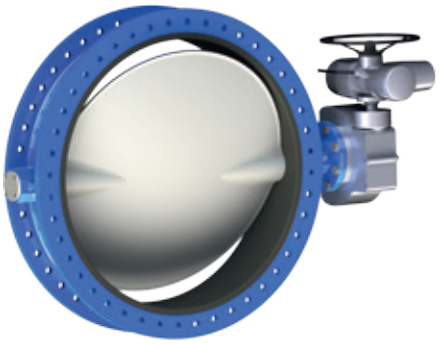
KEYSTONE SERIES GRF RESILIENT SEATED BUTTERFLY VALVES

INSTALLATION AND OPERATION MANUAL

Before installation these instructions must be fully read and understood



Intended valve use

The valve is intended to be used only in applications within the pressure/temperature limits indicated in the P/T diagram of the product manual.
When the valve is used in an end-of-line function, PED Cat-I applications are allowed only. For other categories, please contact the factory.

1 STORAGE AND HANDLING

1.1 Storage

When valves are to be stored for some time (2 months or more) before being fitted, storage should be in the original delivery crates or cases.

1.1.1 Storage conditions

The valves should be stored off the ground in a clean, dry indoor area.
Protect the valve from temperature and humidity extremes, and exposure to excessive dust, moisture, vibration, deformations, sunlight and ozone.

Recommendations

1. Temperature: storage temperature below 25°C (77°F), above 0°C (32°F) preferable below 15°C (59°F).
2. Humidity: storage conditions should be such that condensation does not occur, store in a dry environment. Maximum 50% relative humidity.
3. Light: valve elastomers should be protected from light, in particular direct sunlight or strong artificial light with high ultra violet.
4. Ozone: storage rooms should not contain any equipment generating ozone. E.g. lamps, electric motors.

IMPORTANT

Before valves are installed or used the following actions are recommended.

1. *Valves/parts have to be inspected and thoroughly cleaned if required.*
2. *Elastomer parts need to be greased with silicone grease if not present anymore.*
3. *All surfaces in contact with seats have to be thoroughly cleaned and greased with silicone grease if stored for more than 5 months.*

1.2 Handling

To prevent damage during handling, the valves should be lifted by using appropriate lifting equipment. Do not fasten lifting devices around the valve operating shaft, actuator or through the valve waterway. The valve should be lifted with chains or slings which are fastened to rods or bolts which go through the bolt holes in the body flanges. The valves should be protected from external events e.g. (bumps, hitting and vibration) during transport.
Any flange protection caps need to be removed before the valve is mounted in the pipeline.
Lift the valve with great care from the transport package (crate, pallet). While handling or installing the valve, ensure that no damage occurs to the valve, the pneumatic/electrical/-hydraulic actuator or other instrumentation.

2 SPARE PARTS

Only original Keystone spare parts are allowed to be used. Safe operation cannot be guaranteed if third party spare parts are used.

3 INSTALLATION

WARNING!

For safety reasons, it is important to take the following precautions before you start work on the valve:

1. *Personnel making any adjustments to the valves should utilize suitable equipment. All required personal protection means should be worn.*
2. *The line must be depressurized before installing the valve.*
3. *Installation and handling of valves should be done only by personnel who are trained in all aspects of manual and mechanical handling techniques.*
4. *Misuse of the valve is not allowed. For example: the valve, handles, actuators or other parts may not be used as 'climbing tools'.*
5. *Ensure that valve pressure/temperature limitations marked on the identification tag are within the service conditions. The trim number on the valve's nameplate identifies the valve materials. See Product Manual for valve specific P/T diagram and trim number definition.*
6. *Ensure that valve materials are compatible with the pipeline fluid.*

3.1 Visual valve inspection

1. Confirm that the materials of construction listed on the valve nameplate are appropriate for the service intended and are as specified.
2. Tag/name plate identification
   Manufacturer: Keystone
   Model: Series GRF
   Nominal size: DN or NPS
   M.P.W.P.: maximum permissible working pressure
   Flange compatibility: e.g. ASME 125/150 PN 10/16
   Temperature: e.g. -28/120°C (-18/250°F)
   Trim: Materials of construction

3.2 Flange and pipe compatibility

Check matching of flange drilling pattern of valve and pipe before assembly.
Flanges have to meet the following requirements (see Figure 1):

- The face inside diameter should be:
  D min.: The valve Q-dimension + adequate disc clearance.
  D max.: The optimum inside diameter (ID) is equal to the inside diameter of flange standard EN 1092-1, table 8, type 11 or ASME B16.5, table 8, Weld Neck, dimensions B. For larger than D max inside diameters or other flange types please contact your local Emerson Sales organization, as larger inside diameters might result in reduced valve functionality.
- If the flange (or pipe) is provided with a raised face, the diameter of this shall be at least 8 mm larger than the YY-dimension of the valve.

The use of the flange-gaskets is not allowed since it might damage the valve.
The Keystone seat-face design eliminates the need for the gaskets.
Use flange bolting in accordance with appropriate standard.

Do not use flange gaskets, as this could lead to valve damage!

3.3 Valve installation

The valves are bi-directional and may be installed in either direction relative to the flow. The valve will control flow equally in either direction.
For valve sizes DN 600-1000 (NPS 24-40) the recommended installation position is shaft horizontal and the lower disc edge opening down-stream. (Especially for slurry service and media with a tendency for sedimentation). Valves can be purchased with an option for vertical shaft installation. Valves DN 1050 (NPS 42) and above must be installed with the shaft in horizontal position.
For optimum valve control and smooth performance, it is recommended to have a 10 to 20 pipe diameters of straight run inlet piping and 3 to 5 pipe diameters straight outlet piping. A valve is not a crow-bar. Do not use the valve to spread the flanges. Seat damage might result.

NOTES

- The valve can be installed in the pipe-line either with or without the actuator mounted on top of the valve. Make sure to turn the disc slowly in the event there is a mismatch causing the disc to touch the adjacent piping.
- It is the responsibility of the valve user and not the valve manufacturer to ensure that the pipeline system has been built professionally and the valve has been properly installed.
- Adjacent piping must be positioned so that minimal piping stresses are transmitted to the valve flanges during or after installation.
- Handling and lifting of the valves during installation MUST be performed following the same instructions described in previous section '1.2 Handling'.

IMPORTANT

Mating flange faces should be in good condition and free of dirt and/or inclusions and pipe insides should be well cleaned.

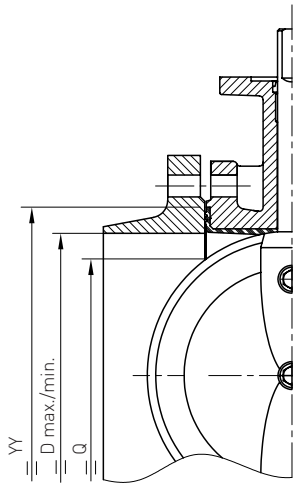


FIGURE 1

3.3.1 Existing system (see Figure 2)

1. Check whether the flange distance meets the valve face-to-face dimensions. Spread the flanges with adequate tooling for easy insertion of the valve.
2. Close the valve so that the disc edge is at least 10 mm (⅜") within the body.
3. Insert the valve between the flanges, center the valve body and insert all flange bolts. Tighten the flange-bolts hand tight.
4. Slowly open the valve completely. (The disc is in line with parallel flats or keyway in shaft head. Keyway points towards disc edge).
5. Maintain the valve flange alignment while gradually removing the flange-spreaders and tighten the flange-bolts hand tight.
6. Slowly close and open the valve to check for adequate disc clearance.
7. Cross-tighten all bolting to the proper torque. Do not over tighten.

3.3.2 New system (see Figure 2)

1. With the disc in the near-closed position, center each mating flange with the valve body. Fix the body with some flange-bolts and tighten the bolts.
2. Use the flange-valve-flange assembly for fit-up and centering to the pipe.
3. Tack-weld the flanges to the pipe.
4. Remove the bolting and remove the valve from between the flanges.

IMPORTANT

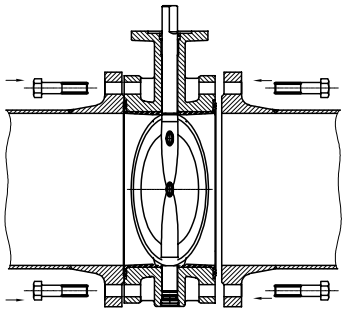
Do not finish-weld the flanges to the pipe with the valve bolted between the flanges as this will result in serious heat-damage to the seat.

5. Finish-weld the flanges to the pipe and allow the flanges to cool completely.
6. Install the valve now according to the procedure for installing in existing systems.

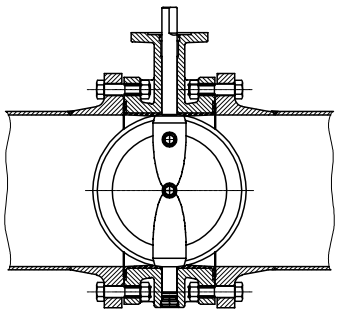
3.4 Valve verification

Check the operation of the valve by operating it to 'full open' and 'full close'. To verify the valve operation, the disc position indicator on the actuator or the handle should rotate between the 'full open' and 'full close' indicators on the actuator or throttle plate. For normal installation the valve disc travels clockwise to close.

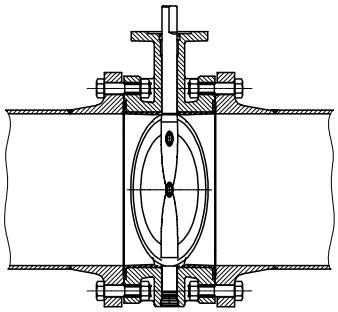
EXISTING SYSTEM



1. Spread the flanges with the adequate tooling. Insert some flange bolts to hold the valve.

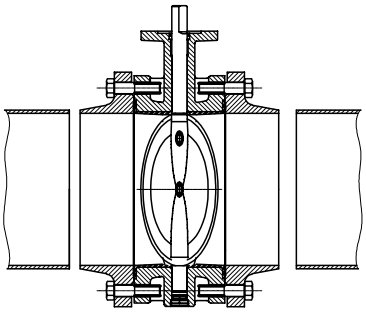


2. Open the valve and remove the flange spreads.

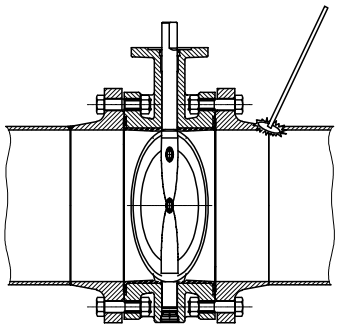


3. Close the valve clockwise, return to open position and cross-tighten all bolting.

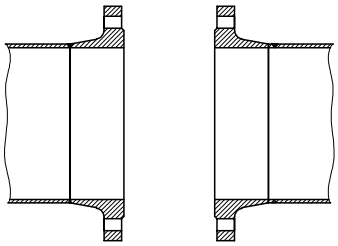
NEW SYSTEM



1. Center a flange-valve-flange assembly between the pipes.



2. Tack weld the flanges to the pipes.



3. Remove the valve and finish weld. Install the valve according to the procedure in the left column.

FIGURE 2

3.5 Sources of possible danger
This section contains some examples of possible foreseen danger sources.

3.5.1 Mechanical
A. When manual operators are used, available space should be checked in order to avoid hands being clamped.
B. Mechanical sparks caused on impact of valve and e.g. tooling, are a potential source of ignition of surrounding atmosphere.

3.5.2 Electrical
If static charges or stray electrical currents can initiate explosions, the valve should be grounded to earth.

3.5.3 Thermal
A. Isolation should be used on valves with application temperatures > +40°C (+104°F) and < -20°C (-4°F) to prevent them from being touched (to avoid burning).
B. If the valve is used in hot gas/fluid applications that might give exothermic reactions, precautions must be taken so that the valve surface cannot lead to danger for people or the direct environment. In dust and possible explosion zones, the operation temperatures and ignition temperatures for dust should be reviewed.

3.5.4 Operational
Closing a valve too fast may result in water hammer in the upstream part of the pipeline. Water hammer results in excessive stresses in the valve and will cause severe damage. Water hammer should be avoided in all circumstances.
Due to differential pressure across the valve disc, butterfly valves have the tendency to be closed by the flow. This is called 'dynamic torque'. Take care when unlatching the valve operating mechanism. The valve might be closed by the dynamic torque created by the flow.

4 MAINTENANCE

WARNING!
Depressurize and, if necessary in case of dangerous fluids, drain the line and flush with appropriate cleaning fluid before starting any maintenance. Failure to do so may cause serious personal injury and/or equipment damage.
Before disassembling the valve, ensure the valve has been decontaminated correctly from any harmful gasses or liquids and that it is within a safe temperature range for handling.
Personnel making any adjustments to the valves should utilize suitable equipment. All required personal protection means should be worn.
We recommend that personnel should be trained in all aspects of these instructions before carrying out handling of any valve.

4.1 Routine maintenance
The Keystone Series GRF butterfly valves are designed to require a minimum of maintenance.
Routine maintenance or lubrication is not required, we recommend periodic (visual) inspection to ensure satisfactory operation and sealing to the environment.

4.2 Removing the valve from the pipe system
1. Turn the disc to nearly closed position. (The disc is in line with the keyway in the shaft).
2. Secure the valve with proper lifting equipment and loosen all flange bolts and remove the bolts, which prevent removing of the valve.
3. Spread the flanges with adequate tooling, and remove the valve.

3.6 TROUBLESHOOTING GUIDE

Symptom	Possible cause	Resolution
Valve would not rotate	1. Actuator has failed	1. Replace or repair
	2. Valve packed with debris	2. Flush or clean valve to remove debris
Valve leaking	1. Valve not fully closed	1. Close valve, check actuator stop settings
	2. Debris trapped in valve	2. Cycle and flush (with valve open) to remove debris
	3. Seat is damaged	3. Replace seat
Jerky operation	1. Extreme dry application	1. Put some silicone oil on seat or increase size of actuator
	2. Air supply actuator inadequate	2. Increase air supply pressure and/or volume

SERIES GRF DN 600 - 1000 (NPS 24 - 40)

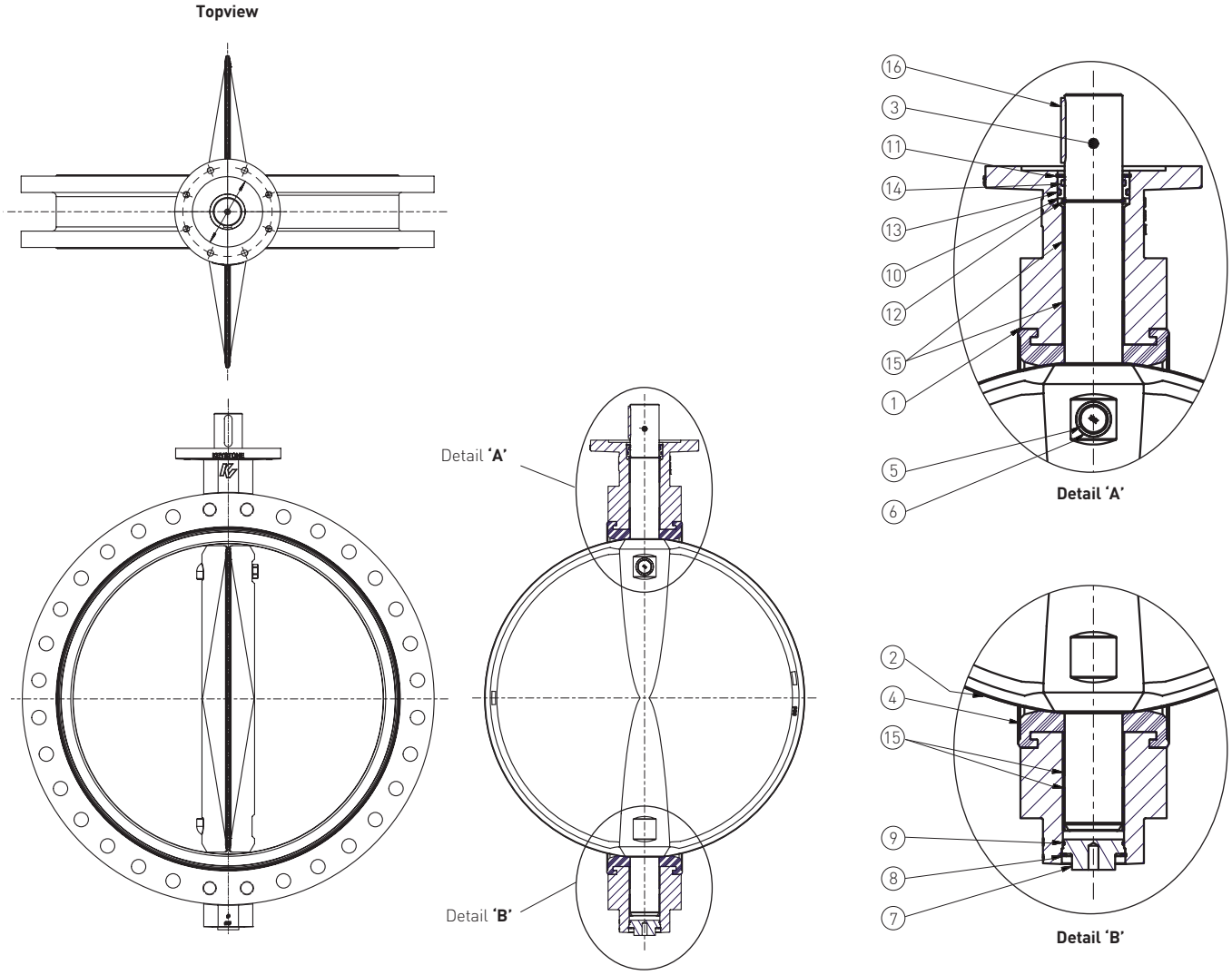


FIGURE 3

PARTS LIST

Item	Description	Item	Description
1	Body	9	Plug O-ring
2	Disc	10	Bushing
3	Shaft	11	Body circlip
4	Seat	12	Shaft circlip
5	Disc screw	13	Body O-ring
6	Disc screw O-ring	14	Shaft O-ring
7	Plug	15	Bearing
8	Plug circlip	16	Parallel key

DN 1050 - 1800 (NPS 42 - 72)

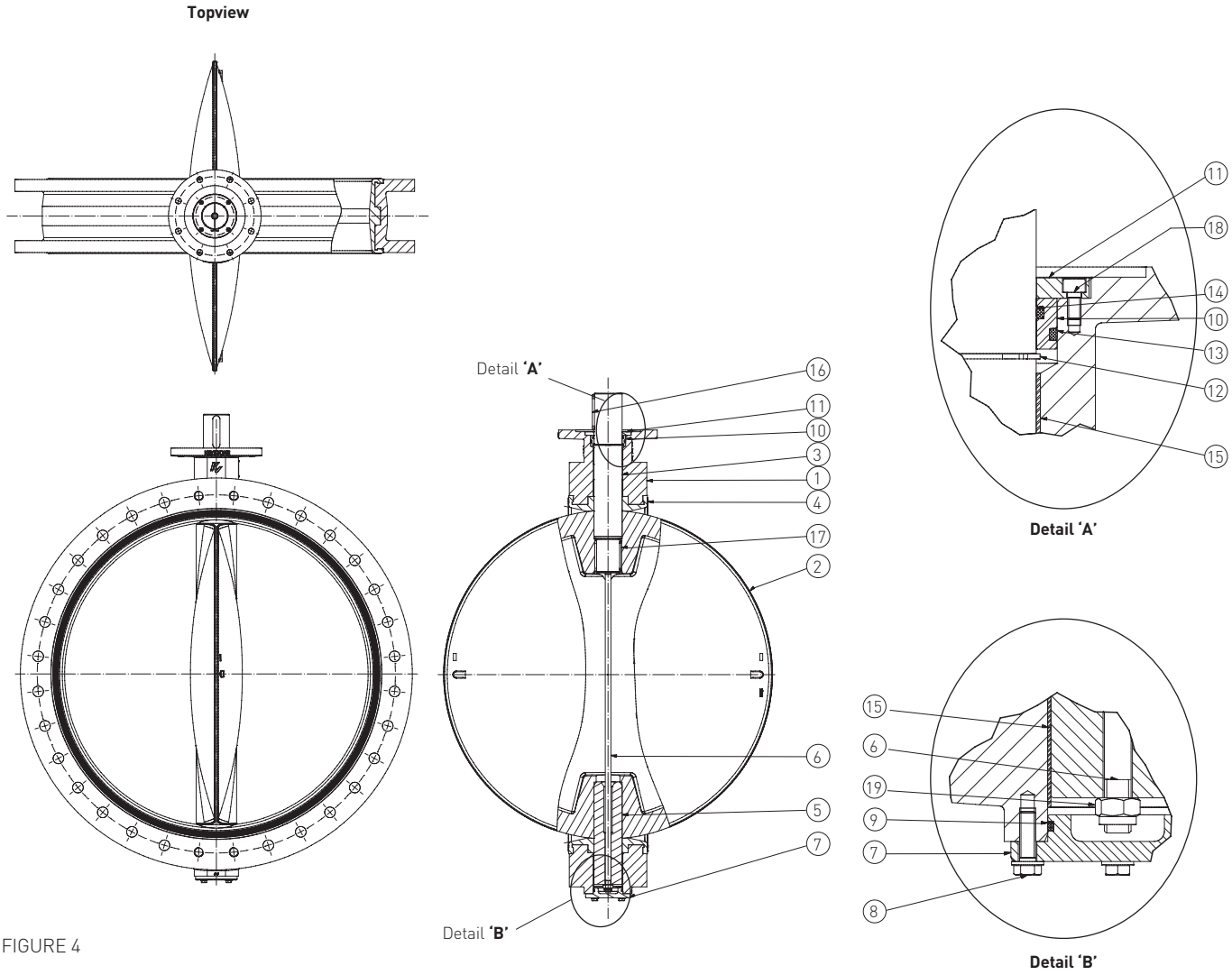


FIGURE 4

PARTS LIST

Item	Description	Item	Description
1	Body	11	Bushing cover
2	Disc	12	Shaft circlip
3	Shaft	13	Body O-ring
4	Seat	14	Shaft O-ring
5	Bottom shaft	15	Bearing
6	Through bolt	16	Parallel key
7	Bottom cover	17	Parallel key disc shaft
8	Bottom cover screw	18	Bushing cover screw
9	Bottom cover O-ring	19	Lock nut
10	Bushing		

4.3 Valve disassembly (see Figure 3)
DN 600-1000 (NPS 24-40)

1. Turn the disc to almost open position.
2. Remove actuator.
3. Remove the disc screw with the O-ring from the disc.
4. Remove the circlip from the top of the body.
5. Remove circlip from the bottom body plug and pull the plug out of the body.
6. Remove the O-ring from the plug.
7. Pull the shaft out of the body.
8. Remove the bushing, shaft seals and circlip from the top of the shaft.
9. Remove the disc by pulling or 'rolling' out of the seat bore.
10. Remove the seat from the body: pry under both seat edges at one point, collapse the seat into the shape of a round bottom heart configuration and pull the seat out of the body bore.
11. Remove bearings from shaft bores.

DN 1050-1800 (NPS 42-72) (see Figure 4)

1. Place valve horizontal on supports. Turn the disc to full open position.
2. Dismount the actuation.
3. Remove screws from bushing cover on dive side. Screws type DIN912 M8, socket 6. Remove bushing cover.
4. Remove bolts form bottom cover. Bolts type hexagon head DIN933 M12 SW19. Remove the bottom cover from body. Remove O-ring from cover.
5. Remove lock nut from through bolt (hexagon head M20 SW30).
6. Pull the drive shaft with the through bolt out of body. If required use the threaded hole in shaft to pull. Support the disc and shafts during removal. Together with the drive shaft the bushing will be removed from the body.
7. Remove bushing and circlip from shaft. Remove O-rings from bushing.
8. Remove the bottom shaft. If necessary the shaft can be pushed out with the help of a bar through the drive shaft hole.
9. Lift the disc out of the seat and body.
10. Pull the lip of the seat out of the groove and deform the seat to the shape of a heart. Remove the seat from the body.
11. Remove the bearings from the body.

4.4 Valve assembly (see Figure 3)
DN 600-1000 (NPS 24-40)

1. Clean all parts.
2. Fit bearings into shaft bores (2 bearings are to be installed close to the bore of the body and 2 bearings at the outer ends of the shaft bores).
3. Collapse the seat in the shape of a round bottom heart firmly place the 'bottom' part of the seat into position in the body. Align the holes in the seat properly with the holes in the body.
4. Fit the shaft circlip to the groove in the shaft.
5. Insert the shaft with sufficient (silicone) grease so that it protrudes approximately 10 mm (⅜") into the inside bore of the seat. Install the disc, with the disc screw holes toward the valve top-plate, by inserting the disc in the seat with the shaft bore on the topside against the shaft, leaving the bottom part of the disc just outside the seat. Push the bottom part of the disc in place with a twisting motion.
6. Insert the shaft completely using a rotating pressure on the shaft, and a rotating motion on the disc. Pay special attention in order that the seat is not damaged due to any misalignment of shaft holes.
7. Align the counter-drilled position of the shaft with the disc screw hole. Place the O-ring on the disc screw. Apply thread locking compound around disc screw thread. Install the disc screw and tighten securely. (See Table 1 for suggested tightening torques)
8. Place the O-ring onto the bottom plug. Place the plug into the body and position it with a circlip.
9. Place the shaft seals on the inside and outside of the bushing then fit it over the top of the shaft and into the top of the body. Retain it in place with the circlip body.
10. Mount the actuator.

TABLE 1 - RECOMMENDED DISC SCREW TIGHTENING TORQUES

Valve size	Valve size	Tightening torques	
DN	**NPS**	**Nm**	**ft•lbs**
600-800	24-32	470	346
900	36	1270	937
1000	40	1650	1216

DN 1050-1800 (NPS 42-72) (see Figure 4)

1. Place valve horizontal on supports.
2. Place bearings in the shaft hole of the body using an assembly tool aligning the bearing split perpendicular to the flow direction. Place splits of the different (2 x 2) bearings on opposite sides.
3. Tilt the seat into the body. Start at the top side and work gradually towards left and right, press the seat in to the groove ending at the bottom shaft. First the hole for the drive shaft needs to be correct in line with the body. Then line up the bottom shaft hole by pulling the seat from the middle of the body.
4. Grease the seat along the disc edge and the shaft holes.
5. Clean and inspect shafts. Check if all edges are rounded and/or broken (deburred). Add circlip DIN471 to drive shaft.
6. Check disc edge for surface scratches/ damages etc. Grease the disc edge.
7. Lower the disc, using a lift frame or adequate hoisting tools, in the body with the heat number of the disc looking from the drive shaft on the left side of the disc.
8. Align the shaft holes of the disc with the shaft holes in the body using a precursor. Than place the bottom shaft, take caution inserting through the seat
9. Assemble the through bolt in the drive shaft. Insert the drive shaft in the body. The marking on the drive shaft should be in line with the disc edge. And the key way in the shaft should face up. Take caution protruding the shaft through the seat.
10. Next press the shaft through the seat and into the disc. Add the nut to the through bolt and tighten with appropriate torque. Tightening torque on nut DIN985 M20 steel 8.8 is 390 Nm (288 ft. lbs).
11. Assemble the O-rings on the bushing using silicon grease. Place bushing in the body. Place bushing cover and screws DIN912 M8, socket 6.
12. Assemble O-ring on bottom cover using silicon grease. Assemble bottom cover in body chamber. Bolt bottom cover to body with bolts DIN933 M12, hexagon head SW19.
13. Remount the actuation.
14. Test the valve.

4.5 Re-installing the valve

See section 3.3.1

FIGURE 5

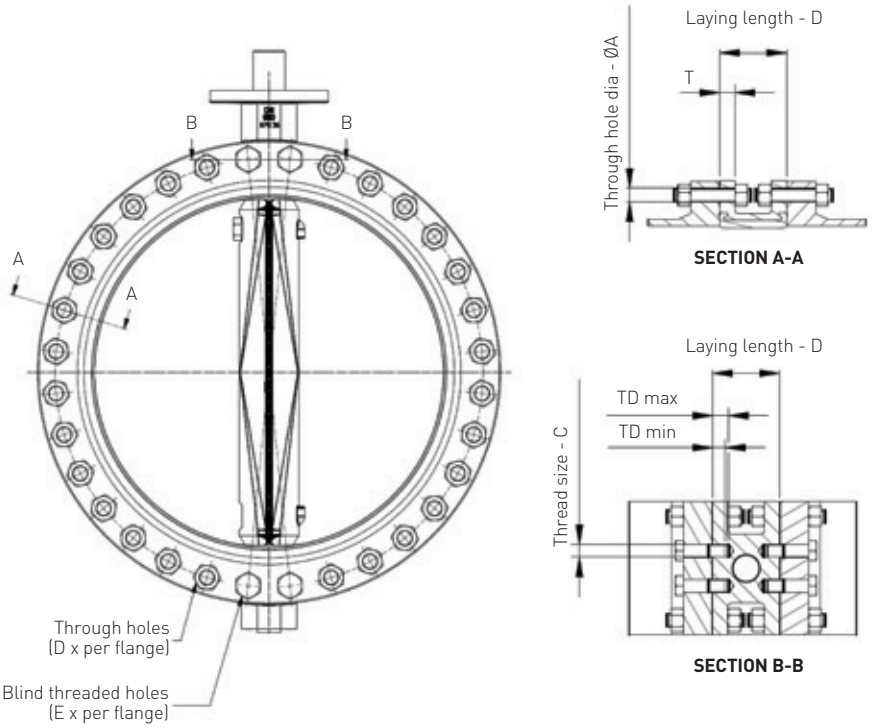


TABLE 2 - BOLTING INFORMATION - DN 600-700 (NPS 24-28) continued next pages

			D	ØA	T	E	C	TD max	TD min
DN (NPS)	**Flange drilling standard**	**Rating**	**Total number of through holes**	**Through hole diameter**	**Flange thickness**	**Number of blind threaded holes**	**Thread size blind holes**	**Thread depth max**	**Minimum insert length bolt**
600	EN 1092-2	PN10	16	31	41	4	M27x3	34	27
(24)	ISO 2084	PN10	16	31	41	4	M27x3	34	27
	ASME B16.5	cl.150	16	34.9	41	4	1¼"-8UN	40	32
	ASME B16.1	cl.125	16	34.9	41	4	1¼"-8UN	40	32
	AWWA C207	table B/D/E	16	34.9	41	4	1¼"-8UN	40	32
	MSS SP44	cl.150	16	34.9	41	4	1¼"-8UN	40	32
	JIS B2210	10K	20	33	41	4	M30x3.5	38	30
	JIS B2210	5K	16	27	41	4	M24x3	30	24
	AS2129	D	12	30	41	4	M27x3	34	27
	AS4087	PN16	12	30	41	4	M27x3	34	27
	AS2129	E	12	33	41	4	M30x3.5	38	30
700	EN 1092-2	PN10	20	31	39.5	4	M27x3	34	27
(28)	ISO 2084	PN10	20	31	39.5	4	M27x3	34	27
	ASME B16.47A	cl.150	24	35	39.5	4	1¼"-8UN	40	32
	AWWA C207	table B/D/E	24	35	39.5	4	1¼"-8UN	40	32
	MSS SP44	cl.150	24	34.9	39.5	4	1¼"-8UN	40	32
	JIS B2210	10K	20	33	39.5	4	M30x3.5	38	30
	JIS B2210	5K	20	27	39.5	4	M24x3	30	24
	AS2129	D	16	30	39.5	4	M27x3	34	27
	AS4087	PN16	16	30	39.5	4	M27x3	34	27
	AS2129	E	16	33	39.5	4	M30x3.5	38	30

NOTES

1. All dimensions in mm
2. Rows in bold: all holes are threaded holes

TABLE 2 - BOLTING INFORMATION - DN 750-1000 (NPS 30-40) continued

				D	ØA	T	E	C	TD max	TD min
DN (NPS)	**Flange drilling standard**	**Rating**		**Total number of through holes**	**Through hole diameter**	**Flange thickness**	**Number of blind threaded holes**	**Thread size blind holes**	**Thread depth max**	**Minimum insert length bolt**
750	ISO 2084	PN10		20	33	43	4	M30x3.5	38	30
(30)	ASME B16.1	cl.125		24	34.9	43	4	1¼"-8UN	40	32
	ASME B16.47A	cl.150		24	34.9	43	4	1¼"-8UN	40	32
	AWWA C207	table B/D/E		24	34.9	43	4	1¼"-8UN	40	32
	MSS SP44	cl.150		24	34.9	43	4	1¼-8UN	40	32
	JIS B2210	10K		20	33	43	4	M30x3.5	38	30
	JIS B2210	**5K**	**O**	**20**	**M30x3.5**	**43**	**4**	**M30x3.5**	**38**	**30**
	AS2129	D		16	33	43	4	M30x3.5	38	30
	AS4087	PN16		16	33	43	4	M30x3.5	38	30
	AS2129	E		16	36	43	4	M33x3.5	40	33
800	EN 1092-2	PN10		20	34	43	4	M30x3.5	38	30
(32)	ISO 2084	PN10		20	34	43	4	M30x3.5	38	30
	ASME B16.47A	cl.150		24	41.1	43	4	1½"-8UN	48	38
	AWWA C207	table B/D/E		24	41.1	43	4	1½"-8UN	48	38
	MSS SP44	cl.150		24	41,1	43	4	1½"-8UN	48	38
	ASME B16.47B	**cl.150**	**O**	**44**	**22.2**	**43**	**4**	**¾"-8UNC**	**24**	**19**
	JIS B2210	10K		24	33	43	4	M30x3.5	38	30
	JIS B2210	**5K**	**O**	**24**	**33**	**43**	**4**	**M30x3.5**	**38**	**30**
	AS2129	D		16	36	43	4	M33x3.5	40	33
	AS4087	PN16		16	36	43	4	M33x3.5	40	33
	AS2129	E		16	36	43	4	M33x3.5	40	33
900	EN 1092-2	PN10		24	34	46.5	4	M30x3.5	37.5	30
(36)	ISO 2084	PN10		24	34	46.5	4	M30x3.5	37.5	30
	ASME B16.1	cl.125		28	41.3	46.5	4	1½-8UN	48	38
	ASME B16.47A	cl.150		28	41.3	46.5	4	1½-8UN	48	38
	AWWA C207	table B/D/E		28	41.3	46.5	4	1½-8UN	48	38
	MSS SP44	cl.150		28	41.1	46.5	4	1½-8UN	48	38
	ASME B16.47B	**cl.150**	**O**	**40**	**⅞"-8UNC**	**46.5**	**4**	**⅞"-8UNC**	**28**	**22**
	JIS B2210	10K		24	33	46.5	4	M30x3.5	37.5	30
	JIS B2210	**5K**	**O**	**20**	**M30x3.5**	**46.5**	**4**	**M30x3.5**	**38**	**30**
	AS2129	D		20	36	46.5	4	M33x3.5	41.25	33
	AS4087	PN16		20	36	46.5	4	M33x3.5	41.25	33
	AS2129	E		20	36	46.5	4	M33x3.5	41.25	33
1000	EN 1092-2	PN10		24	37	50	4	M33x3.5	40	33
(40)	ISO 2084	PN10		24	37	50	4	M33x3.5	40	33
	ASME B16.47A	cl.150		32	41.1	50	4	1½"-8UN	48	38
	AWWA C207	table B/D/E		32	41.1	50	4	1½"-8UN	48	38
	MSS SP44	cl.150		32	41.1	50	4	1½"-8UN	48	38
	ASME B16.47B	**cl.150**	**O**	**40**	**1"-8UN**	**50**	**4**	**1"-8UN**	**32**	**25**
	JIS B2210	10K		24	39	50	4	M36x4	45	36
	JIS B2210	**5K**	**O**	**24**	**M30x3.5**	**50**	**4**	**M30x3.5**	**38**	**30**
	AS2129	D		20	36	50	4	M33x3.5	40	33
	AS4087	PN16		20	36	50	4	M33x3.5	40	33
	AS2129	E		20	39	50	4	M36x4	45	36

NOTES

1. All dimensions in mm
2. Rows in bold: all holes are threaded holes

TABLE 2 - BOLTING INFORMATION - DN 1050-1500 (NPS 42-60) continued

				D	ØA	T	E	C	TD max	TD min
DN (NPS)	**Flange drilling standard**	**Rating**		**Total number of through holes**	**Through hole diameter**	**Flange thickness**	**Number of blind threaded holes**	**Thread size blind holes**	**Thread depth max**	**Minimum insert length bolt**
1050	ASME B16.47A	cl.150		36	41.1	42.5	4	1½"-8UN	43	38
(42)	ASME B16.1	cl.125		36	41.1	42.5	4	1½"-8UN	43	38
	AWWA C207	table B/D/E		36	41.1	42.5	4	1½"-8UN	43	38
	MSS SP44	cl.150		36	41.1	42.5	4	1½"-8UN	43	38
1100	EN 1092-2	PN10		32	37	42.5	4	M33x3.5	42.5	33
(44)	ISO 2084	PN10		32	37	42.5	4	M33x3.5	42.5	33
	ASME B16.47A	cl.150		40	41.1	42.5	4	1½"-8UN	42.5	38
	AWWA C207	table B/D/E		40	41.1	42.5	4	1½"-8UN	42.5	38
	MSS SP44	cl.150		40	41.1	42.5	4	1½"-8UN	42.5	38
	ASME B16.47B	**cl.150**	**O**	**52**	**1"-8UN**	**42.5**	**4**	**1"-8UN**	**42.5**	**25**
	JIS B2210	10K		28	39	42.5	4	M36x4	42.5	36
	JIS B2210	**5K**	**O**	**28**	**M30x3.5**	**42.5**	**4**	**M30x3.5**	**42.5**	**30**
1200	EN 1092-2	PN10		32	41	45	4	M36x4	45	36
(48)	ISO 2084	PN10		32	41	45	4	M36x4	45	36
	ASME B16.1	cl.125		44	41.1	45	4	1½"-8UN	45	38
	ASME B16.47A	cl.150		44	41.1	45	4	1½"-8UN	45	38
	AWWA C207	table B/D/E		44	41.1	45	4	1½"-8UN	45	38
	MSS SP44	cl.150		44	41.1	45	4	1½"-8UN	45	38
	ASME B16.47B	**cl.150**	**O**	**44**	**1¼"-8UN**	**45**	**4**	**1¼"-8UN**	**45**	**32**
	JIS B2210	10K		32	39	45	4	M36x4	45	36
	JIS B2210	**5K**	**O**	**32**	**M30x3.5**	**45**	**4**	**M30x3.5**	**45**	**30**
	AS2129	D		32	36	45	4	M33x3.5	45	33
	AS4087	PN16		32	36	45	4	M33x3.5	45	33
	AS2129	E		32	39	45	4	M36x4	45	36
1350	ASME B16.47A	cl.150		44	47.6	46	4	1¾"-8UN	46	44
(54)	ASME B16.1	cl.125		44	50.8	46	4	1¾"-8UN	46	44
	AWWA C207	table B/D/E		44	47.6	46	4	1¾"-8UN	46	44
	MSS SP44	cl.150		44	47.6	46	4	1¾"-8UN	46	44
	ASME B16.47B	**cl.150**	**O**	**56**	**1⅛"-8UN**	**46**	**4**	**1⅛"-8UN**	**46**	**32**
	JIS B2210	10K		36	45	46	4	M42x4	46	42
	JIS B2210	**5K**	**O**	**32**	**M30x3.5**	**46**	**4**	**M30x3.5**	**46**	**30**
1400	EN 1092-2	PN10		36	44	46	4	M39x4	46	39
(56)	ISO 2084	PN10		36	44	46	4	M39x4	46	39
	ASME B16.47A	cl.150		48	47.6	46	4	1¾"-8UN	46	45
	MSS SP44	cl.150		48	47.7	46	4	1¾"-8UN	46	45
	ASME B16.47B	**cl.150**	**O**	**60**	**1⅛"-8UN**	**46**	**4**	**1⅛"-8UN**	**46**	**32**
	AS2129	D		36	36	46	4	M33x3.5	46	33
	AS4087	PN16		36	36	46	4	M33x3.5	46	33
1500	EN 1092-2	PN10		36	44	47.5	4	M39x4	47	39
(60)	ISO 2084	PN10		36	44	47.5	4	M39x4	47	39
	ASME B16.1	cl.125		52	50.8	47.5	4	1¾"-8UN	47	45
	ASME B16.47A	cl.150		52	47.6	47.5	4	1¾"-8UN	47	45
	AWWA C207	table B/D/E		52	47.6	47.5	4	1¾"-8UN	47	45
	MSS SP44	cl.150		52	47.6	47.5	4	1¾"-8UN	47	45
	ASME B16.47B	**cl.150**	**O**	**52**	**1½"-8UN**	**47.5**	**4**	**1½"-8UN**	**47**	**38**
	JIS B2210	10K		40	39	47.5	4	M42x4	47	42
	JIS B2210	**5K**	**O**	**36**	**M30x3.5**	**47.5**	**4**	**M30x3.5**	**47**	**30**

NOTES

1. All dimensions in mm
2. Rows in bold: all holes are threaded holes

TABLE 2 - BOLTING INFORMATION - DN 1600-1800 (NPS 64-72) continued

			D	ØA	T	E	C	TD max	TD min
DN (NPS)	**Flange drilling standard**	**Rating**	**Total number of through holes**	**Through hole diameter**	**Flange thickness**	**Number of blind threaded holes**	**Thread size blind holes**	**Thread depth max**	**Minimum insert length bolt**
1600	EN 1092-2	PN10	40	50	49	4	M45x4,5	49	45
(64)	ISO 2084	PN10	40	50	49	4	M45x4,5	49	45
	AS2129	D	40	39	49	4	M36x4	49	36
1650 (66)	AWWA C207	table B/D/E	52	50.8	50	4	1¾"-8UN	50	45
1800	EN 1092-2	PN10	44	50	52	4	M45x4	52	45
(72)	ISO 2084	PN10	44	50	52	4	M45x4	52	45
	ASME B16.1	cl.125	60	50.8	52	4	1¾"-8UN	52	45
	AWWA C207	table B/D/E	60	50.8	52	4	1¾"-8UN	52	45
	AS2129	D	44	50	52	4	M39x4	52	39
	AS4087	PN16	44	50	52	4	M39x4	52	39

NOTES

1. All dimensions in mm
2. Rows in bold: all holes are threaded holes