage caused by misuse, abuse, neglect, acts of God, or improper installation. For the purpose of this section, “Normal Use” means in strict accordance with the installation, operation and maintenance manual. The warranty for all other products is provided by the original equipment manufacturer.

Remedies

Seller shall repair or replace, at its option, any non-conforming or otherwise defective product, upon receipt of notice from Buyer during the Manufacturer’s warranty period at no additional charge. SELLER HEREBY DISCLAIMS ALL OTHER EXPRESSED OR IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS OR FITNESS FOR A PARTICULAR PURPOSE.

Limitation of Liability

UNDER NO CIRCUMSTANCES SHALL EITHER PARTY BE LIABLE TO THE OTHER FOR INCIDENTAL, PUNITIVE, SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND. BUYER HEREBY ACKNOWLEDGES AND AGREES THAT UNDER NO CIRCUMSTANCES, AND IN NO EVENT, SHALL SELLER'S LIABILITY, IF ANY, EXCEED THE NET SALES PRICE OF THE DEFECTIVE PRODUCT(S) PURCHASED DURING THE PREVIOUS CONTRACT YEAR.

Labor Allowance

Seller makes NO ADDITIONAL ALLOWANCE FOR THE LABOR OR EXPENSE OF REPAIRING OR REPLACING DEFECTIVE PRODUCTS OR WORKMANSHIP OR DAMAGE RESULTING FROM THE SAME.

Recommendations by Seller

Seller may assist Buyer in selection decisions by providing information regarding products that it manufacturers and those manufactured by others. However, Buyer acknowledges that Buyer ultimately chooses the product’s suitability for its particular use, as normally signified by the signature of Buyer’s technical representative. Any recommendations made by Seller concerning the use, design, application or operation of the products shall not be construed as representations or warranties, expressed or implied. Failure by Seller to make recommendations or give advice to Buyer shall not impose any liability upon Seller.

Excused Performance

Seller will make a good faith effort to complete delivery of the products as indicated by Seller in writing, but Seller assumes no responsibility or liability and will accept no back-charge for loss or damage due to delay or inability to deliver, caused by acts of God, war, labor difficulties, accidents, inability to obtain materials, delays of carriers, contractors or suppliers or any other causes of any kind whatever beyond the control of Seller. Under no circumstances shall Seller be liable for any special, consequential, incidental, or indirect damages, losses, or expense (whether or not based on negligence) arising directly or indirectly from delays or failure to give notice of delay.

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