INTRODUCTION

This instruction manual includes storage, installation, operation and maintenance information for iron body bronze mounted gate, globe, and check valves. This manual addresses 125 pound 200 WOG bolted bonnet cast iron valves. Only standard manual valves are addressed.

STORAGE

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.

Temporary Storage

If valves are to be temporarily stored prior to installation, the following should be observed.

1. Keep the valves wrapped and protected at all times.
2. Preferably, store the valves in a dust-free and well ventilated place with low humidity.
3. If stored outside, make sure that the valves are well protected from the environment and positioned so that water does not accumulate on or in the valve.
4. Apply an adequate type of end protector to protect against mechanical damage and prevention of dust and foreign object intrusion.
5. Valves should be kept in the close position.

Long Term Storage

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

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

INSTALLATION

WARNING

To avoid personal injury to your self, fellow workers, or damage to property from release of process fluid, before installation:

a. Shut off all operating lines to the valve site
b. Isolate the valve site completely from the process
c. Release process pressure
d. 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 hand wheel to easily and safely operate the valve and that 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. Only use full face gasket.

12. Insert the appropriate gasket between the flanges and align the holes with the pipe flange.

13. While holding the gasket in place, 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.

16. For gate and globe valves, cycle the valve once completely to ensure no obstructions exist.

OPERATION

1. Gate valves are not designed for throttling (modulating) service and should be used in the open or closed positions only. 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.

2. For Gate and Globe valves, turn the hand wheel counter-clockwise to open the valve. Turn the hand wheel 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.

3. For Gate and Globe valves, on a new valve or a valve that has had new packing installed, the hand wheel torque may be relatively high. This high torque will diminish to a reasonable level after the valve has been operated several times. Hand wheel 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.

4. For Gate valves, after closing a valve completely, it is recommended that the hand wheel 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.

5. For Gate and Globe valves, sometimes material in the line can get stuck between the disc and seating area. Should this happen, re-open 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.

6. Check valves are a process operated device. The valve will begin opening when upstream pressure is appropriately higher than downstream pressure. When upstream and down stream pressures equalize, or when downstream pressure is higher than upstream pressure, the valve will close.

TROUBLESHOOTING

The following is intended as a guide only.

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 insure 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
Hand wheel 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 hand wheel to see if the valve is tightly closed
	There is an obstruction between the seat and disc	Open and close the valve a couple 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

Table 1

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 from normal noise 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, gate valves should be operated in the full open or close 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:

1. Valve disassembly
2. Examination of valve components
3. Component repair and/or replacement
4. Valve reassembly
5. Test and inspections

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. Note that often for IBBM valves, the cost of repair parts may not be as economical as complete replacement of the valve.

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

a. Shut off all operating lines to the valve.
b. Isolate the valve completely from the process.
c. Release process pressure.
d. 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.

Disassembly and Assembly

GATE VALVES

For the following disassembly and assembly instructions, refer to Figure 6 and 7. Numbered parts are indicated for figure (651) and figure [651A] Note: All gate valves may not have the same components listed below. Consult the specific series drawing 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 two full hand wheel turn.
2. Remove the bonnet nuts (8)[7] and bolts (7)[6].
3. Mark the body (1)[1] and bonnet (9)[9] flanges so they can be matched up during assembly.
4. Lift the bonnet (9)[9], stem (5)[8], and wedge (3)[3] assembly out of the body (1)[1] using care not to scratch any of the seating surfaces. Mark the wedge (3)[3] and body (1)[1] so that the wedge can be returned in the same position.
5. Remove the bonnet gasket (6)[5] from the valve.
6. Remove the wedge (3)[3] from the T-head of the stem (5)[8]. Be careful to protect the seating surfaces of the wedge.
7. Unfasten the hand wheel nut (22)[22]. Remove the hand wheel (21)[20] and hand wheel washer [24], if applicable, from the valve.
8. Remove the set screw (20)[19] from the top of the yoke (17)[16], and then unscrew the stem nut bushing (19)[18].
9. While holding the stem (5)[8], turn the stem nut (18)[17] to remove it from the stem (5)[8].
10. Unfasten the packing gland nuts (16)[13] to loosen the packing gland (14)[11]. Pulling from below, remove the stem (5)[8], turning it back and forth. Be careful not to score or scratch the stem's machined surface.
11. Remove the packing (11)[10] using appropriate tools. Do not score or scratch the packing well.
12. If necessary and so equipped, remove the back seat bushing (10)[23] from the inside top of the bonnet (9)[9].

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 wedge (3)[3] and valve seat (2)[2] with a solvent soaked cloth. Clean the body (1)[1] and bonnet (9)[9] flange surfaces and all nuts and bolts.
2. If necessary and so equipped, install the back seat bushing (10)[23] into the inside top of the bonnet (9)[9].
3. Install the stem (5)[8] carefully, sliding it through the bonnet (9)[9], packing gland (14)[11] and through the top of the yoke (17)[16].
4. Holding the stem (5)[8], screw the stem nut onto the stem and down into the yoke (17)[16]. Thread the stem nut bushing (19)[18] into the yoke (17)[16] until hand tight. Back off the stem nut bushing (19)[18] just enough to align the hole for the set screw (20)[19] and install the screw.
5. Place the hand wheel washer [24], if applicable, and hand wheel (21)[20] onto the stem nut (18)[17] and secure with the hand wheel nut (22)[22].
6. Position a new bonnet gasket (6)[5] on the body's (1)[1] bonnet flange, aligning it within the holes of the body. The gasket should not extend over the open body cavity or bolt holes. **DO NOT REUSE GASKETS.**
7. Install the wedge (3)[3] on to the T-head of the stem (5)[8] using the locator marks applied during disassembly.
8. Lift the bonnet (9)[9], stem (5)[8], and wedge (3)[3] assembly up and over the body. Check the location marks previously made to align the bonnet (9)[9] and body (1)[1] and the wedge (3)[3] and body (1)[1] properly. Carefully lower the assembly until the body (1)[1] and bonnet (9)[9] flange marks meet. Again, caution must be used to prevent scoring or scratching of the seating surfaces. Keeping the bonnet (9)[9] stationary, open the valve a few turns to ensure the wedge (3)[3] is not engaging the seats (2)[2].
9. Line up the body (1)[1] and bonnet (9)[9] holes. Make sure the gasket (6)[5] does not extend into any of the bolt holes.
10. Install the bonnet bolting (7)[6] and nuts (8)[7] and tighten in a cross-over pattern (see Figure 5) to evenly load the gasket (6)[5] to the appropriate torque value listed in Table 7.
11. Install new packing (11)[10] per instructions in section "Stem Packing Replacement".
12. Align and center the packing gland (14)[11] over the packing well.
13. Holding the packing gland bolt (15)[12] up, lower the packing gland (14)[11] over the packing (11)[10].
14. Install the packing gland nuts (16)[13] and alternate tightening until hand tight. With a wrench, tighten the packing gland nuts at least 1/2 to 3/4 turns more. Additional packing adjustments may be needed once the valve is in service.
15. Open and close the valve using the hand wheel (21)[20]. The action should be smooth and regular through full stem travel.

GLOBE VALVES

For the following disassembly and assembly instructions, refer to Figure 8. Note: All globe valves may not have the same components listed below. Consult the specific series drawing 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 two full hand wheel turn.
2. Remove the bonnet nuts (12) and studs (11).
3. Mark the body (1) and bonnet (18) flanges so they can be matched up during assembly.
4. Lift the bonnet (18), stem (6), and disc (5) 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. If necessary, remove the seat ring (2) with a spanner wrench.
7. Remove the disc (5) from the stem (6) by grinding the tack weld off, removing the set screw (7), and unthreading the disc cover (8). Note the location by marking the disc and cover. This information will be used during assembly. Be careful to protect the seating surfaces of the disc.
8. Unfasten the hand wheel nut (23). Remove the washer (22) and hand wheel (21) from the valve.
9. Unfasten the packing gland nuts (17) to loosen the packing gland (14) and the gland follower (15). Pulling from below, remove the stem (6), turning it counterclockwise. Be careful not to score or scratch the stem's machined surface.
10. Remove the stem nut screw (20) and then unthread the stem nut (19) by turning it counterclockwise.
11. Remove the packing (13) 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 (5) and valve seat (2) with a solvent soaked cloth. Clean the body (1) and bonnet (18) flange surfaces and all nuts and bolts.
2. Install the stem nut (19) by threading it all the way into the top of the bonnet (18) yoke. Back the stem nut off just enough to align the hole for the stem nut screw (20), and then install the screw.
3. Lubricate the stem (6) and install it carefully, sliding it through the disc cover (8) (Make sure the threads are pointing towards the bottom of the stem), bonnet (18) packing well, packing gland (14), and gland follower (15) until the threads are engaged with the stem nut (19). Slowly rotate the stem clockwise until it extends well beyond the bonnet (18).
4. Place the hand wheel (21) and the hand wheel washer (22) on to the top of the valve stem (6) and secure with the hand wheel nut (23).
5. Install the disc (5) by screwing it onto the disc cover (8) all the way. When tightening, align the marks you applied during disassembly. Then install and tighten the set screw (7). Re-tack the disc and disc cover to secure them.
6. If necessary, install the seat ring (2) with a spanner wrench.
7. 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 or the bolt holes. **DO NOT REUSE GASKETS.**
8. Lift the bonnet (18), stem (6), and disc (5) assembly up and over the body. Check the location marks previously made to align the bonnet (18) and body (1) properly. Carefully lower the assembly until the body (1) and bonnet (18) flange marks meet. Again, caution must be used to prevent scoring or scratching of the seating surfaces. Keeping the bonnet (18) stationary, open the valve a few turns to ensure the disc (5) is not touching the seat (2).
9. Line up the body (1) and bonnet (18) holes. Make sure the gasket (9) does not extend into any of the bolt holes.
10. Install the bonnet studs (11) and nuts (12) and tighten in a cross-over pattern (see Figure 5) to evenly load the gasket (9) to the appropriate torque value listed in Table 7.
11. Install new packing (13) per instructions in section "Stem Packing Replacement".
12. Align and center the packing gland (14) and gland follower (15) over the packing well.
13. Holding the square head bolts (16) up, lower the packing gland (14) and gland follower (15) over the packing bolts.
14. Install the packing gland nuts (17) and alternate tightening until hand tight. With a wrench, tighten the packing gland nuts at least 1/2 to 3/4 turns more. Additional packing adjustments may be needed once the valve is in service.
15. Open and close the valve using the hand wheel (21). The action should be smooth and regular through full stem travel.

BOLTED COVER SWING CHECK VALVES

For the following disassembly and assembly instructions, refer to Figure 9. Note: All swing check valves may not have the same components listed below. Consult the drawing for the specific series drawing for correct bill of materials. These steps assume the valve has already been removed from the pipeline.

Disassembly

1. Unfasten the cover nuts (13) and remove the cover bolts (12).
2. Mark the body (1) and cover (15) flanges so they can be matched up during assembly.
3. Lift the cover (15) off the body (1).
4. Remove the gasket (14) from the valve body (1).
5. Remove the plug (11).
6. Insert a bolt into end of the hinge pin (10) and pull it from the body (1). (Be sure to support the disc and hinge assembly on the inside.)
7. Lift the disc (4) assembly out of the body (1). Be careful not to scratch any of the seating surfaces.
8. To remove the hinge arm (5) from the disc (4), remove the wire or cotter pin (9) and unfasten the disc nut (7) and washer (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 (4) and valve seat (2) with a solvent soaked cloth. Clean the body (1) and cover (15) flange surfaces and all nuts and bolts.
2. Slide the hinge arm (5) over the stud on the disc (4), followed by the disc washer (6). Secure the assembly with the disc nut (7) threaded all the way. Back the disc nut (7) off just enough to align the hole through the nut with the hole in the stud on the disc(4). 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. Lift the disc (4) assembly into the body (1), again, being careful not to scratch the seating surfaces. While supporting the assembly, insert the hinge pin (10).
4. Install the plug (11). (Be sure to use appropriate thread sealer on the plug.)
5. Open the valve by lifting the hinge arm (5). The action should be smooth and regular through the full rotation around the hinge pin (10).
6. Position a new gasket (14) on the body's (1) cover flange, aligning the holes in gasket and body. The gasket should not extend over the open body cavity or bolt holes. **DO NOT REUSE GASKETS**.
7. Line up the body (1) and cover (15) holes and align the mark applied during disassembly. Make sure the gasket (14) does not extend into any of the bolt holes and lower the cover onto the body.
8. Install the cover bolts (12) and nuts (13) and tighten in a cross-over pattern (see Figure 5) to evenly load the gasket (14) to the appropriate torque value listed in Table 7.

Stem Packing Replacement

WARNING

Repacking of valves under pressure is NOT a recommended practice. Serious injury can occur even if the valve appears to be back-seated. Foreign matter may have accumulated on the back seat or the stem could be accidentally moved off the back seat position, exposing maintenance personnel to potentially dangerous media which could result in serious injury. Prior to changing the packing, it will be necessary to isolate, remove pressure, and drain the valve. If necessary, allow the valve to cool and/or decontaminate before working on it.

1. Check the original tightness of the valve operation. Loosen and remove the packing gland nuts. Lift the packing gland up the stem, clear of the packing well, and tie it off with string or wire or secure it with tape (see Figure 1).
2. Remove the existing packing rings with a sharp tool or packing remover such as a flexible cork screw 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 and packing well with a solvent soaked rag.
4. Packing is graphite rings cut at an angle (see Figure 2). Table 2 lists quantity and dimensions for packing.
5. Install the new packing by slipping the rings over the stem. Stagger the joints at 120 degree. Every 4th joint will be in the same position as the first (see Figure 3). Install rings individually. Tamp each ring when installed.
6. When the packing well is full, reassemble the packing gland over the packing gland bolt and secure with packing nuts. Alternate tightening of the eye bolt until hand tight. If the packing 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. Give each packing gland nut a 1/4 to 1/2 turn initially. Additional packing adjustments may be needed when the valve is first returned to service. Compare the valve operation to the original tightness. If the valve operation is considerably tighter than the original tightness, the packing gland nuts can be backed off 1/4 turn, but not loose enough to cause a packing leak. Recheck the valve operation 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. Should there be a packing leak, turn the eye bolt nuts evenly at 1/4 turn increments until the leakage stops.

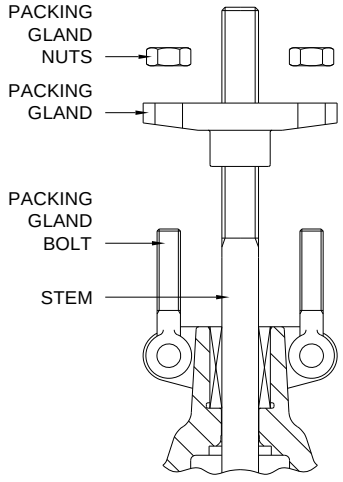
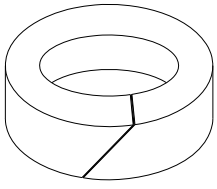


Figure 1



45° END CUT

Figure 2

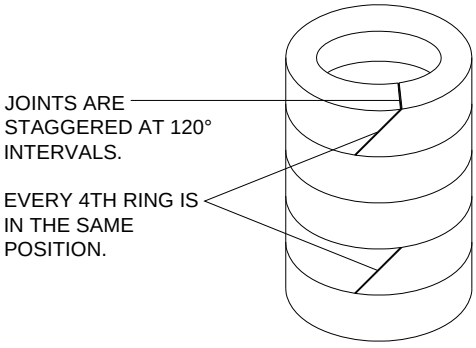
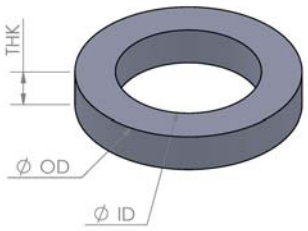


Figure 3



Size	Fig. 651 (2011 & Earlier)			Fig. 651A (2011 & Later)			Fig. 661			Qty
	ID	OD	THK	ID	OD	THK	ID	OD	THK	
2"	18	28	5	18	28	5	20	32	6	5
2-1/2"	18	28	5	18	28	5	20	32	6	5
3"	20	32	6	20	32	6	24	36	6	5
4"	26	38	6	22	34	6	26	38	6	5
5"	28	40	6	24	36	6	28	40	6	5
6"	30	46	8	26	38	6	30	46	8	5
8"	32	48	8	28	44	8	32	48	8	5
10"	36	52	8	32	48	8	42	62	10	5
12"	40	56	8	36	52	8	48	68	10	5

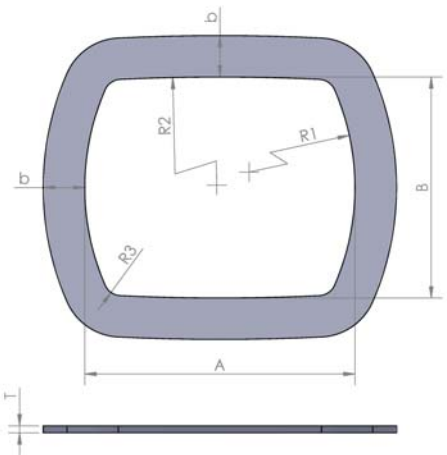
Dimensions: mm

Table 2 – Packing Dimensions

Bonnet Gasket Replacement

Factory supplied gaskets are made from thin perforated steel plates sandwiched between layers of graphite. Factory gaskets are recommended, however dimensional information is provided in Tables 3, 4, 5, and 6. **If parts other than factory supplied are used, the customer is responsible to determine suitability for the given application.**

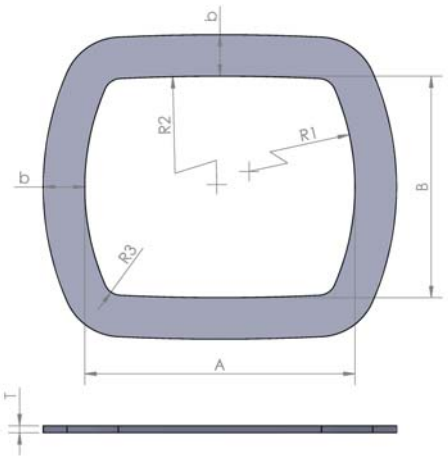
1. Follow the initial steps outlined in the Disassembly Instructions for removing the bonnet of the applicable valve.
2. Thoroughly clean the body and bonnet joint surfaces.
3. Check the body and bonnet gasket surfaces for any scratches, gouges, or other irregularities.
4. In the event that any sealing surfaces are marred, they must be filed or machined flat again. If the damage is considerable, the body or bonnet may have to be replaced. In this event, it may be more economical to replace the entire valve.
5. With the surfaces clean and flat, place the new gasket on the body and replace the bonnet. Make sure the gasket does not extend into the body area or any of the bolt holes. Line up the body and bonnet holes and align the mark applied during disassembly.
6. Reinstall the body/bonnet bolts and nuts and then follow the bolt torque sequence outlined in Figure 5 and Table 7.



Size	A	B	R1	R2	R3	b	T (min.)
2"	91	65	70.5	620.5	5.5	13.5	2
2-1/2"	106	74	101	631	5	15	2
3"	126	82	121	651	8	15	2
4"	141	87	250	343	10	16	1.5
5"	171	98	234	339	6	16	2
6"	202	112	202	428	6	20	2
8"	260	137	245	570	13	23	3
10"	360	190	155	629	10	25	2
12"	368	164	297	1082	12	29	2

Dimensions: mm

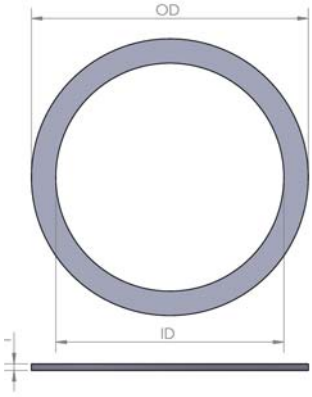
Table 3 – Fig. 651 (2011 & Earlier) Gasket Dimensions



Size	A	B	R1	R2	R3	b	T (min.)
2"	80	58	126	201	7	12.5	2
2-1/2"	98	63	141	226	7	13	2
3"	108	66	156	301	9	13	2
4"	134	71	181	341	9	15	2
5"	164	77	196	401	11	17	2
6"	193	85	221.5	621.5	11.5	18	2
8"	247	95	246	921	11	20	2
10"	306	112	252	1102	14	24	2
12"	359	126	322	1002	12	28	2

Dimensions: mm

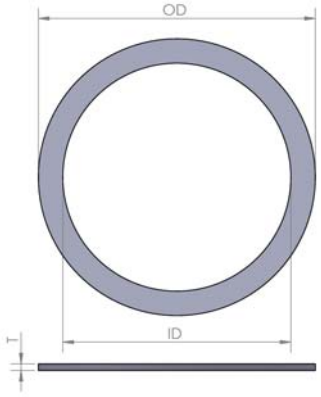
Table 4 – Fig. 651A (20011 & Later) Gasket Dimensions



Size	ID	OD	T
2"	70	85	2
2-1/2"	85	105	3
3"	95	115	3
4"	120	140	2
5"	148	174	2
6"	176	206	2
8"	224	258	2
10"	264	302	3
12"	296	346	3

Dimensions: mm

Table 5 – Fig. 661 Gasket Dimensions



Size	ID	OD	T
2"	70	85	2
2-1/2"	85	105	3
3"	95	115	3
4"	120	140	2
5"	148	174	2
6"	176	206	2
8"	224	258	2
10"	264	302	3
12"	296	346	3

Dimensions: mm

Table 6 – Fig. 671 Gasket Dimensions

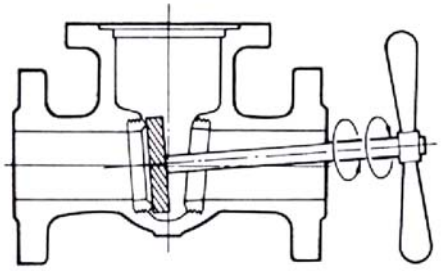
Seat Re-Facing

When leakage past the seat occurs, it is possible that foreign matter has lodged in the seat. It may be possible to wash the foreign matter away by opening and closing the valve several times. If the application causes buildup on the seat sealing surfaces, a drain port installed on the valve body can be considered so that the seat area can be flushed prior to closing the valve. It may also be possible to achieve closure by tightening the valve further. However, if leakage continues, disassembly and inspection is required.

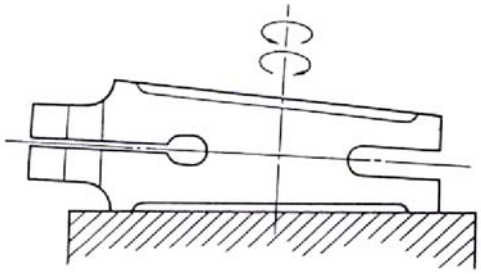
Minor scratches on seat sealing surfaces can be reduced or corrected by polishing the wedge or disc using 400-grit sandpaper on a flat inspection surface. Care should be taken not to change the wedge's angle. If seats are damaged, lapping can be performed or used of a valve repair shop or replacement should be considered. Common lapping steps are:

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. Lapping powder should be equivalent to 400-grit sandpaper or finer.
3. While lapping, apply a pressure of 0.5 kgF/cm^2 to the lapping plate. Excessive surface pressure will make lapping too fast and cause too much erosion of sealing material.
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.

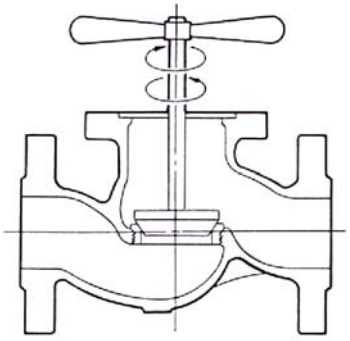
Lapping Wedge Gate Seat



Lapping Wedge Gate Disc



Lapping Globe Valve Seat



Lapping Swing Check Disc

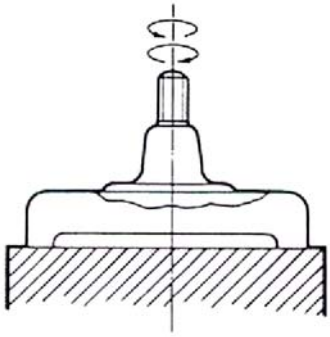


Figure 4

Bolt Tightening Sequence

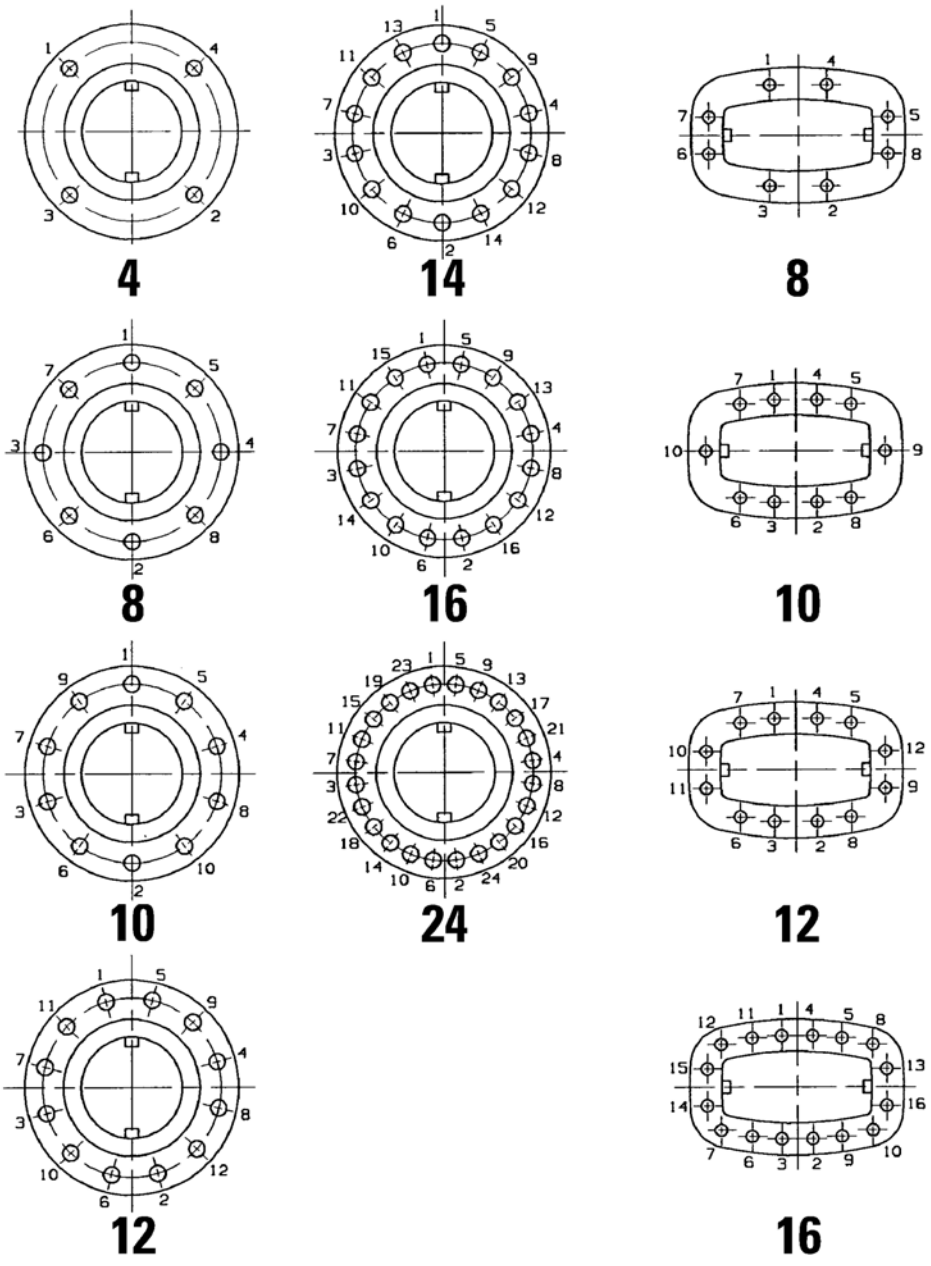


Figure 5

Bonnet Bolting Torques (Ft-Lbs) for ASTM A307 Steel Bolts Only

Make sure all contact surfaces are clean and dry. The torques listed below assume clean, undamaged, and well lubricated fasteners. Tightening is recommended in two steps. First tighten to approximately 1/2 the listed torque value, and then tighten the bolts to their final torque value. Use the bolt tightening sequences shown in Figure 5.

Bolt Diameter	7/16”	1/2"	9/16”	5/8”	3/4"	7/8”	1”	1-1/8”	1-1/4”	1-3/8”	1-1/2”
Torque	30	45	66	93	150	202	300	474	659	884	1057

Table 7

General Construction Drawing – IBBM Gate Valve Figure 651 (2011 & Earlier)

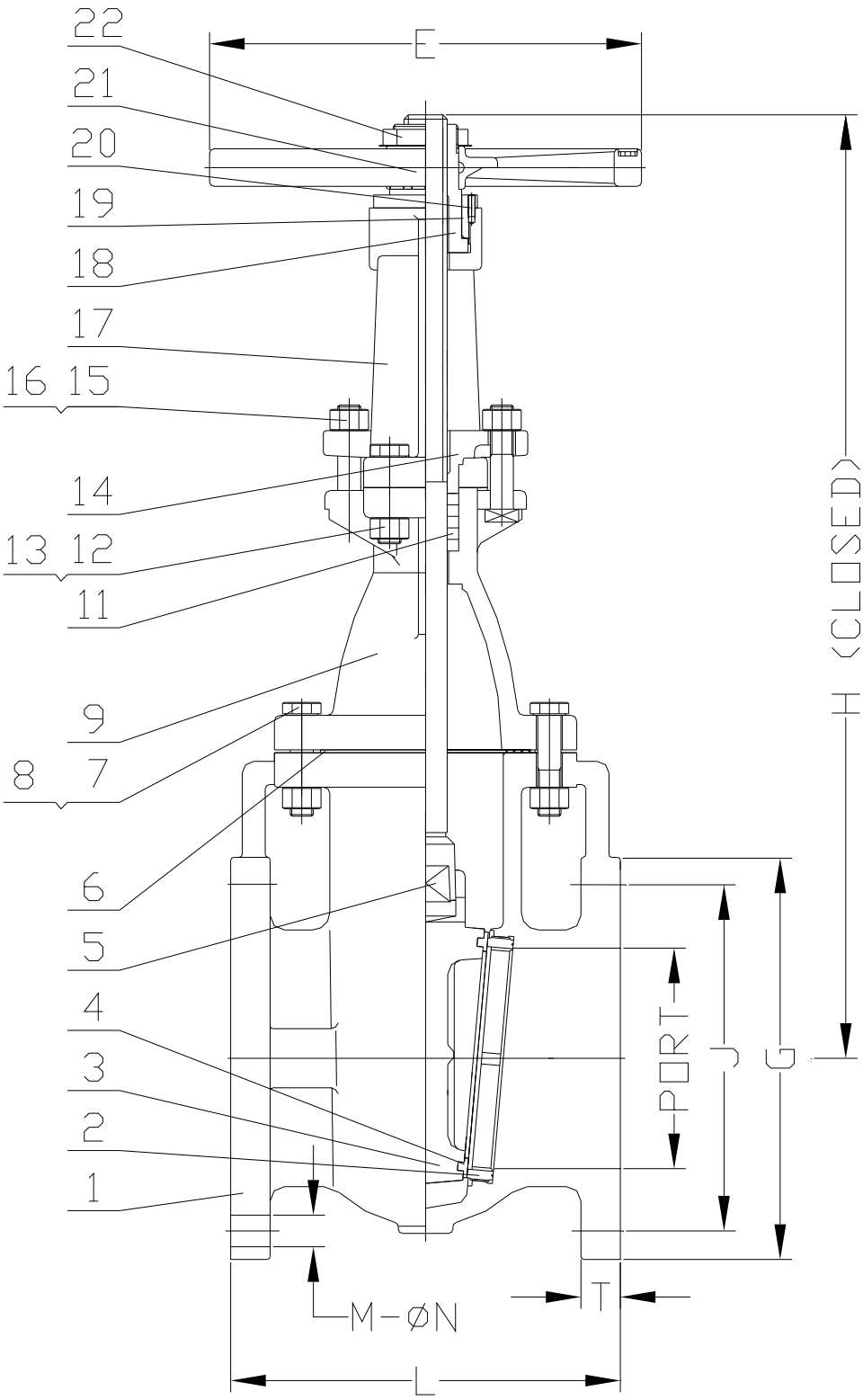


Figure 6

General Construction Drawing – IBBM Gate Valve Figure 651A (2011 & Later)

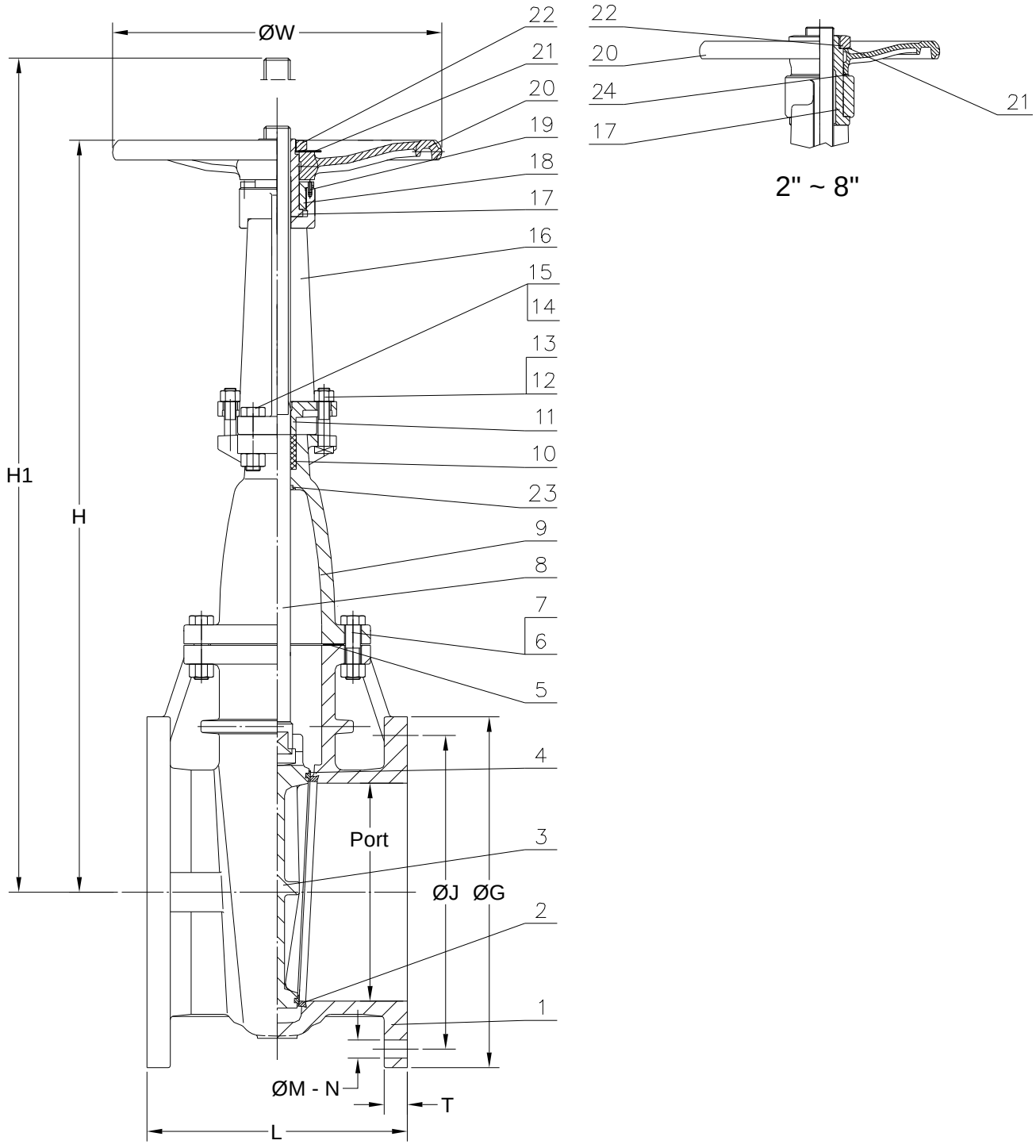


Figure 7

General Construction Drawing – IBBM Globe Valve Figure 661

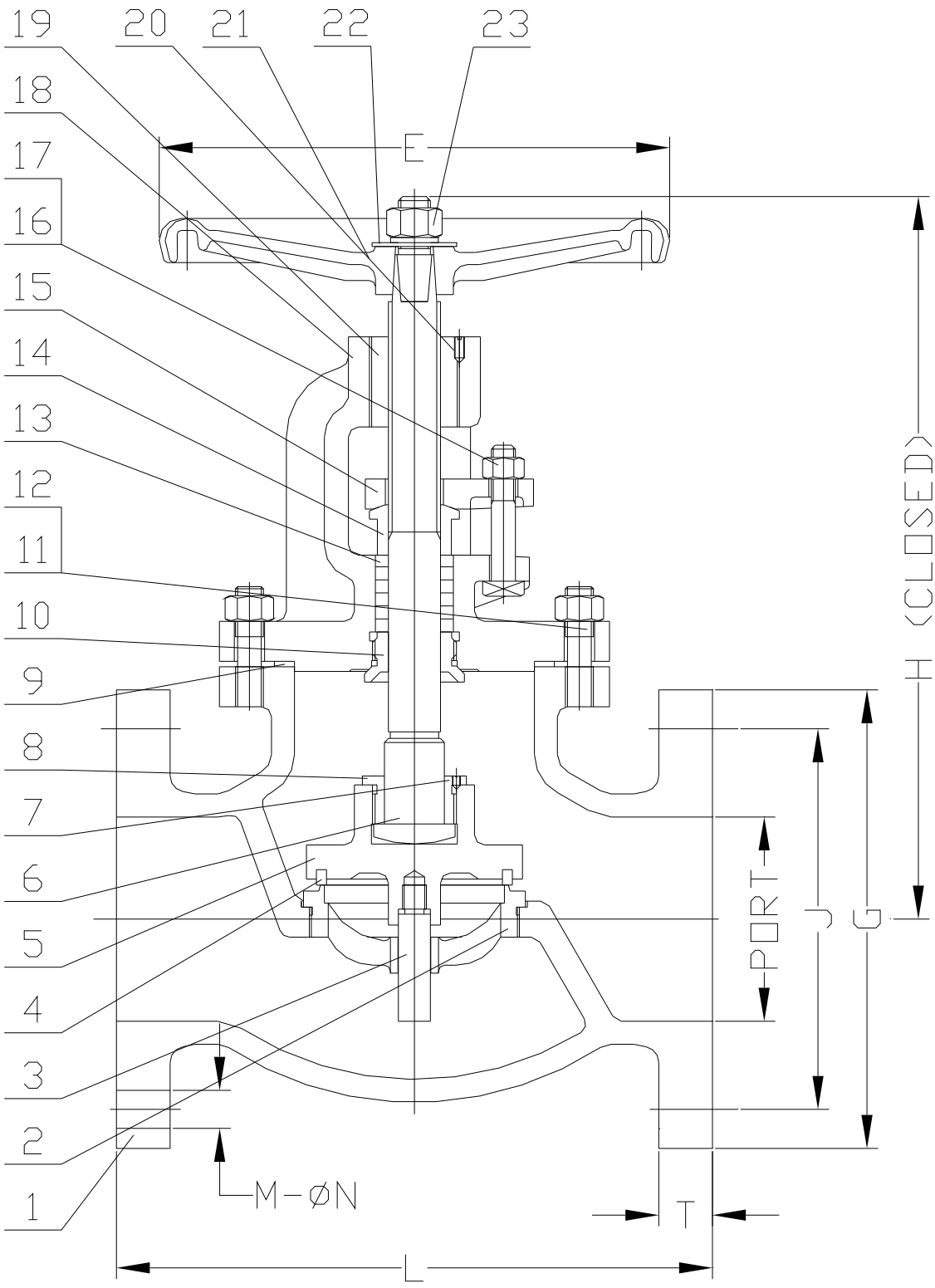


Figure 8

General Construction Drawing – IBBM Swing Check Valve Figure 671

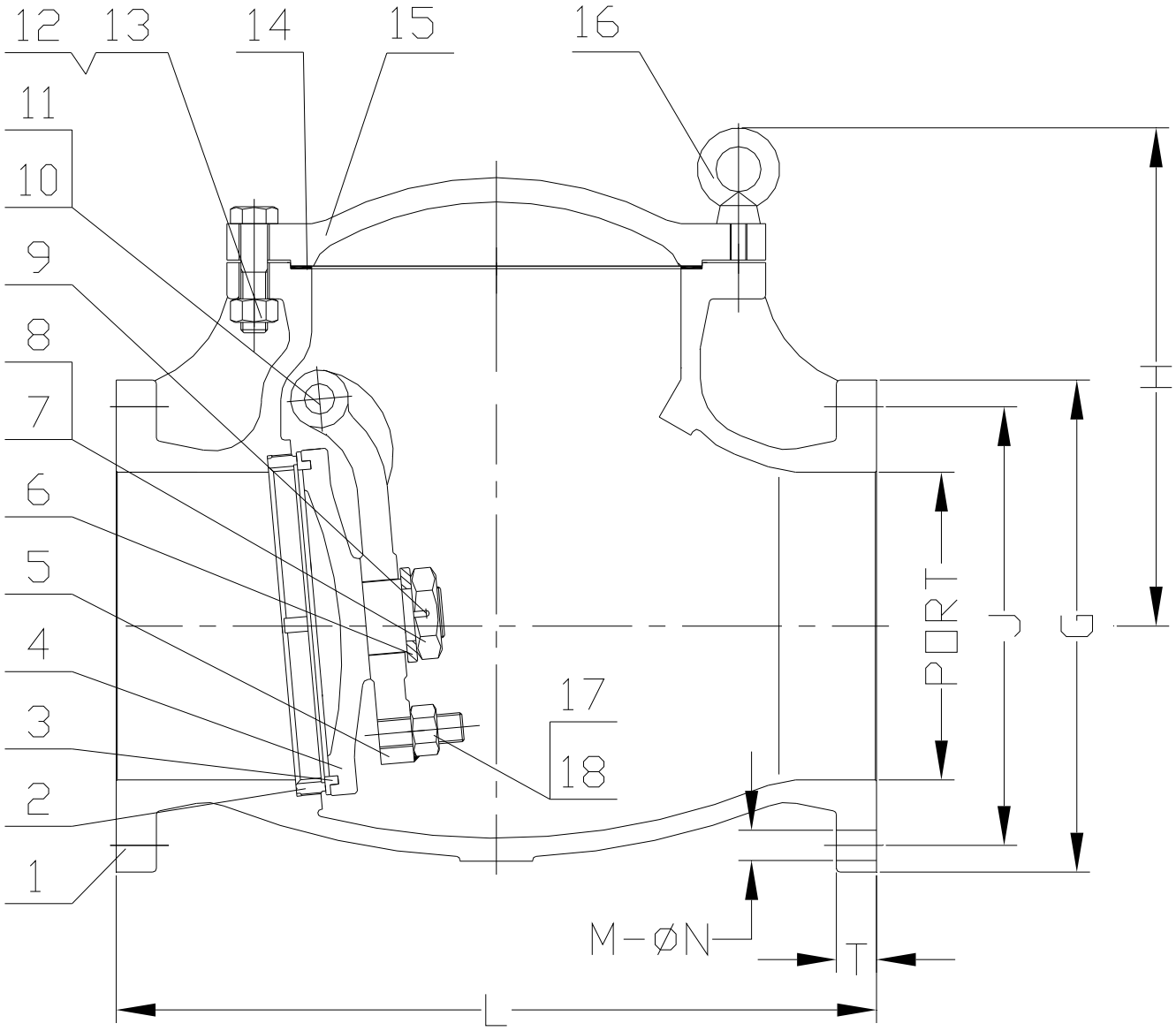


Figure 9

WARRANTY

1. **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.

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4. **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.

5. **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.

6. **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.