

INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS

Review Date: 06/28/2021
Original Date: 06/01/2009

Installation, Operation, and Maintenance Guidelines for NIBCO[®] Butterfly Valves with Rubber Seats

Figure Numbers

Commercial Series Valves

N-200** Series
LD-2000* NPS 14 & 24 Series
LD-1000* NPS 14 & 48 Series
GD-4700 Series
LD/WD-2000/3000/5000 Series
LC/WC-2000 Series
FC/FD-2000 Series
FC/FD-5000 Series
LD-7000/8000 Series

Fire Protection Valves*

LD/WD-3510 Series*
GD-4865 Series*
GD-6865 Series*

**Fire Protection Butterfly Valves listed with UL, ULC, and/or FM*

***Cartridge-Liner Seat*

For any technical inquiries please call NIBCO Technical Services

CAUTION: Only qualified personnel should undertake the procedures outlined in this document. NIBCO INC., its agents, representatives and employees assumes no liability for the use of these procedures. These procedures are offered as suggestions only.

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I. SHIPMENT & STORAGE

NIBCO butterfly valves are individually boxed thru the 12" size. The 14" through 48" butterfly valves are shipped individually with the faces covered using cardboard or plywood to protect the flange sealing surfaces.

The disc is shipped in the nearly closed position to protect the sealing edge and prevents the liner from taking a temporary set. The stem bushings and disc edge have been coated with a factory-applied lubricant to prolong storage and service life.

Valves may be shipped or stored in any position. Storage should be limited to 10 years indoors with a temperature range of 40° F to 90° F (4°C to 32°C).

II. BUTTERFLY VALVE INSTALLATION GUIDELINES

NIBCO rubber-lined butterfly valves, depending on size and pressure rating, are designed to mate with Class 125/150 flange patterns in conformance to ASME B16.1, ASME B16.5, B16.42, or ASME B16.47 (Series A) flanges. Cast iron and steel flat-face flanges can be used with all NIBCO butterfly valves; however, steel raised-face flanges should not be used with cast grey iron lug-style butterfly valves (NIBCO N150/N200 Series).

While flange standards specify flange OD, thickness, bolt size, bolt-circle diameter, and number of bolts, they may not specify flange opening ID. Care must be used when selecting mating components for use with NIBCO lug and wafer style butterfly valves. **The internal diameter of flanges, fittings, and pipe must be compatible with the butterfly valve for proper seal-face integrity and disc operation.**

When in the open position, the disc extends outward from the valve body. The internal diameter of connecting components must be large enough to allow clearance for the disc to fully open. The disc clearances specified in **Table 1** (below) are in accordance with **MSS Standard Practice SP-67 Butterfly Valves, Table A1**.

NIBCO 2" thru 48" size butterfly valves have an integral rubber face that seals to the attaching flange; therefore, a separate gasket is not necessary and should never be used.

The flange inside diameter must not be too large or it will not mate properly with this integral seal. See **Table 1** for minimum and maximum inside diameters of connecting piping/flanges to assure proper seal-face integrity and full operation of NIBCO butterfly valves. Verify the inside diameter and clearance dimensions of all components connecting directly to a butterfly valve.

NIBCO butterfly valves are bi-directional and may be installed with flow in either direction. These valves can be installed in any horizontal or vertical position. If a choice of stem positions exists, the valve should be installed with the stem in the horizontal position; this will minimize seat wear by distributing the stem and disc weight evenly. Also, if the media is abrasive, the horizontal stem position is highly preferred.

Butterfly valves should be installed a minimum of six (6) pipe diameters, upstream and downstream, from other line components. This is not always practical but it is important to design in as much distance as possible. Interference may occur when valves are installed directly to the outlet flange of a swing check, silent check, or reducing flange. Check valve and butterfly valve combinations are very popular; normally a short spool piece is required between the valves.

When using a valve with gear operator attached, it may be desirable to have the hand wheel positioned to allow easy access, or for use of an optional adjustable sprocket rim (chain wheel) for remote operation. Before valve installation, please review Gear Operator Installation and Hand Wheel Positioning section of this booklet. These instructions illustrate how to orient the

gear operator hand wheel position in relation to the valve body and piping system. Pre-planning may save from having to remove a newly installed valve and reinstalling in another orientation.

TABLE 1 - Piping/Flange Inside Diameter Requirements - Flange, Lug, & Wafer BFVs Only

Valve Series	LD/WD/LC/WC 1000/2000/3000/5000 Series		LD7000/8000 Series		N200 Series	
	Minimum Pipe/Flange ID for Disc Clearance	Maximum Pipe/Flange ID for Proper Seal	Minimum Pipe/Flange ID for Disc Clearance	Maximum Pipe/Flange ID for Proper Seal	Minimum Pipe/Flange ID for Disc Clearance	Maximum Pipe/Flange ID for Proper Seal
2"	2.00	2.49	1.31	2.43	1.38	2.24
2½"	2.37	2.86	1.89	3.06	1.95	2.74
3"	2.67	3.43	2.64	3.65	2.66	3.33
4"	3.69	4.55	3.67	4.75	3.67	4.55
5"	4.76	5.62	4.44	5.54	4.48	5.50
6"	5.84	6.62	5.96	6.84	5.96	6.66
8"	8.01	8.62	7.85	8.89	7.85	8.61
10"	10.00	10.80	9.73	10.70	9.76	10.75
12"	11.99	13.12	11.71	12.74	11.72	12.79
14"	13.02	14.01	13.02	15.50	—	—
16"	15.20	16.30	15.20	17.90	—	—
18"	17.09	18.31	17.16	19.67	—	—
20"	18.90	20.08	19.10	21.05	—	—
24"	23.05	24.71	23.04	25.57	—	—
28"	—	—	27.10	29.31	—	—
30"	29.06	30.29	29.08	31.28	—	—
32"	—	—	30.91	33.93	—	—
36"	33.59	35.78	33.60	36.77	—	—
42"	39.83	42.77	39.87	44.96	—	—
48"	44.85	48.27	44.86	51.57	—	—
54"	—	—	50.67	54.25	—	—
60"	—	—	54.93	60.25	—	—

III. GEAR OPERATOR INSTALLATION AND HANDWHEEL POSITIONING

NOTE: These positioning options are not available for UL/FM Gear Operators/Valves

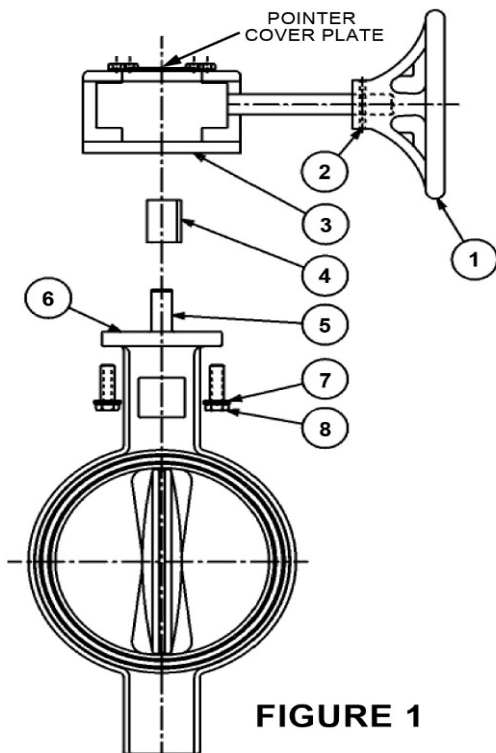


FIGURE 1

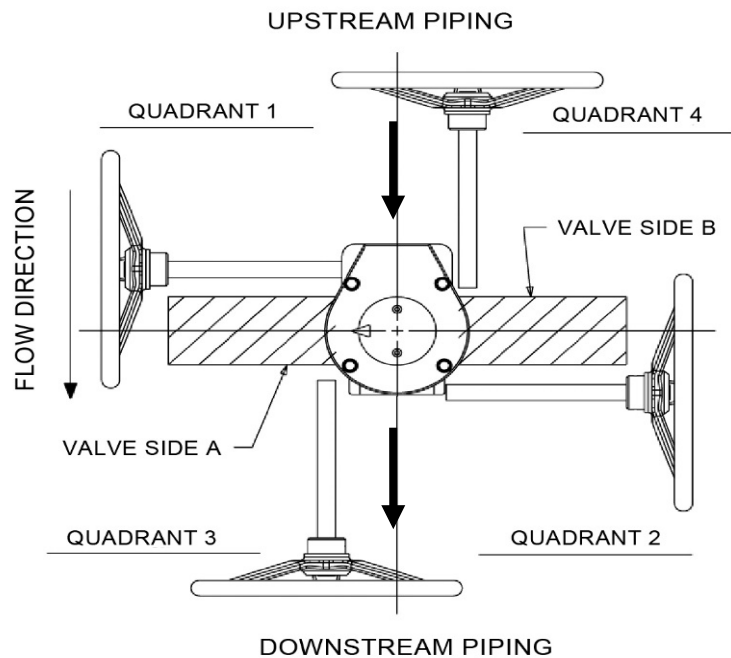


FIGURE 2

Fire Protection (UL/FM)	2" – 8"	9/16" Hex Wrench and 1/8" Hex Allen Wrench
	10" – 12"	3/4" Hex Wrench and 1/8" Hex Allen Wrench
	All Sizes	5/16" Socket Wrench for Stamped Flag
Commercial	2" – 8"	9/16" Hex Wrench
	10" – 14"	3/4" Hex Wrench
	16" – 18"	1-1/8" Hex Wrench

For Commercial Gear Operators Only

(Fire Protections GOs can only be mounted in one orientation):

1. Install hand wheel (1) onto gear operator shaft and secure with pin (2). (If not already attached) See *Figure 1*.
2. Turn the hand wheel (1) clockwise until in full SHUT position.
3. Remove 2 screws holding pointer cover plate to center of gear operator to expose bore. Retain pointer cover plate and screws for reinstallation later.
4. Assure valve is in full SHUT position, turn valve stem (5) to close disc if necessary.
5. Assure mounting base of gear operator (3) and the valve top flange (6) are both clean and dry.
6. Determine desired hand wheel position in reference to the piping system and compare with Fig. 2. There are 2 mounting positions for the gear operator onto the valve and the valve can be mounted in either direction into the piping system. This will allow hand wheel to be positioned in any of the 4 quadrants as shown in Fig. 2. Note that all Fire Protection and 10" and 12" size commercial valves allow for hand wheel positioning in quadrants 1 and 2 only.
- 7a. Gear operators with adapter bushing:
 - Insert adapter bushing (4) into gear operator (3) bore aligning bushing key with desired keyway. Keyway selection will determine hand wheel orientation position. (Note that Fire Protection model adapter bushings differ from illustration and only have 1 keyway position).
 - Align adapter bushing (4) bore with valve stem (5) and slide gear operator assembly onto valve stem (5) until seated with valve top flange.
- 7b. Gear operators without adapter bushing:
 - Align gear operator (3) bore with valve stem (5) and align with desired keyway. Keyway selection will determine hand wheel orientation position.
 - Slide gear operator assembly onto the valve stem (5) until seated with valve top flange.
8. Tightly secure gear operator (3) to valve top flange (6) using supplied* fasteners (7 & 8).
9. Reinstall pointer cover plate onto gear operator removed in Step 3 above. Arrow should be aligned to indicate SHUT position.
10. Install flag and secure with Allen Screw. (*Fire Protection gear operators only*).
11. Rotate hand wheel from SHUT to fully OPEN positions several times to assure proper orientation. See Stop Adjustment Procedure Section of this instruction booklet if stop alignment adjustment is necessary.
12. Proceed with valve installation into piping system.

* A minimum of two fasteners is required, installed in opposite diagonal corners, for commercial gear operators.

NOTES:

- For Fire Protection gear operators, it is critical to use only the key supplied with gear operator in order to conform to UL, FM and ULC specifications.
- Connection of gear operator to valve stem varies depending on gear operator model, size and style. The adapter bushing and key may be different from *Figure 1* illustration shown.

IV. VALVE INSTALLATION PROCEDURE – FLANGE, LUG & WAFER STYLE ONLY

Always position the connecting pipe flanges accurately in the line, allowing sufficient space between the flanges for the valve. Make sure the pipe flange faces are clean of any foreign material such as scale, metal shavings or welding slag. Valves should be installed with the disc in the closed position to prevent damage to sealing surfaces.

NOTE: Fully open and fully shut any butterfly valve before attempting to install it into a system, to ensure and confirm the valve is operational across its travel range and seating properly in the opened and shut positions.

1. Carefully insert the valve between the pipe flanges. Do not apply any lubricants to the seat faces as this may damage them.
2. Line up, center and secure the valve between flanges using desired bolts or studs (see *Figure 4*) as listed in **Table 4**. Do not tighten bolts at this time.
3. Carefully open the valve to assure free unobstructed disc movement. Disc interference may result when valves are installed in pipelines having smaller than normal inside diameters, such as heavy wall pipe, plastic-lined pipe, as-cast flanges, or reducing flanges. Interference can also occur when connecting directly to a swing check or silent check. Suitable corrective measures must be taken to remove these obstructions, such as taper boring the pipe or installing a spacer or spool piece. See **Table 1** for more details on minimum and maximum pipe clearances.
4. After proper operation is verified, tighten the bolts to the minimum recommended bolt torques listed in **Table 3**, using a cross-over pattern as shown in *Figure 3*.

NOTE: When installing any cartridge liner butterfly valve (N150/N200 Series valves and LD 1000/2000 valves NPS 14” and larger) between two flanges, it is critical that the cartridge liner be evenly compressed from both sides of the mating flanges.

5. NIBCO recommends a multi-stepped process utilizing the cross-over pattern be used to draw the flanges against the liner from both sides of the valve at the same rate, ensuring the liner is compressed evenly. This method differs from the practice used on smaller valves, wherein one flange side is completely tightened before moving to the opposite side. **SEE SECTION XIII**, below, for specific bolting sequencing recommendations. **See NIBCO Technical Bulletin NTB-1012** for troubleshooting. Refer to **ASME PCC-1 GUIDELINES FOR PRESSURE BOUNDARY BOLTED FLANGE JOINT ASSEMBLY** for bolt tightening methodology.
6. Pressurize piping to valve and inspect for leakage. If leakage is observed, tighten bolts using cross-over pattern, increasing torque until leak stops.

WARNING: DO NOT EXCEED MAXIMUM TORQUES LISTED IN TABLE 3.

7. Recommended torques are made without warranty. Installer must verify proper strength bolts for application. Bolts shall be clean and un-lubricated.

NOTES:

- Cast iron and steel flat-face flanges can be used with all NIBCO butterfly valves; however, steel raised-face flanges should not be used with cast grey iron lug-style butterfly valves (N200 series).
- LUG STYLE VALVES – Extra care should be used when installing with raised faced flanges. Over tightening of bolts can result in broken valve lugs.
- Class 250 cast iron and Class 300 steel flanges **cannot** be used on these valves.
- Rubber faced or mechanical flanges are **not** recommended.
- These valves are **not** recommended for steam service.
- Valves should **not** be assembled to the flanges & then welded into the piping system.
- Lever-lock handles are **not** recommended for use on 8” and larger valves.
- Do **not** install valves with EPDM liner in compressed air lines.

Flange Size	Bolt Size	Minimum Bolt Torque (ft./lbs.)	Maximum Bolt Torque (ft./lbs.)
2" – 4"	5/8"	20	70
5" – 8"	3/4"	30	120
10" and 12"	7/8"	50	200
14" and 16"	1"	70	240
18" and 20"	1-1/8"	100	380
24" – 30"	1-1/4"	140	520
32" – 48"	1-1/2"	200	800
54" – 60"	1-3/4"	350	1800

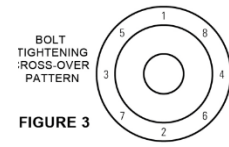


FIGURE 3

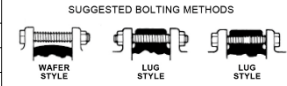


FIGURE 4

VALVE SIZE (RUBBER SEATED BFVS ONLY)	REFERENCE VALVE BODY WIDTH	FLANGE THICKNESS			BOLT LENGTH		BOLT QTY/SIZE	
		ASME B16.1 CLASS 125 CAST IRON	ASME B16.5 CLASS 150 STEEL	ASME B16.47 (SERIES A) CLASS 150 STEEL	LUG STYLE VALVES DIMENSION "Y"	WAFER STYLE VALVES DIMENSION "X"	LD LUG / WD WAFER (MOUNTING 2 FLANGES)	BOLT SIZE
2"	1.75	0.63	-	-	1.25	4.00	8/4	5/8"-11 UNC
		-	0.75	-	1.50			
2½"	1.88	0.69	-	-	1.50	5.00	8/4	5/8"-11 UNC
		-	0.88	-	1.50			
3"	1.88	0.75	-	-	1.50	5.00	8/4	5/8"-11 UNC
		-	0.94	-	1.75			
4"	2.13	0.94	0.94	-	1.75	5.00	16/8	5/8"-11 UNC
5"	2.25	0.94	0.94	-	1.75	5.00	16/8	3/4"-10 UNC
6"	2.25	1.00	1.00	-	2.00	6.00	16/8	3/4"-10 UNC
8"	2.44	1.13	1.13	-	2.25	6.00	16/8	3/4"-10 UNC
10"	2.75	1.19	1.19	-	2.25	7.00	24/12	7/8"-9UNC
12"	3.06	1.25	1.25	-	2.50	7.00	24/12	7/8"-9UNC
14"	3.50	1.38	1.38	-	2.50	7.00	24/12	1"-8 UNC
16"	3.75	1.44	1.44	-	3.00	8.00	32/16	1"-8 UNC
18"	4.50	1.56	1.56	-	3.50	9.00	32/16	1½" - 7 UNC
20"	5.25	1.69	1.69	-	3.50	10.00	40/20	1½" - 7 UNC
24"	6.13	1.88	1.88	-	4.00	12.00	40/20	1¾"-7 UNC
26"	6.75	-	-	2.69	5.00	-	48	1¾"-7 UNC
28"	6.75	-	-	2.81	5.00	-	56	1¾"-7 UNC
30"	6.75	2.13	-	-	4.00	-	56	1¾"-7 UNC
		-	-	2.94	5.00	-		
32"	7.50	-	-	3.19	5.00	-	56	1½"-6 UNC
36"	8.25	2.38	-	-	5.00	-	64	1½"-6 UNC
		-	-	3.56	6.00	-		
42"	10.00	2.63	-	-	5.00	-	72	1½"-6 UNC
		-	-	3.81	6.00	-		
48"	11.00	2.75	-	-	6.00	-	88	1½"-6 UNC
		-	-	4.25	7.00	-		
52"	15.00	-	-	4.56	8.00	-	88	1½"-6UNC
54"	15.00	-	-	4.75	8.00	-	88	1½"-6UNC
60"	15.00	-	-	5.19	8.00	-	104	1½"-6UNC

V. STOP ADJUSTMENT PROCEDURE

NOTE: It is best to visually check the valve disc OPEN and SHUT positions before the valve is installed in the system piping to assure proper valve operation.

1. Attach gear operator to the top of the valve and securely tighten bolts, or verify bolts are securely tight if you received a valve with the gear operator already attached.
2. Rotate the hand wheel clockwise until it stops. Visually check to see that the valve disc is centered in the valve seat for proper seal. Note that the indicator flag (Fire Protection) or pointer (Commercial) on top of gear operator represents the disc position. If the stop location is not correct, proceed to step 5.
3. Rotate the hand wheel counter-clockwise until it stops. Visually check to see that the valve disc is centered in the valve opening. Note that the indicator flag (Fire Protection) or pointer (Commercial) on top of gear operator represents the disc position. If the stop location is not correct, proceed to step 5.
4. If both stops are set correctly, valve is ready for installation.
5. Stop adjustment – Using a proper size hex Allen wrench, remove both locking set screws (A) as shown in *Figures 5 and 6*.
 - SHUT stop adjustment - Using proper size hex Allen wrench, turn set screw (B) counter-clockwise 2 turns. Rotate hand wheel until disc is centered in valve seat. Turn set screw (B) clockwise until it stops. Secure set screw “B” by replacing only one locking set screw (A) in same hole and tightening it until it stops.
 - OPEN stop adjustment – Using proper size hex Allen wrench, turn set screw (C) counter-clockwise 2 turns. Rotate hand wheel until disc is centered in valve opening. Turn set screw (C) clockwise until it stops. Secure set screw (C) by replacing second locking set screw (A) in same hole and tightening it until it stops.
6. Again visually verify both OPEN and SHUT stops are correctly set. Repeat step 5 if necessary.
7. If the valve is installed in the system piping and cannot be removed, it is possible to adjust the stops, but is a little more difficult. The only difference is that instead of visually checking the actual disc in the valve; you have to visually check the flag (Fire Protection) or pointer (Commercial) position. Because the exact flag or pointer position is more difficult to determine, it may take a couple tries to set the SHUT stop. OPEN stop adjustment is not critical; $\pm 5^\circ$ travel is adequate.

NOTE: The gear operator’s OPEN and SHUT positions have been set at time of shipping. These instructions should be used for slight adjustment as needed.

GEAR OPERATOR PART NUMBERS

2" – 12" UL/FM VALVE GEAR OPERATOR		
Part Number	Valve Size	Valve Series
T117166 PP	2" – 4" 2-1/2" – 3"	WD/LD-3510 GD-4765
T117167 PP	5" – 6" 4" – 6"	WD/LD-3510 GD-4765
T117890 PP	8" 8"	WD/LD-3510 GD-4765
T117168 PP	10" – 12" 10"	WD/LD-3510 GD-4765

2-1/2" – 10" UL/FM VALVE GEAR OPERATOR		
Part Number	Valve Size	Valve Series
T118775 PP	2-1/2" – 4"	GD-4865/6865
T118776 PP	6" – 8"	GD-4865/6865
T117168 PP	10"	GD-4865/6865

2" – 24" COMMERCIAL VALVE GEAR OPERATOR		
Part Number	Valve Size	Valve Series
T117118 PP	2" – 6" 2" – 5"	WD/LD-2000/3000 FC/FD/GD- 2000/5000/4000
T117119 PP	8" 6" – 8"	WD/LD-2000/3000 FC/FD/GD- 2000/5000/4000
T117120 PP T117121 PP	10" 12" 10" – 12"	WD/LD-2000/3000 WD/LD-2000/3000 FC/FD/GD- 2000/5000/4000
T116697 PP T026150 PP T026151 PP T026211 PP T026212 PP	14" 16" 18" 20" 24"	LD-1000/2000

BUTTERFLY VALVE GEAR OPERATOR SETTING INSTRUCTIONS

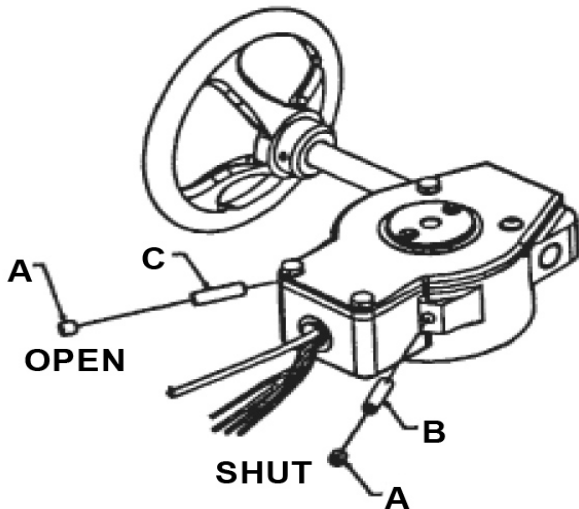


FIGURE 5

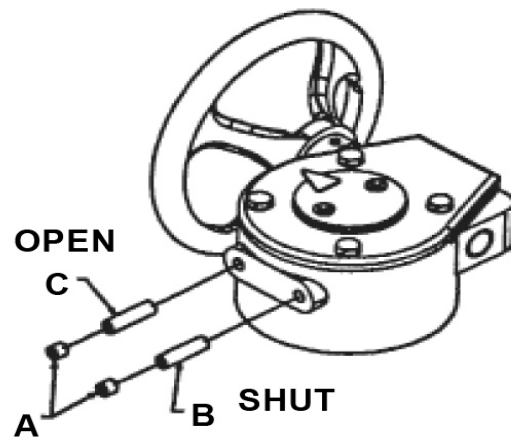


FIGURE 6

Table 5 - Tools Required	
2" – 8" valves	4mm or 5mm Hex Allen Wrench
10" – 18" valves	6mm Hex Allen Wrench
20" – 24" valves	8mm Hex Allen Wrench

VI. SWITCH DETAILS– UL/FM FIRE PROTECTION GEAR OPERATORS

Rating:

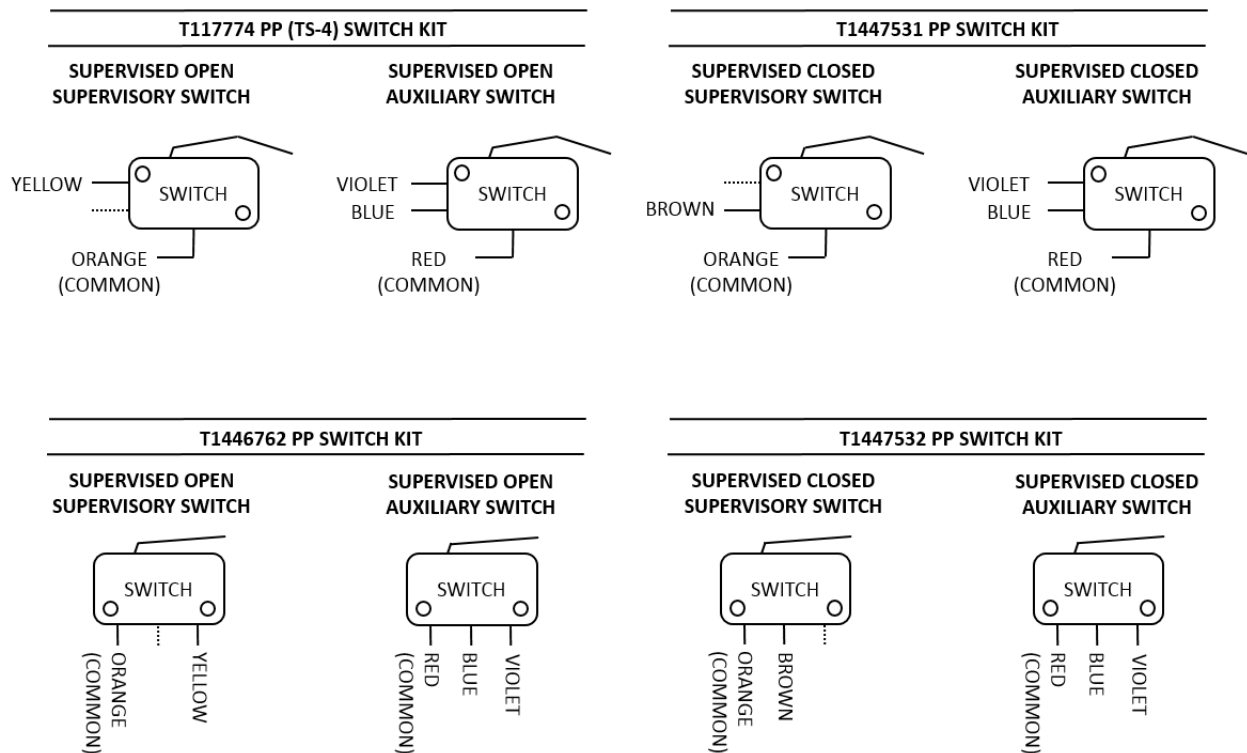
11 amps @ 125 VAC 60 Hz, or 1 amp @ 28 VDC non-inductive.

Wiring:

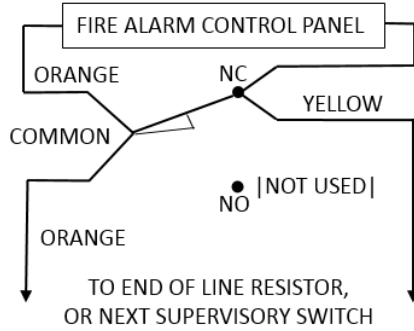
All lead wires are 18 AWG, 18 inches long and exit the operator housing through a single threaded hole designed for use with a ½ inch conduit fitting.

Valve Series	Supervision Position	Switch Kit Number
GD4765-8N WD/LD3510-8*	Valve Open	T117774 PP (TS-4)
GD4765C-8N WD/LD3510C-8*	Valve Closed	T118542 PP
GD4865-8N GD6865-8N	Valve Open	T1446762 PP
GD4865C-8N GD6865C-8N	Valve Closed	T1447532 PP

*2002 or Newer Model Wafer & Lug UL/FM Butterfly Valves



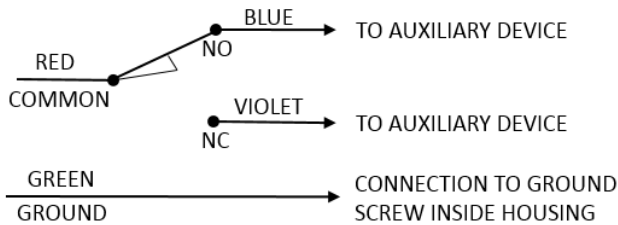
SUPERVISED OPEN SUPERVISORY SWITCH



SPDT SWITCH WITH DUAL LEADS SOLDERED TO SWITCH TABS.

SWITCH POSITON SHOWN WHEN VALVE IS IN THE NON-OPEN POSITON.

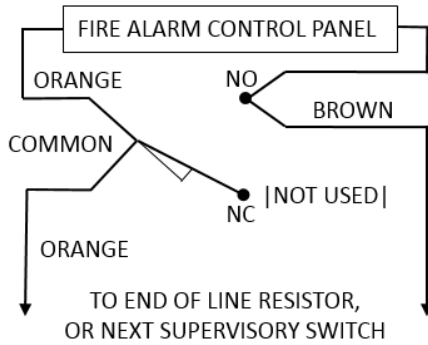
SUPERVISED OPEN AUXILIARY SWITCH



SPDT SWITCH WITH SINGLE LEADS SOLDERED TO SWITCH TABS.

SWITCH POSITON SHOWN WHEN VALVE IS IN THE NON-OPEN POSITON.

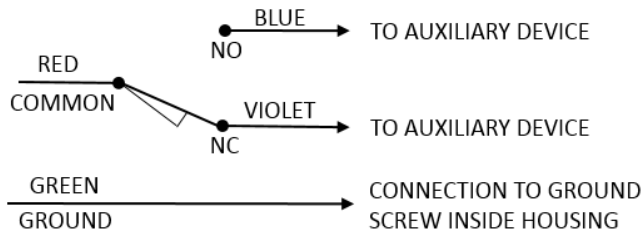
SUPERVISED CLOSED SUPERVISORY SWITCH



SPDT SWITCH WITH DUAL LEADS SOLDERED TO SWITCH TABS.

SWITCH POSITON SHOWN WHEN VALVE IS IN THE FULLY CLOSED POSITON.

SUPERVISED CLOSED AUXILIARY SWITCH



SPDT SWITCH WITH SINGLE LEADS SOLDERED TO SWITCH TABS.

SWITCH POSITON SHOWN WHEN VALVE IS IN THE FULLY CLOSED POSITON.

**VII. TS-4 SWITCH T117774 PP & T118542 PP SWITCH REPLACEMENT
INSTRUCTIONS FOR FACTORY INSTALLED SWITCHES FOR NIBCO GD4765-8N,
GD4765C-8N, WD/LD3510-8, WD/LD3510C-8 (2002 or Newer Model Wafer & Lug
UL/FM Butterfly Valves)**

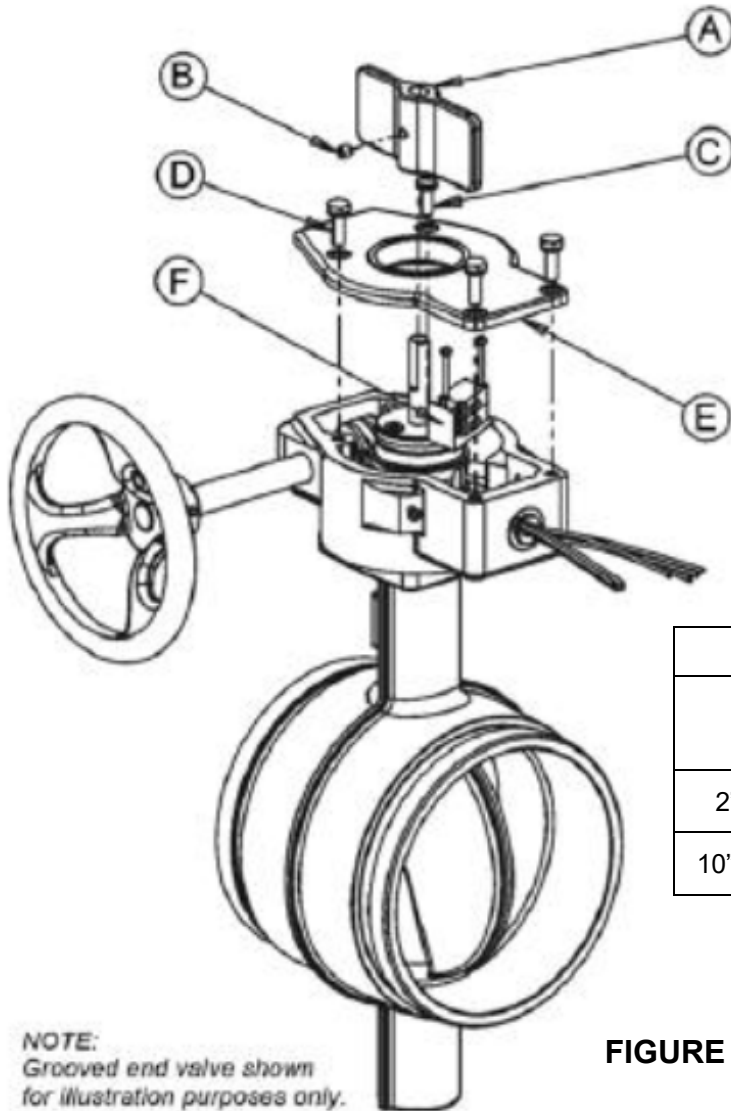


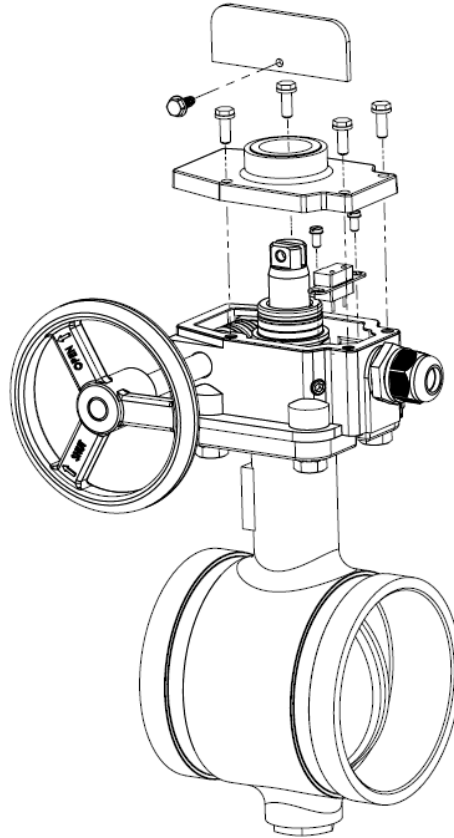
TABLE 6 – Tools Required	
All valves	1/8" Hex Allen Wrench Standard Flat Blade Screwdriver Continuity Tester
2" – 8" valves	5/32" Pin Head Wrench 9/16" Socket Wrench
10" – 12" valves	3/16" Pin Head Wrench 3/4" Socket Wrench

FIGURE 8

1. Remove flag (A) by backing out (approx. 2 turns) screw (B). See *Figure 8*.
2. Remove one tamper-proof pin head screw (C), three hex head screws (D), and gear operator cover (E).
3. Remove the two screws holding the switch assembly into the housing, and one screw holding the green ground wire to housing, and remove complete switch assembly.
4. Feed electrical wires of new switch assembly through the conduit hole in rear of housing.
5. Place two screws (with lock washers) thru the switch mounting holes, then thru the mounting holes of the insulation paper. Place switch assembly (F) into gear housing with switch actuating arms against quadrant gear. Tighten two screws to secure switches, and one screw to secure green ground wire to housing.
6. Conduct switch continuity test to make sure they are functioning properly. Refer to *Figure 7*.
7. Reinstall cover plate, screws, and flag. Tighten all screws.
8. Auxiliary switch end connection to be reviewed and accepted by local authority having jurisdiction.

NOTE: Instructions are the same regardless of valve end connections.

**VIII. T1446762 PP AND T1447532 PP SWITCH REPLACEMENT INSTRUCTIONS
FACTORY INSTALLED SWITCHES FOR NIBCO GD4865-8N, GD4865-C-8N,
GD6865-8N, GD6865-C-8N UL/FM Butterfly Valves**



NOTE: Grooved end valve shown
For illustration purposes only.
See SECTION VII. SWITCH REPLACEMENT INSTRUCTIONS

TABLE 7 - Gear Operator Switch Installation Tools

All Valves	5/16" Socket Wrench (Flag Removal)
	Standard Flat Blade Screwdriver
	Continuity Tester
2 ½", 76mm, 3", 4"	5/16" Socket Wrench
	1/8" Pin Head Wrench
6", 165mm, 8"	7/16 Socket Wrench
	5/32" Pin Head Wrench
10"	1/2" Socket Wrench
	3/16" Pin Head Wrench

IX. KEY DRIVE REPLACEMENT INSTRUCTIONS – 2” THRU 12” UL / FM BUTTERFLY VALVES

NOTES:

- All replacement parts must be obtained from your NIBCO distributor. Key drive material and size is specifically designed to meet performance requirements of UL and FM. Failure to use the properly sized replacement parts may void the UL and FM ratings.
- Drive Key (section of weakness) will shear if excessive torque is applied to the input of the gear operator while the disc is blocked partially open.

TABLE 8 - Tools Required	
All valves	1/8" Hex Allen Wrench
2" – 8" valves	9/16" Socket Wrench
10" – 12" valves	3/4" Socket Wrench

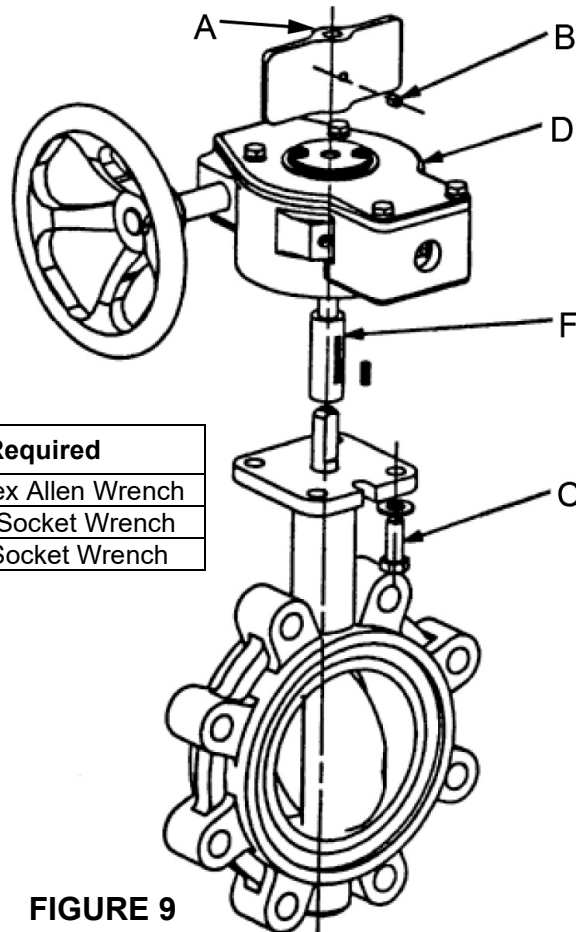


FIGURE 9

1. Loosen the set screw (B) that secures the flag (A) to the stem. Remove the flag. See Fig. 9.
2. Remove the four (4) hex head cap screws (C) that fasten the gear operator (D) to the valve.
3. Lift the gear operator straight up from the valve. In most cases the adapter bushing (F) will stay in the segment quadrant gear because the broken key causes interference between the gear and adapter bushing.
4. Pull the adapter bushing from the gear. Some force may be required.
5. After removing the adapter bushing, remove the broken key.
6. Place the new key in keyway of adapter bushing (F).
7. With drive adapter bushing and key in place within gear operator, carefully slide the gear operator over stem until it rests flush on the valve operator mounting flange. The hand wheel may need to be turned in order to align bolt holes and the orientation pin.
8. Secure gear operator with four (4) hex head screws (securely tighten), replace flag on stem and then tighten set screw on flag.
9. Check operation of valve by turning hand wheel from fully OPEN to fully SHUT position.

**X. MEMORY STOP INSTALLATION INSTRUCTIONS –
2” THRU 24” SIZE COMMERCIAL GEAR OPERATORS ONLY**

TABLE 9 - Tools Required	
All valves	2.5mm Hex Allen Wrench
2” – 8” valves	10mm Wrench
10” – 24” valves	13mm Wrench

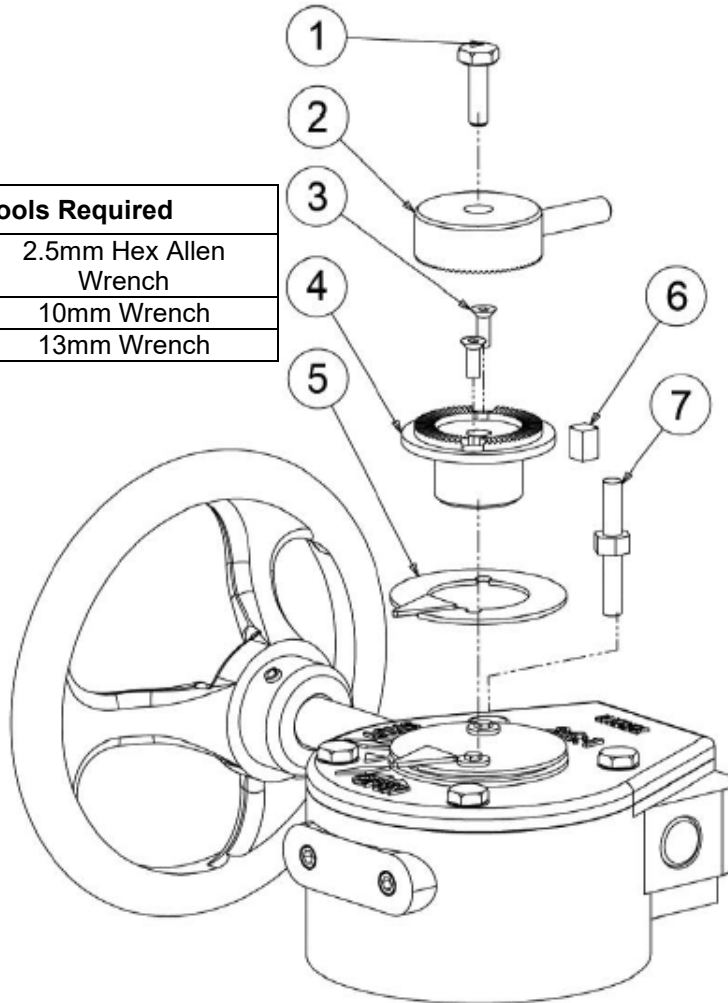


FIGURE 10

1. Remove the two screws holding the top cover (Indicator Pointer) onto segment gear. Discard cover and screws. See *Figure 10*.
 2. Place indicator (5), supplied with kit, around bottom hub (4). Align key (6) on bottom hub with slot in segment gear and slide into place.
 3. Attach with two supplied M4 x 12 flat head screws (3).
 4. Remove one cap screw (1) holding cover onto gear operator housing and replace with stop pin (7).
 5. Use cap screw (1) you just removed to secure the top hub (2) to the bottom hub (4). Top hub can be moved 360 degrees in 5 degree increments.
 6. Tighten cap screw (1) once top hub is appropriately set.
- NOTE:** The gear operator provides a large mechanical advantage. Be careful to stop turning the handwheel when the pointer of top hub (2) contacts stop pin (7) to prevent damage.

XI. MAINTENANCE AND REPAIR – ALL SERIES & SIZES - VALVES ONLY

Due to the many unique features in the NIBCO butterfly valve design, there is no regular maintenance or lubrication required.

XII. GEAR OPERATOR SERVICE & MAINTENANCE

During installation, customer should carefully adjust gear operator stops for proper valve OPEN and SHUT positioning.

NIBCO gear operators are suitable for both indoor and outdoor service. However, outdoor service can be harsh depending upon the conditions that the unit is exposed to. For example; constant exposure to high heat, humidity, rain, snow, salt spray, or other corrosive media may lead to corrosion of the iron castings, steel hand wheel shaft, or other components.

NIBCO recommends that gear operators exposed to these extreme conditions be checked and serviced on a regular basis. This can be accomplished during normal exercising or operation of the valve (Butterfly Valves should be operated at least once per year or depending upon conditions, as often as quarterly).

NIBCO tries to balance the needs of our customers and provide a gear operator that fits most service conditions. It is the responsibility of the ultimate installer / owner to specify the valve and gear operator based upon the application and conditions that it will be exposed to.

For general gear operator maintenance, refer to NIBCO Technical Bulletin NTB-1012-01.

For harsh outdoor service refer to NIBCO Technical Bulletin NTB-0208-02 to address maintenance that can be performed in the field for units installed outdoors in extreme conditions.

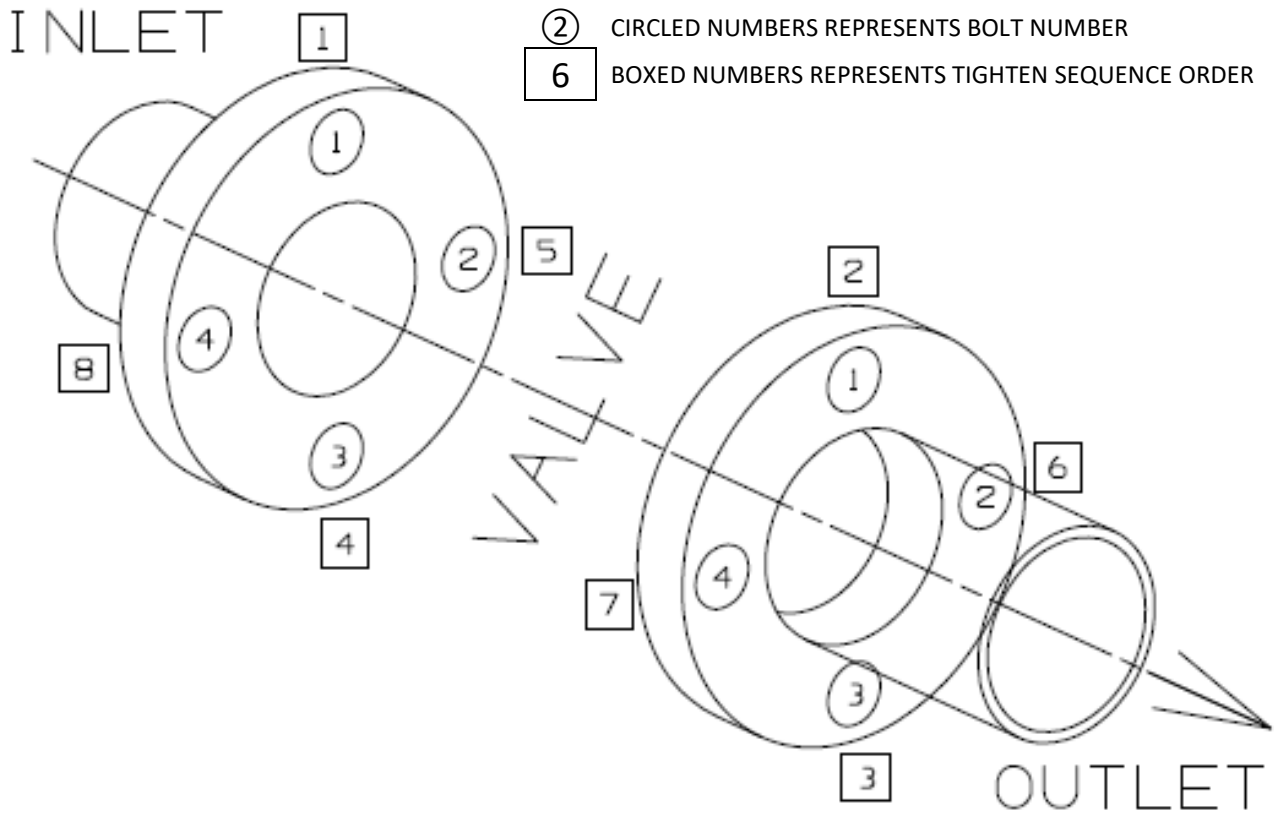
For installations where spare parts are held on site, it is suggested that a spare gear operator be held as an interchangeable item.

For Fire Protection Valves:

ALL REPLACEMENT PARTS MUST BE OBTAINED FROM THE MANUFACTURER TO ASSURE PROPER OPERATION OF THE VALVE, AND TO MAINTAIN APPROVAL OF THE DEVICE.

XIII. CARTRIDGE LINER BUTTERFLY VALVE – BOLTING SEQUENCES

a. 4-Bolt Flanges



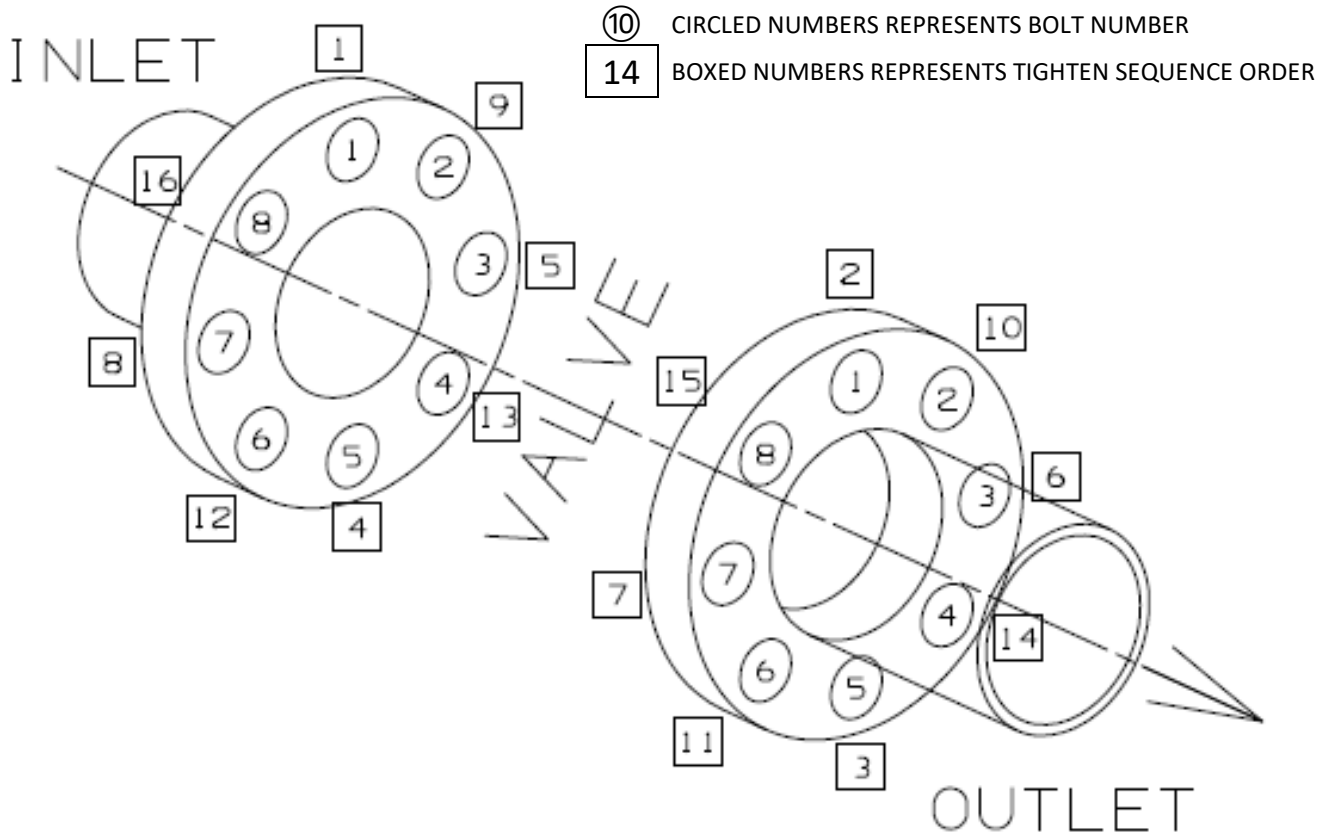
4 BOLT FLANGES	
TIGHTENING SEQUENCE	BOLT NUMBER
1	1
2	3
3	2
4	4

- Carefully insert the valve between the Inlet and Outlet flanges.
- Line-up, center, and secure the valve between flanges using desired bolts or studs. **DO NOT TIGHTEN BOLTS AT THIS TIME.** Use a marker to number each both head as shown in above Drawing.
- Carefully fully open the valve to assure free unobstructed disc movement. Disc interference may result when valves are installed in pipelines having smaller than normal inside diameters, such as heavy wall pipe, plastic-lined pipe, as-cast flanges, or reducing flanges. Interference can also occur when connecting directly to a swing check or silent check. Suitable corrective measures must be taken to remove these obstructions, such as taper boring the pipe/flange, installing a spacer or spool piece.
- After proper operation is verified, tighten bolts to the **MINIMUM** recommended bolt torques as shown in Table below. NOTE that the torques are different for lubricated and non-lubricated bolts.
- A multi-stepped process utilizing the cross-over pattern should be used to draw the flanges against the valve from both sides of the valve at the same rate, ensuring the rubber seal face surfaces are compressed evenly. See Drawing above and Sequence Table to left. This should be followed by 2 sets of Chase patterns, alternating from one side of the valve to the other to assure all bolts are evenly torqued.
- Refer to ASME PCC-1 GUIDELINES FOR PRESSURE BOUNDARY BOLTED FLANGE JOINT ASSEMBLY for bolt tightening methodology.
- Pressurize piping to valve and inspect for leakage. If leakage is observed, tighten bolts using cross-over pattern, increasing torque until leakage stops. All bolts must be tightened to the same torque. **DO NOT EXCEED MAXIMUM TORQUES** shown in Table.
- Recommended torques are made without warranty. Installer must verify proper strength bolts for application.

RECOMMENDED BOLT TIGHTENING TORQUES

NON-LUBRICATED BOLTS				LUBRICATED BOLTS			
VALVE SIZE	BOLT SIZE	MINIMUM FT·LBS	MAXIMUM FT·LBS	VALVE SIZE	BOLT SIZE	MINIMUM FT·LBS	MAXIMUM FT·LBS
2"→4"	5/8"	20	60	2"→4"	5/8"	15	40
5"→8"	3/4"	35	110	5"→8"	3/4"	20	60
10"→12"	7/8"	50	160	10"→12"	7/8"	30	90
14"→16"	1"	75	240	14"→16"	1"	45	140
18"→20"	1 1/8"	100	350	18"→20"	1 1/8"	70	200
24"→32"	1 1/4"	150	500	24"→32"	1 1/4"	100	300
36"→48"	1 1/2"	240	800	36"→48"	1 1/2"	170	500

b. 8-Bolt Flanges



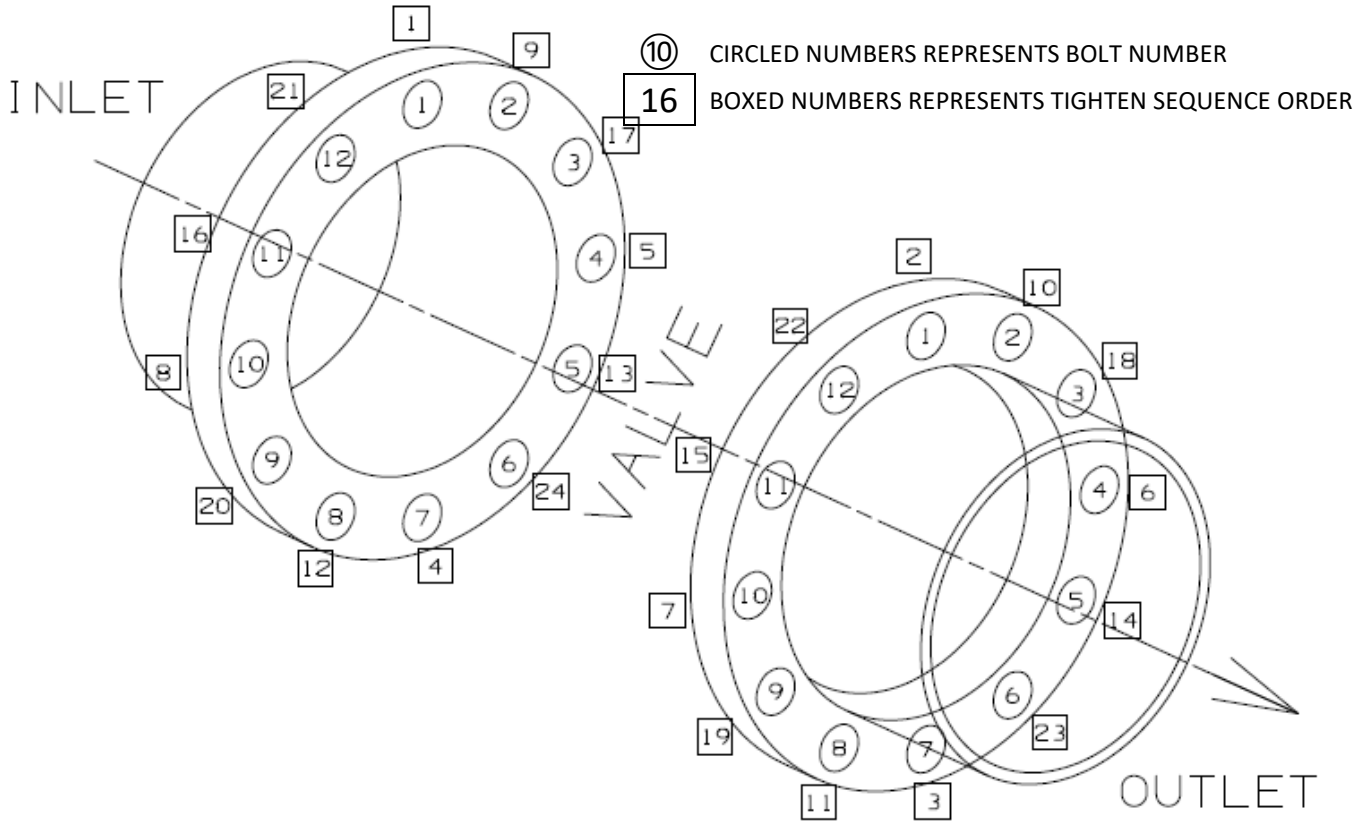
8 BOLT FLANGES	
TIGHTENING SEQUENCE	BOLT NUMBER
1	1
2	5
3	3
4	7
5	2
6	6
7	4
8	8

- Carefully insert the valve between the Inlet and Outlet flanges.
- Line-up, center, and secure the valve between flanges using desired bolts or studs. **DO NOT TIGHTEN BOLTS AT THIS TIME.** Use a marker to number each both head as shown in above Drawing.
- Carefully fully open the valve to assure free unobstructed disc movement. Disc interference may result when valves are installed in pipelines having smaller than normal inside diameters, such as heavy wall pipe, plastic-lined pipe, as-cast flanges, or reducing flanges. Interference can also occur when connecting directly to a swing check or silent check. Suitable corrective measures must be taken to remove these obstructions, such as taper boring the pipe/flange, installing a spacer or spool piece.
- After proper operation is verified, tighten bolts to the **MINIMUM** recommended bolt torques as shown in Table below. NOTE that the torques are different for lubricated and non-lubricated bolts.
- A multi-stepped process utilizing the cross-over pattern should be used to draw the flanges against the valve from both sides of the valve at the same rate, ensuring the rubber seal face surfaces are compressed evenly. See Drawing above and Sequence Table to left. This should be followed by 2 sets of Chase patterns, alternating from one side of the valve to the other to assure all bolts are evenly torqued.
- Refer to ASME PCC-1 GUIDELINES FOR PRESSURE BOUNDRY BOLTED FLANGE JOINT ASSEMBLY for bolt tightening methodology.
- Pressurize piping to valve and inspect for leakage. If leakage is observed, tighten bolts using cross-over pattern, increasing torque until leakage stops. All bolts must be tightened to the same torque. **DO NOT EXCEED MAXIMUM TORQUES** shown in Table.
- Recommended torques are made without warranty. Installer must verify proper strength bolts for application.

RECOMMENDED BOLT TIGHTENING TORQUES

NON-LUBRICATED BOLTS				LUBRICATED BOLTS			
VALVE SIZE	BOLT SIZE	MINIMUM FT-LBS	MAXIMUM FT-LBS	VALVE SIZE	BOLT SIZE	MINIMUM FT-LBS	MAXIMUM FT-LBS
2"→4"	5/8"	20	60	2"→4"	5/8"	15	40
5"→8"	3/4"	35	110	5"→8"	3/4"	20	60
10"→12"	7/8"	50	160	10"→12"	7/8"	30	90
14"→16"	1"	75	240	14"→16"	1"	45	140
18"→20"	1½"	100	350	18"→20"	1½"	70	200
24"→32"	1¾"	150	500	24"→32"	1¾"	100	300
36"→48"	1½"	240	800	36"→48"	1½"	170	500

c. 12-Bolt Flanges

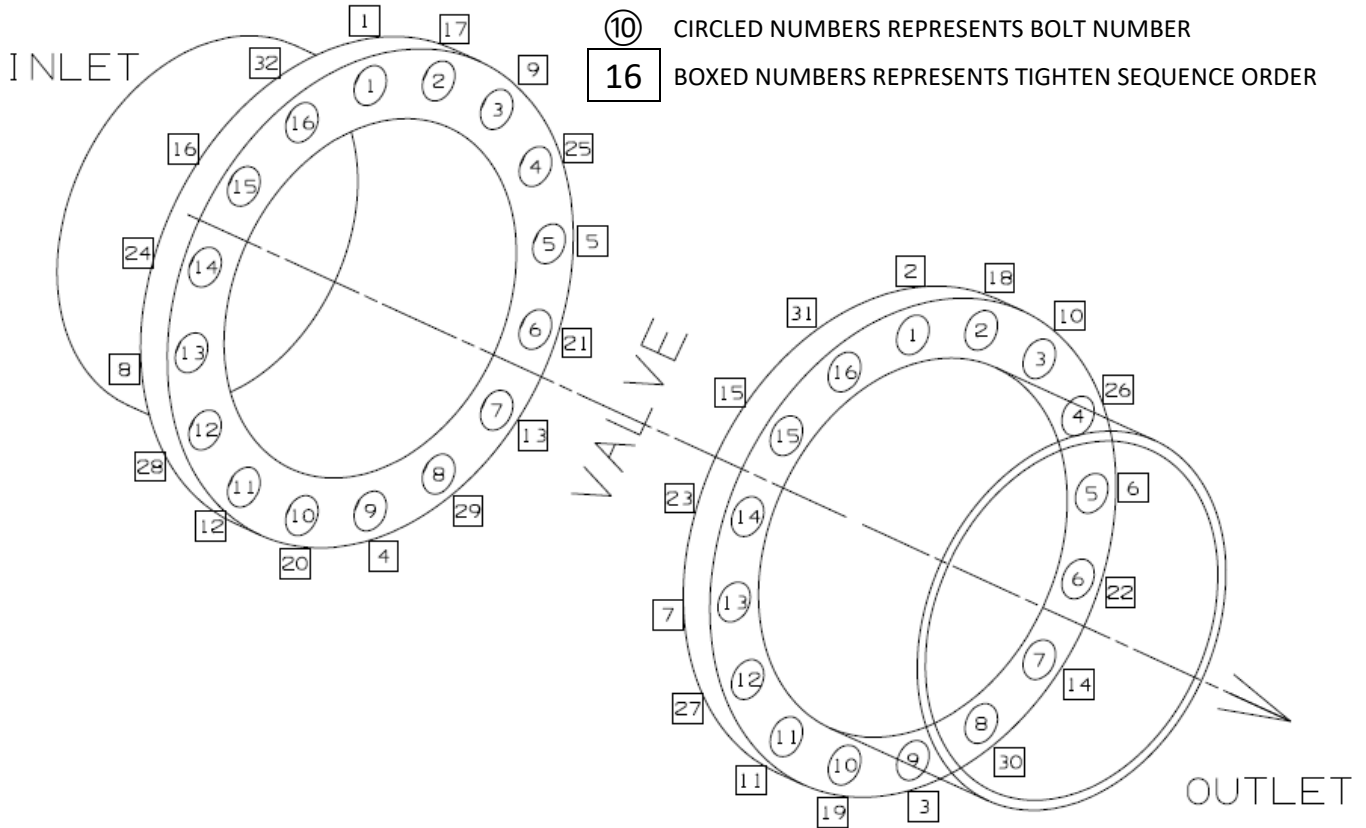


12 BOLT FLANGES	
TIGHTENING SEQUENCE	BOLT NUMBER
1	1
2	7
3	4
4	10
5	2
6	8
7	5
8	11
9	3
10	9
11	6
12	12

- Carefully insert the valve between the Inlet and Outlet flanges.
- Line-up, center, and secure the valve between flanges using desired bolts or studs. DO NOT TIGHTEN BOLTS AT THIS TIME. Use a marker to number each both head as shown in above Drawing.
- Carefully fully open the valve to assure free unobstructed disc movement. Disc interference may result when valves are installed in pipelines having smaller than normal inside diameters, such as heavy wall pipe, plastic-lined pipe, as-cast flanges, or reducing flanges. Interference can also occur when connecting directly to a swing check or silent check. Suitable corrective measures must be taken to remove these obstructions, such as taper boring the pipe/flange, installing a spacer or spool piece.
- After proper operation is verified, tighten bolts to the MINIMUM recommended bolt torques as shown in Table below. NOTE that the torques are different for lubricated and non-lubricated bolts.
- A multi-stepped process utilizing the cross-over pattern should be used to draw the flanges against the valve from both sides of the valve at the same rate, ensuring the rubber seal face surfaces are compressed evenly. See Drawing above and Sequence Table to left. This should be followed by 2 sets of Chase patterns, alternating from one side of the valve to the other to assure all bolts are evenly torqued.
- Refer to ASME PCC-1 GUIDELINES FOR PRESSURE BOUNDRY BOLTED FLANGE JOINT ASSEMBLY for bolt tightening methodology.
- Pressurize piping to valve and inspect for leakage. If leakage is observed, tighten bolts using cross-over pattern, increasing torque until leakage stops. All bolts must be tightened to the same torque. DO NOT EXCEED MAXIMUM TORQUES shown in Table.
- Recommended torques are made without warranty. Installer must verify proper strength bolts for application.

RECOMMENDED BOLT TIGHTENING TORQUES							
NON-LUBRICATED BOLTS				LUBRICATED BOLTS			
VALVE SIZE	BOLT SIZE	MINIMUM FT-LBS	MAXIMUM FT-LBS	VALVE SIZE	BOLT SIZE	MINIMUM FT-LBS	MAXIMUM FT-LBS
2"→4"	5/8"	20	60	2"→4"	5/8"	15	40
5"→8"	3/4"	35	110	5"→8"	3/4"	20	60
10"→12"	7/8"	50	160	10"→12"	7/8"	30	90
14"→16"	1"	75	240	14"→16"	1"	45	140
18"→20"	1½"	100	350	18"→20"	1½"	70	200
24"→32"	1¾"	150	500	24"→32"	1¾"	100	300
36"→48"	1½"	240	800	36"→48"	1½"	170	500

d. 16-Bolt Flanges

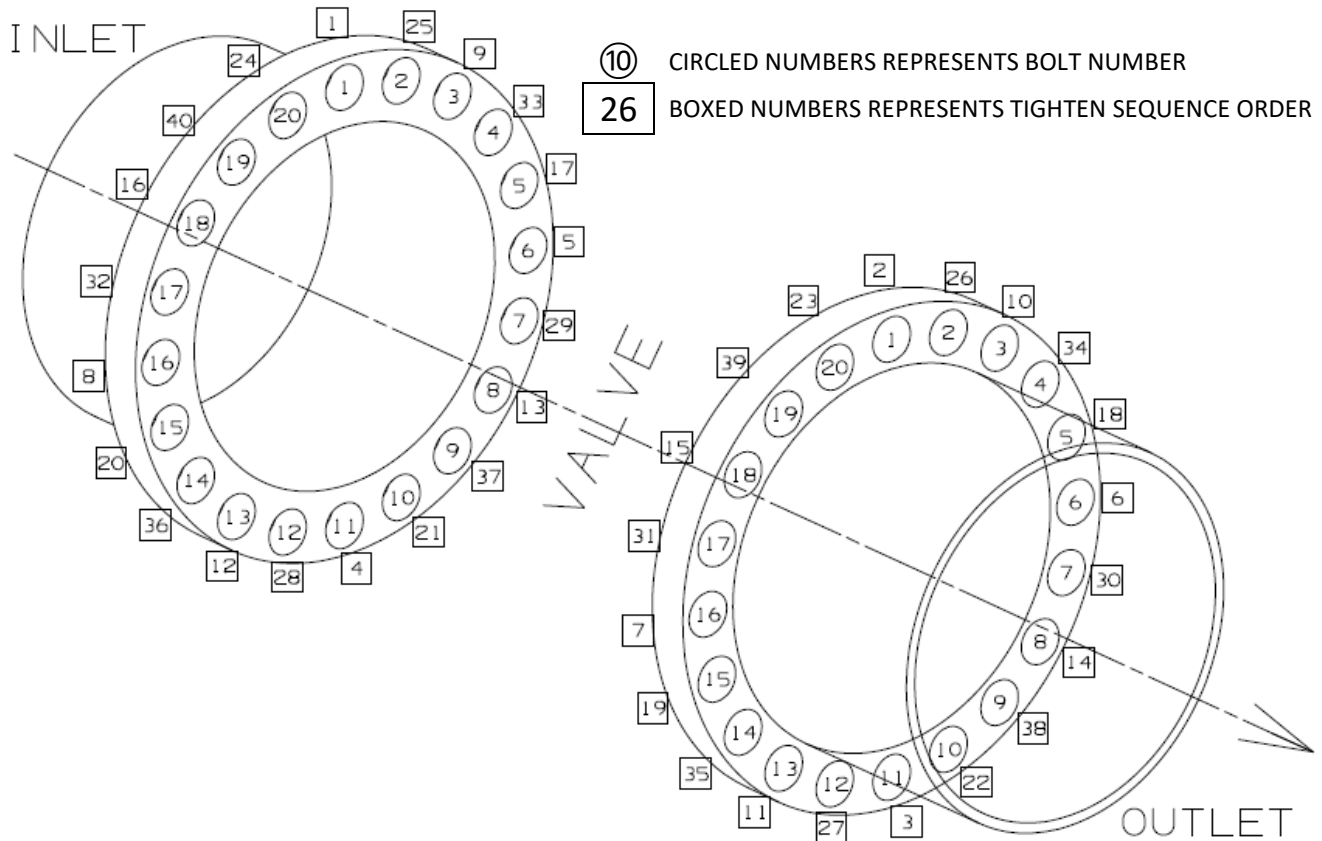


16 BOLT FLANGES	
TIGHTENING SEQUENCE	BOLT NUMBER
1	1
2	9
3	5
4	13
5	3
6	11
7	7
8	15
9	2
10	10
11	6
12	14
13	4
14	12
15	8
16	16

- Carefully insert the valve between the Inlet and Outlet flanges.
- Line-up, center, and secure the valve between flanges using desired bolts or studs. **DO NOT TIGHTEN BOLTS AT THIS TIME.** Use a marker to number each both head as shown in above Drawing.
- Carefully fully open the valve to assure free unobstructed disc movement. Disc interference may result when valves are installed in pipelines having smaller than normal inside diameters, such as heavy wall pipe, plastic-lined pipe, as-cast flanges, or reducing flanges. Interference can also occur when connecting directly to a swing check or silent check. Suitable corrective measures must be taken to remove these obstructions, such as taper boring the pipe/flange, installing a spacer or spool piece.
- After proper operation is verified, tighten bolts to the **MINIMUM** recommended bolt torques as shown in Table below. **NOTE** that the torques are different for lubricated and non-lubricated bolts.
- A multi-stepped process utilizing the cross-over pattern should be used to draw the flanges against the valve from both sides of the valve at the same rate, ensuring the rubber seal face surfaces are compressed evenly. See Drawing above and Sequence Table to left. This should be followed by 2 sets of Chase patterns, alternating from one side of the valve to the other to assure all bolts are evenly torqued.
- Refer to **ASME PCC-1 GUIDELINES FOR PRESSURE BOUNDARY BOLTED FLANGE JOINT ASSEMBLY** for bolt tightening methodology.
- Pressurize piping to valve and inspect for leakage. If leakage is observed, tighten bolts using cross-over pattern, increasing torque until leakage stops. All bolts must be tightened to the same torque. **DO NOT EXCEED MAXIMUM TORQUES** shown in Table.
- Recommended torques are made without warranty. Installer must verify proper strength bolts for application.

RECOMMENDED BOLT TIGHTENING TORQUES							
NON-LUBRICATED BOLTS				LUBRICATED BOLTS			
VALVE SIZE	BOLT SIZE	MINIMUM FT-LBS	MAXIMUM FT-LBS	VALVE SIZE	BOLT SIZE	MINIMUM FT-LBS	MAXIMUM FT-LBS
2"→4"	5/8"	20	60	2"→4"	5/8"	15	40
5"→8"	3/4"	35	110	5"→8"	3/4"	20	60
10"→12"	7/8"	50	160	10"→12"	7/8"	30	90
14"→16"	1"	75	240	14"→16"	1"	45	140
18"→20"	1 1/8"	100	350	18"→20"	1 1/8"	70	200
24"→32"	1 1/4"	150	500	24"→32"	1 1/4"	100	300
36"→48"	1 1/2"	240	800	36"→48"	1 1/2"	170	500

e. 20-Bolt Flanges

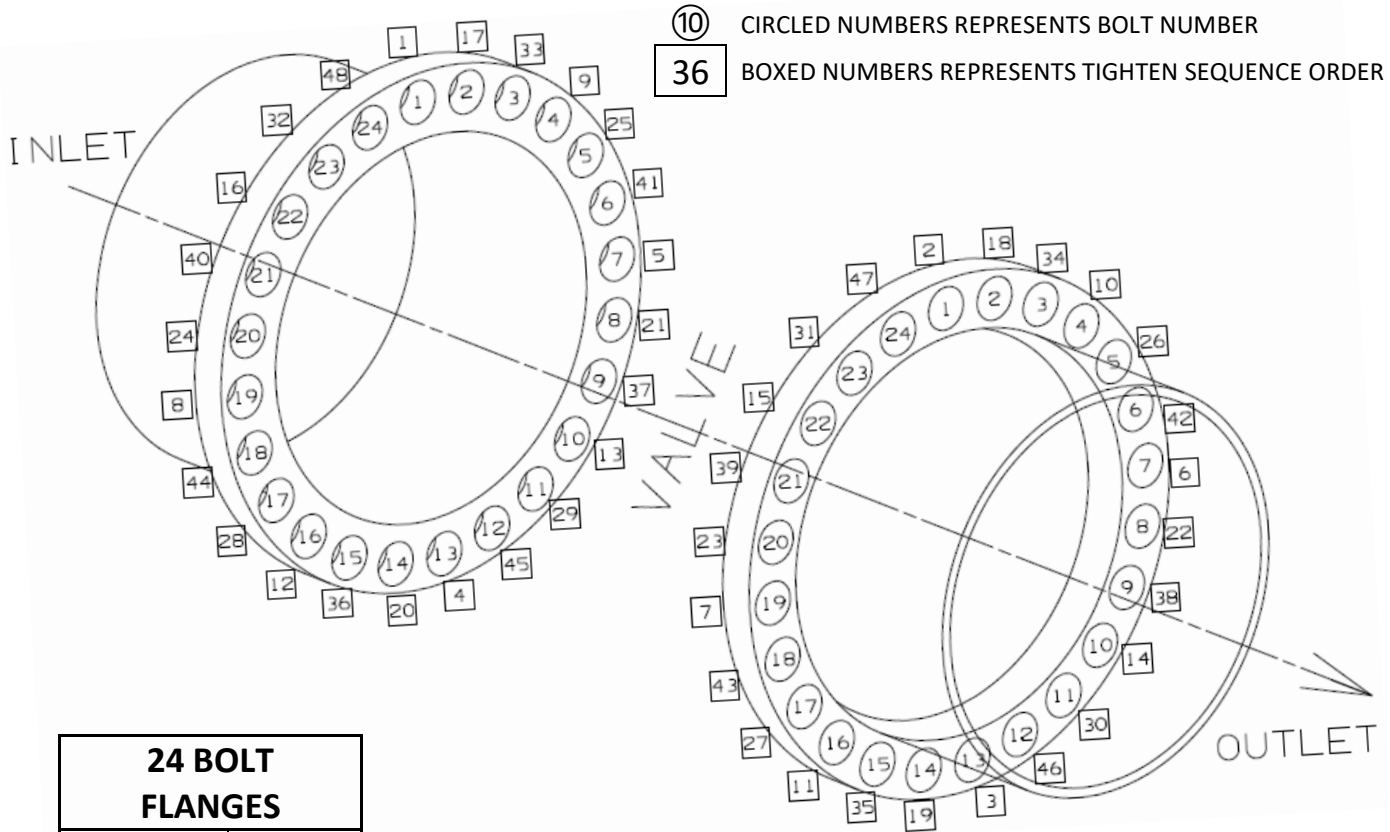


20 BOLT FLANGES	
TIGHTENING SEQUENCE	BOLT NUMBER
1	1
2	11
3	6
4	16
5	3
6	13
7	8
8	18
9	5
10	15
11	10
12	20
13	2
14	12
15	7
16	17
17	4
18	14
19	9
20	19

- Carefully insert the valve between the Inlet and Outlet flanges.
- Line-up, center, and secure the valve between flanges using desired bolts or studs. DO NOT TIGHTEN BOLTS AT THIS TIME. Use a marker to number each both head as shown in above Drawing.
- Carefully fully open the valve to assure free unobstructed disc movement. Disc interference may result when valves are installed in pipelines having smaller than normal inside diameters, such as heavy wall pipe, plastic-lined pipe, as-cast flanges, or reducing flanges. Interference can also occur when connecting directly to a swing check or silent check. Suitable corrective measures must be taken to remove these obstructions, such as taper boring the pipe/flange, installing a spacer or spool piece.
- After proper operation is verified, tighten bolts to the MINIMUM recommended bolt torques as shown in Table below. NOTE that the torques are different for lubricated and non-lubricated bolts.
- A multi-stepped process utilizing the cross-over pattern should be used to draw the flanges against the valve from both sides of the valve at the same rate, ensuring the rubber seal face surfaces are compressed evenly. See Drawing above and Sequence Table to left. This should be followed by 2 sets of Chase patterns, alternating from one side of the valve to the other to assure all bolts are evenly torqued.
- Refer to ASME PCC-1 GUIDELINES FOR PRESSURE BOUNDRY BOLTED FLANGE JOINT ASSEMBLY for bolt tightening methodology.
- Pressurize piping to valve and inspect for leakage. If leakage is observed, tighten bolts using cross-over pattern, increasing torque until leakage stops. All bolts must be tightened to the same torque. DO NOT EXCEED MAXIMUM TORQUES shown in Table.
- Recommended torques are made without warranty. Installer must verify proper strength bolts for application.

RECOMMENDED BOLT TIGHTENING TORQUES							
NON-LUBRICATED BOLTS				LUBRICATED BOLTS			
VALVE SIZE	BOLT SIZE	MINIMUM FT-LBS	MAXIMUM FT-LBS	VALVE SIZE	BOLT SIZE	MINIMUM FT-LBS	MAXIMUM FT-LBS
2"→4"	5/8"	20	60	2"→4"	5/8"	15	40
5"→8"	3/4"	35	110	5"→8"	3/4"	20	60
10"→12"	7/8"	50	160	10"→12"	7/8"	30	90
14"→16"	1"	75	240	14"→16"	1"	45	140
18"→20"	1½"	100	350	18"→20"	1½"	70	200
24"→32"	1¼"	150	500	24"→32"	1¼"	100	300
36"→48"	1½"	240	800	36"→48"	1½"	170	500

f. 24-Bolt Flanges



⑩ CIRCLED NUMBERS REPRESENTS BOLT NUMBER
 36 BOXED NUMBERS REPRESENTS TIGHTEN SEQUENCE ORDER

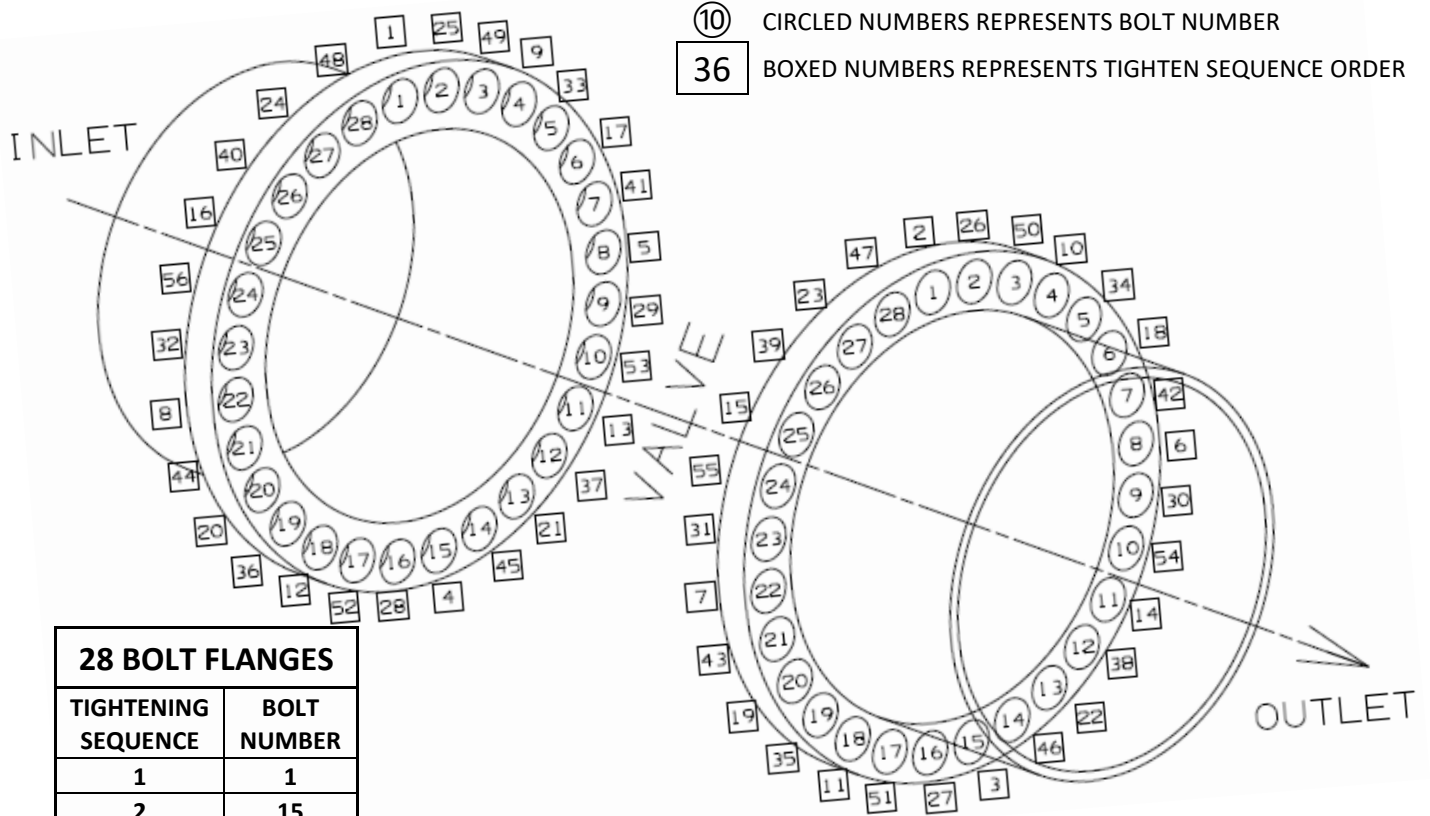
24 BOLT FLANGES	
TIGHTENING SEQUENCE	BOLT NUMBER
1	1
2	13
3	7
4	19
5	4
6	16
7	10
8	22
9	2
10	14
11	8
12	20
13	5
14	17
15	11
16	23
17	3
18	15
19	9
20	21
21	6
22	18
23	12
24	24

- Carefully insert the valve between the Inlet and Outlet flanges.
- Line-up, center, and secure the valve between flanges using desired bolts or studs. **DO NOT TIGHTEN BOLTS AT THIS TIME.** Use a marker to number each both head as shown in above Drawing.
- Carefully fully open the valve to assure free unobstructed disc movement. Disc interference may result when valves are installed in pipelines having smaller than normal inside diameters, such as heavy wall pipe, plastic-lined pipe, as-cast flanges, or reducing flanges. Interference can also occur when connecting directly to a swing check or silent check. Suitable corrective measures must be taken to remove these obstructions, such as taper boring the pipe/flange, installing a spacer or spool piece.
- After proper operation is verified, tighten bolts to the **MINIMUM** recommended bolt torques as shown in Table below. **NOTE** that the torques are different for lubricated and non-lubricated bolts.
- A multi-stepped process utilizing the cross-over pattern should be used to draw the flanges against the valve from both sides of the valve at the same rate, ensuring the rubber seal face surfaces are compressed evenly. See Drawing above and Sequence Table to left. This should be followed by 2 sets of Chase patterns, alternating from one side of the valve to the other to assure all bolts are evenly torqued.
- Refer to ASME PCC-1 GUIDELINES FOR PRESSURE BOUNDARY BOLTED FLANGE JOINT ASSEMBLY for bolt tightening methodology.
- Pressurize piping to valve and inspect for leakage. If leakage is observed, tighten bolts using cross-over pattern, increasing torque until leakage stops. All bolts must be tightened to the same torque. **DO NOT EXCEED MAXIMUM TORQUES** shown in Table.
- Recommended torques are made without warranty. Installer must verify proper strength bolts for application.

RECOMMENDED BOLT TIGHTENING TORQUES

NON-LUBRICATED BOLTS				LUBRICATED BOLTS			
VALVE SIZE	BOLT SIZE	MINIMUM FT-LBS	MAXIMUM FT-LBS	VALVE SIZE	BOLT SIZE	MINIMUM FT-LBS	MAXIMUM FT-LBS
2"→4"	5/8"	20	60	2"→4"	5/8"	15	40
5"→8"	3/4"	35	110	5"→8"	3/4"	20	60
10"→12"	7/8"	50	160	10"→12"	7/8"	30	90
14"→16"	1"	75	240	14"→16"	1"	45	140
18"→20"	1 1/8"	100	350	18"→20"	1 1/8"	70	200
24"→32"	1 1/4"	150	500	24"→32"	1 1/4"	100	300
36"→48"	1 1/2"	240	800	36"→48"	1 1/2"	170	500

g. 28-Bolt Flanges



28 BOLT FLANGES	
TIGHTENING SEQUENCE	BOLT NUMBER
1	1
2	15
3	8
4	22
5	4
6	18
7	11
8	25
9	6
10	20
11	13
12	27
13	2
14	16
15	9
16	23
17	5
18	19
19	12
20	26
21	7
22	21
23	14
24	28
25	3
26	17
27	10
28	24

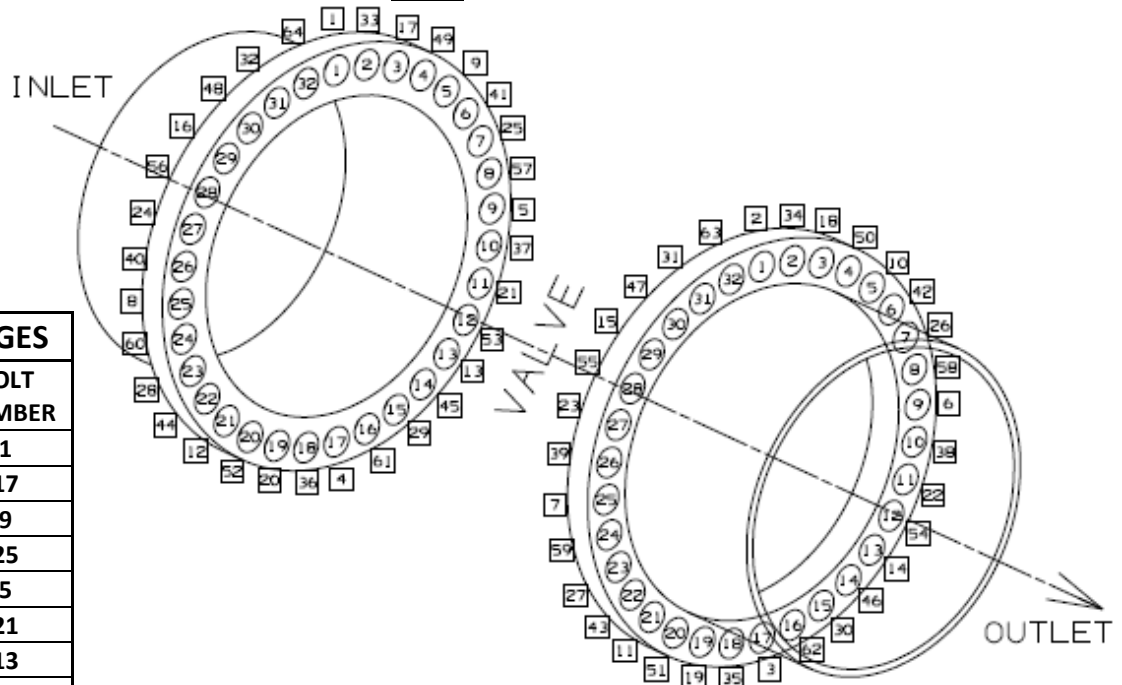
- Carefully insert the valve between the Inlet and Outlet flanges.
- Line-up, center, and secure the valve between flanges using desired bolts or studs. DO NOT TIGHTEN BOLTS AT THIS TIME. Use a marker to number each both head as shown in above Drawing.
- Carefully fully open the valve to assure free unobstructed disc movement. Disc interference may result when valves are installed in pipelines having smaller than normal inside diameters, such as heavy wall pipe, plastic-lined pipe, as-cast flanges, or reducing flanges. Interference can also occur when connecting directly to a swing check or silent check. Suitable corrective measures must be taken to remove these obstructions, such as taper boring the pipe/flange, installing a spacer or spool piece.
- After proper operation is verified, tighten bolts to the MINIMUM recommended bolt torques as shown in Table below. NOTE that the torques are different for lubricated and non-lubricated bolts.
- A multi-stepped process utilizing the cross-over pattern should be used to draw the flanges against the valve from both sides of the valve at the same rate, ensuring the rubber seal face surfaces are compressed evenly. See Drawing above and Sequence Table to left. This should be followed by 2 sets of Chase patterns, alternating from one side of the valve to the other to assure all bolts are evenly torqued.
- Refer to ASME PCC-1 GUIDELINES FOR PRESSURE BOUNDARY BOLTED FLANGE JOINT ASSEMBLY for bolt tightening methodology.
- Pressurize piping to valve and inspect for leakage. If leakage is observed, tighten bolts using cross-over pattern, increasing torque until leakage stops. All bolts must be tightened to the same torque. DO NOT EXCEED MAXIMUM TORQUES shown in Table.
- Recommended torques are made without warranty. Installer must verify proper strength bolts for application.

RECOMMENDED BOLT TIGHTENING TORQUES							
NON-LUBRICATED BOLTS				LUBRICATED BOLTS			
VALVE SIZE	BOLT SIZE	MINIMUM FT-LBS	MAXIMUM FT-LBS	VALVE SIZE	BOLT SIZE	MINIMUM FT-LBS	MAXIMUM FT-LBS
2"→4"	5/8"	20	60	2"→4"	5/8"	15	40
5"→8"	3/4"	35	110	5"→8"	3/4"	20	60
10"→12"	7/8"	50	160	10"→12"	7/8"	30	90
14"→16"	1"	75	240	14"→16"	1"	45	140
18"→20"	1 1/8"	100	350	18"→20"	1 1/8"	70	200
24"→32"	1 1/4"	150	500	24"→32"	1 1/4"	100	300
36"→48"	1 1/2"	240	800	36"→48"	1 1/2"	170	500

h. 32-Bolt Flanges

⑩ CIRCLED NUMBERS REPRESENTS BOLT NUMBER

36 BOXED NUMBERS REPRESENTS TIGHTEN SEQUENCE ORDER



32 BOLT FLANGES	
TIGHTENING SEQUENCE	BOLT NUMBER
1	1
2	17
3	9
4	25
5	5
6	21
7	13
8	29
9	3
10	19
11	11
12	27
13	7
14	23
15	15
16	31
17	2
18	18
19	10
20	26
21	6
22	22
23	14
24	30
25	4
26	20
27	12
28	28
29	8
30	24
31	16
32	32

- Carefully insert the valve between the Inlet and Outlet flanges.
- Line-up, center, and secure the valve between flanges using desired bolts or studs. **DO NOT TIGHTEN BOLTS AT THIS TIME.** Use a marker to number each both head as shown in above Drawing.
- Carefully fully open the valve to assure free unobstructed disc movement. Disc interference may result when valves are installed in pipelines having smaller than normal inside diameters, such as heavy wall pipe, plastic-lined pipe, as-cast flanges, or reducing flanges. Interference can also occur when connecting directly to a swing check or silent check. Suitable corrective measures must be taken to remove these obstructions, such as taper boring the pipe/flange, installing a spacer or spool piece.
- After proper operation is verified, tighten bolts to the **MINIMUM** recommended bolt torques as shown in Table below. **NOTE** that the torques are different for lubricated and non-lubricated bolts.
- A multi-stepped process utilizing the cross-over pattern should be used to draw the flanges against the valve from both sides of the valve at the same rate, ensuring the rubber seal face surfaces are compressed evenly. See Drawing above and Sequence Table to left. This should be followed by 2 sets of Chase patterns, alternating from one side of the valve to the other to assure all bolts are evenly torqued.
- Refer to **ASME PCC-1 GUIDELINES FOR PRESSURE BOUNDARY BOLTED FLANGE JOINT ASSEMBLY** for bolt tightening methodology.
- Pressurize piping to valve and inspect for leakage. If leakage is observed, tighten bolts using cross-over pattern, increasing torque until leakage stops. All bolts must be tightened to the same torque. **DO NOT EXCEED MAXIMUM TORQUES** shown in Table.
- Recommended torques are made without warranty. Installer must verify proper strength bolts for application.

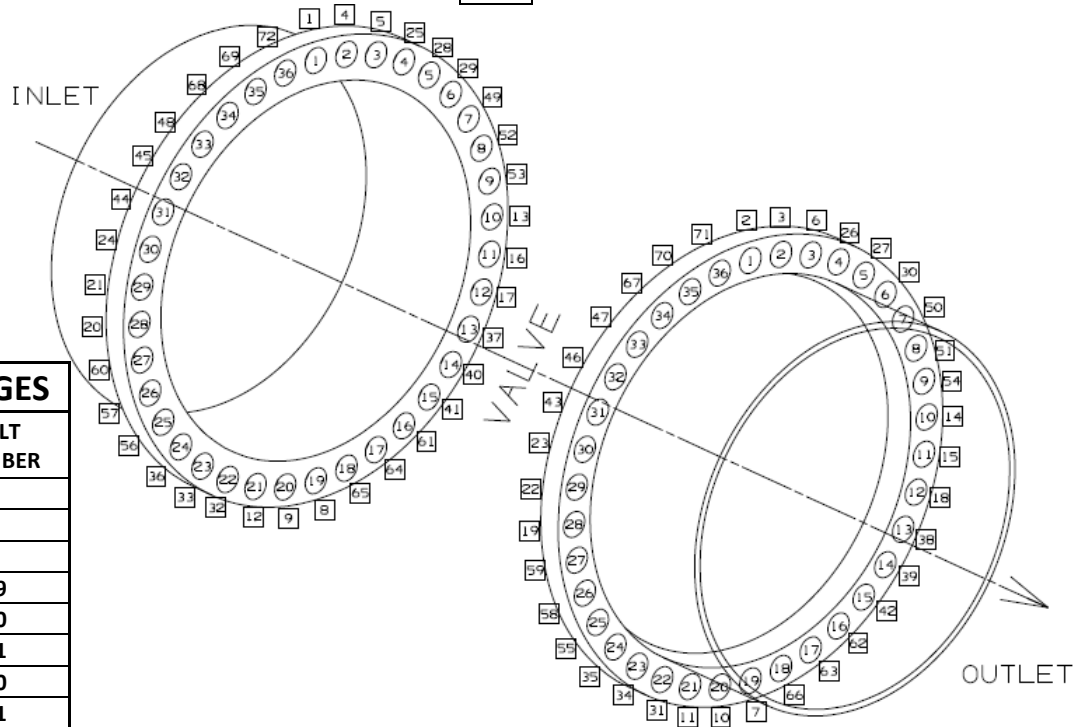
RECOMMENDED BOLT TIGHTENING TORQUES

NON-LUBRICATED BOLTS				LUBRICATED BOLTS			
VALVE SIZE	BOLT SIZE	MINIMUM FT-LBS	MAXIMUM FT-LBS	VALVE SIZE	BOLT SIZE	MINIMUM FT-LBS	MAXIMUM FT-LBS
2"→4"	5/8"	20	60	2"→4"	5/8"	15	40
5"→8"	3/4"	35	110	5"→8"	3/4"	20	60
10"→12"	7/8"	50	160	10"→12"	7/8"	30	90
14"→16"	1"	75	240	14"→16"	1"	45	140
18"→20"	1 1/8"	100	350	18"→20"	1 1/8"	70	200
24"→32"	1 1/4"	150	500	24"→32"	1 1/4"	100	300
36"→48"	1 1/2"	240	800	36"→48"	1 1/2"	170	500

i. 36-Bolt Flanges

⑩ CIRCLED NUMBERS REPRESENTS BOLT NUMBER

36 BOXED NUMBERS REPRESENTS TIGHTEN SEQUENCE ORDER



36 BOLT FLANGES

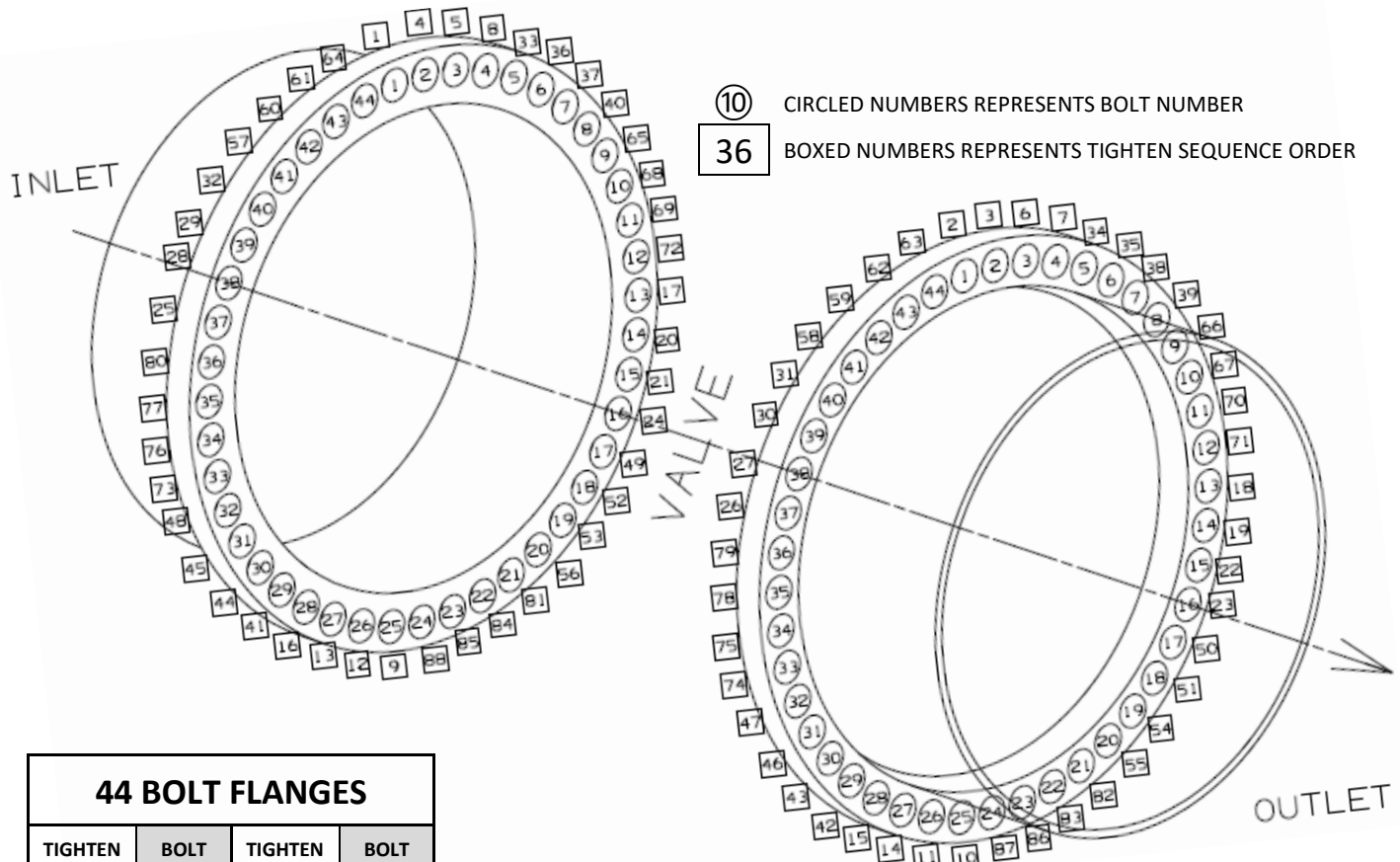
TIGHTENING SEQUENCE	BOLT NUMBER
1	1
2	2
3	3
4	19
5	20
6	21
7	10
8	11
9	12
10	28
11	29
12	30
13	4
14	5
15	6
16	22
17	23
18	24
19	13
20	14
21	15
22	31
23	32
24	33
25	7
26	8
27	9
28	25
29	26
30	27
31	16
32	17
33	18
34	34
35	35
36	36

- Carefully insert the valve between the Inlet and Outlet flanges.
- Line-up, center, and secure the valve between flanges using desired bolts or studs. **DO NOT TIGHTEN BOLTS AT THIS TIME.** Use a marker to number each both head as shown in above Drawing.
- Carefully** fully open the valve to assure free unobstructed disc movement. Disc interference may result when valves are installed in pipelines having smaller than normal inside diameters, such as heavy wall pipe, plastic-lined pipe, as-cast flanges, or reducing flanges. Interference can also occur when connecting directly to a swing check or silent check. Suitable corrective measures must be taken to remove these obstructions, such as taper boring the pipe/flange, installing a spacer or spool piece.
- After proper operation is verified, tighten bolts to the **MINIMUM** recommended bolt torques as shown in Table below. **NOTE** that the torques are different for lubricated and non-lubricated bolts.
- A multi-stepped process utilizing the cross-over pattern should be used to draw the flanges against the valve from both sides of the valve at the same rate, ensuring the rubber seal face surfaces are compressed evenly. See Drawing above and Sequence Table to left. This should be followed by 2 sets of Chase patterns, alternating from one side of the valve to the other to assure all bolts are evenly torqued.
- Refer to ASME PCC-1 GUIDELINES FOR PRESSURE BOUNDARY BOLTED FLANGE JOINT ASSEMBLY for bolt tightening methodology.
- Pressurize piping to valve and inspect for leakage. If leakage is observed, tighten bolts using cross-over pattern, increasing torque until leakage stops. All bolts must be tightened to the same torque. **DO NOT EXCEED MAXIMUM TORQUES** shown in Table.
- Recommended torques are made without warranty. Installer must verify proper strength bolts for application.

RECOMMENDED BOLT TIGHTENING TORQUES

NON-LUBRICATED BOLTS				LUBRICATED BOLTS			
VALVE SIZE	BOLT SIZE	MINIMUM FT-LBS	MAXIMUM FT-LBS	VALVE SIZE	BOLT SIZE	MINIMUM FT-LBS	MAXIMUM FT-LBS
2"→4"	5/8"	20	60	2"→4"	5/8"	15	40
5"→8"	3/4"	35	110	5"→8"	3/4"	20	60
10"→12"	7/8"	50	160	10"→12"	7/8"	30	90
14"→16"	1"	75	240	14"→16"	1"	45	140
18"→20"	1 1/8"	100	350	18"→20"	1 1/8"	70	200
24"→32"	1 1/4"	150	500	24"→32"	1 1/4"	100	300
36"→48"	1 1/2"	240	800	36"→48"	1 1/2"	170	500

j. 44-Bolt Flanges



44 BOLT FLANGES

TIGHTEN SEQUENCE	BOLT NUMBER	TIGHTEN SEQUENCE	BOLT NUMBER
1	1	23	31
2	2	24	32
3	3	25	17
4	4	26	18
5	25	27	19
6	26	28	20
7	27	29	41
8	28	30	42
9	13	31	43
10	14	32	44
11	15	33	9
12	16	34	10
13	37	35	11
14	38	36	12
15	39	37	33
16	40	38	34
17	5	39	35
18	6	40	36
19	7	41	21
20	8	42	22
21	29	43	23
22	30	44	24

- Carefully insert the valve between the Inlet and Outlet flanges.
- Line-up, center, and secure the valve between flanges using desired bolts or studs. **DO NOT TIGHTEN BOLTS AT THIS TIME.** Use a marker to number each both head as shown in above Drawing.
- Carefully** fully open the valve to assure free unobstructed disc movement. Disc interference may result when valves are installed in pipelines having smaller than normal inside diameters, such as heavy wall pipe, plastic-lined pipe, as-cast flanges, or reducing flanges. Interference can also occur when connecting directly to a swing check or silent check. Suitable corrective measures must be taken to remove these obstructions, such as taper boring the pipe/flange, installing a spacer or spool piece.
- After proper operation is verified, tighten bolts to the **MINIMUM** recommended bolt torques as shown in Table below. NOTE that the torques are different for lubricated and non-lubricated bolts.
- A multi-stepped process utilizing the cross-over pattern should be used to draw the flanges against the valve from both sides of the valve at the same rate, ensuring the rubber seal face surfaces are compressed evenly. See Drawing above and Sequence Table to left. This should be followed by 2 sets of Chase patterns, alternating from one side of the valve to the other to assure all bolts are evenly torqued.
- Refer to ASME PCC-1 GUIDELINES FOR PRESSURE BOUNDARY BOLTED FLANGE JOINT ASSEMBLY for bolt tightening methodology.
- Pressurize piping to valve and inspect for leakage. If leakage is observed, tighten bolts using cross-over pattern, increasing torque until leakage stops. All bolts must be tightened to the same torque. **DO NOT EXCEED MAXIMUM TORQUES** shown in Table.
- Recommended torques are made without warranty. Installer must verify proper strength bolts for application.

RECOMMENDED BOLT TIGHTENING TORQUES

NON-LUBRICATED BOLTS				LUBRICATED BOLTS			
VALVE SIZE	BOLT SIZE	MINIMUM FT-LBS	MAXIMUM FT-LBS	VALVE SIZE	BOLT SIZE	MINIMUM FT-LBS	MAXIMUM FT-LBS
2"→4"	5/8"	20	60	2"→4"	5/8"	15	40
5"→8"	3/4"	35	110	5"→8"	3/4"	20	60
10"→12"	7/8"	50	160	10"→12"	7/8"	30	90
14"→16"	1"	75	240	14"→16"	1"	45	140
18"→20"	1½"	100	350	18"→20"	1½"	70	200
24"→32"	1¾"	150	500	24"→32"	1¾"	100	300
36"→48"	1½"	240	800	36"→48"	1½"	170	500