
McCANNALOK SERIES

HIGH PERFORMANCE BUTTERFLY VALVE

Installation, Operation and Maintenance Manual

ASME Pressure Class

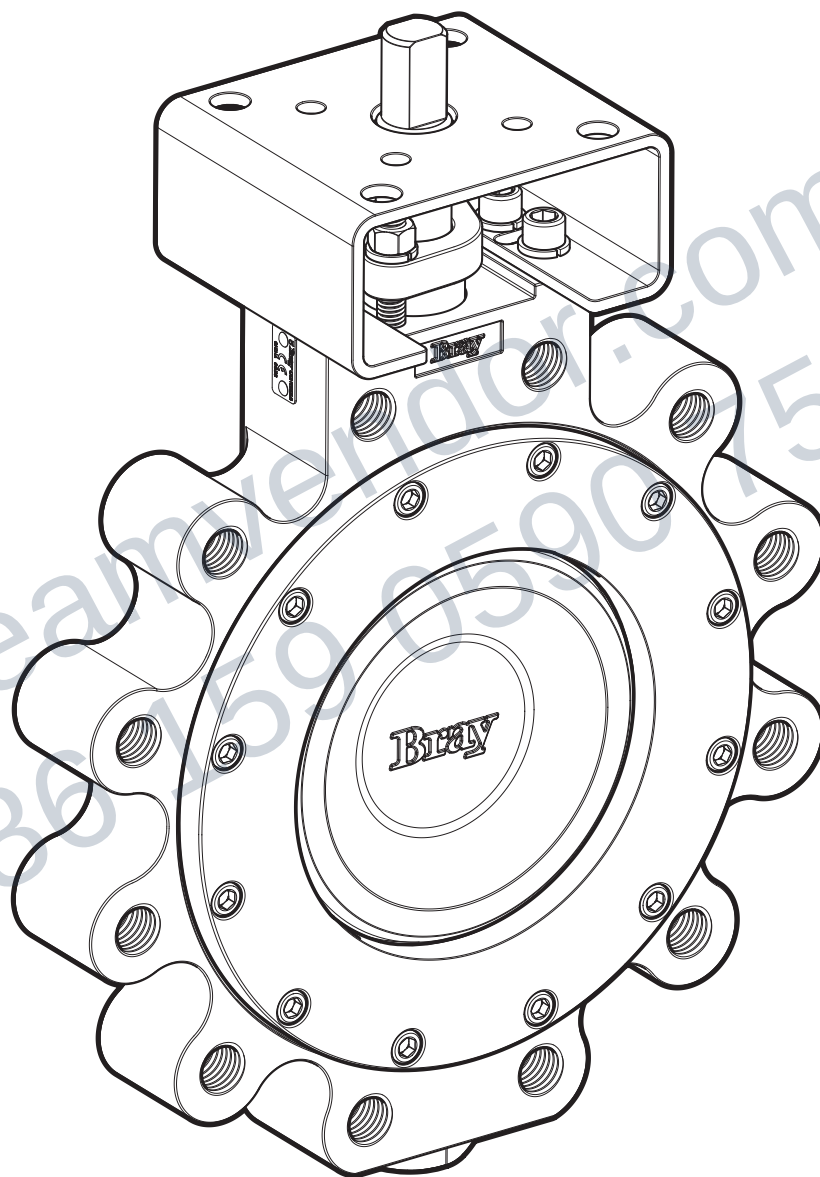


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For information on this product and other Bray products please visit us at our web page - www.bray.com.



**READ AND FOLLOW THESE INSTRUCTIONS CAREFULLY.
SAVE THIS MANUAL FOR LATER USE.**

1.0 DEFINITION OF TERMS

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

Used without the safety alert symbol, indicates a potential situation which, if not avoided, may result in an undesirable result or state, including property damage.

2.0 INTRODUCTION

2.1 The McCannalok high performance butterfly valve combines the advantages of trunnion type ball valves with the easy operation, light weight and low cost of butterfly valves. One basic design is suitable for a wide range of services, including oxygen, hydrogen, chlorine, sour gas, vacuum and steam applications.

2.2 Features Include:

Bubble tight shutoff provided throughout a wide range of operating conditions.

Suitable for both modulating and on/off services, the McCannalok butterfly valve is easily automated with your choice of manual operators, electric and pneumatic actuators, positioners and controls.

The McCannalok is available in a Fire Safe model qualified to API 607 and BS 6755 Part 2.

The McCannalok is also available in a Metal Seated model providing IEC 60534-4 Class IV bidirectional leakage rates through full pressure range.

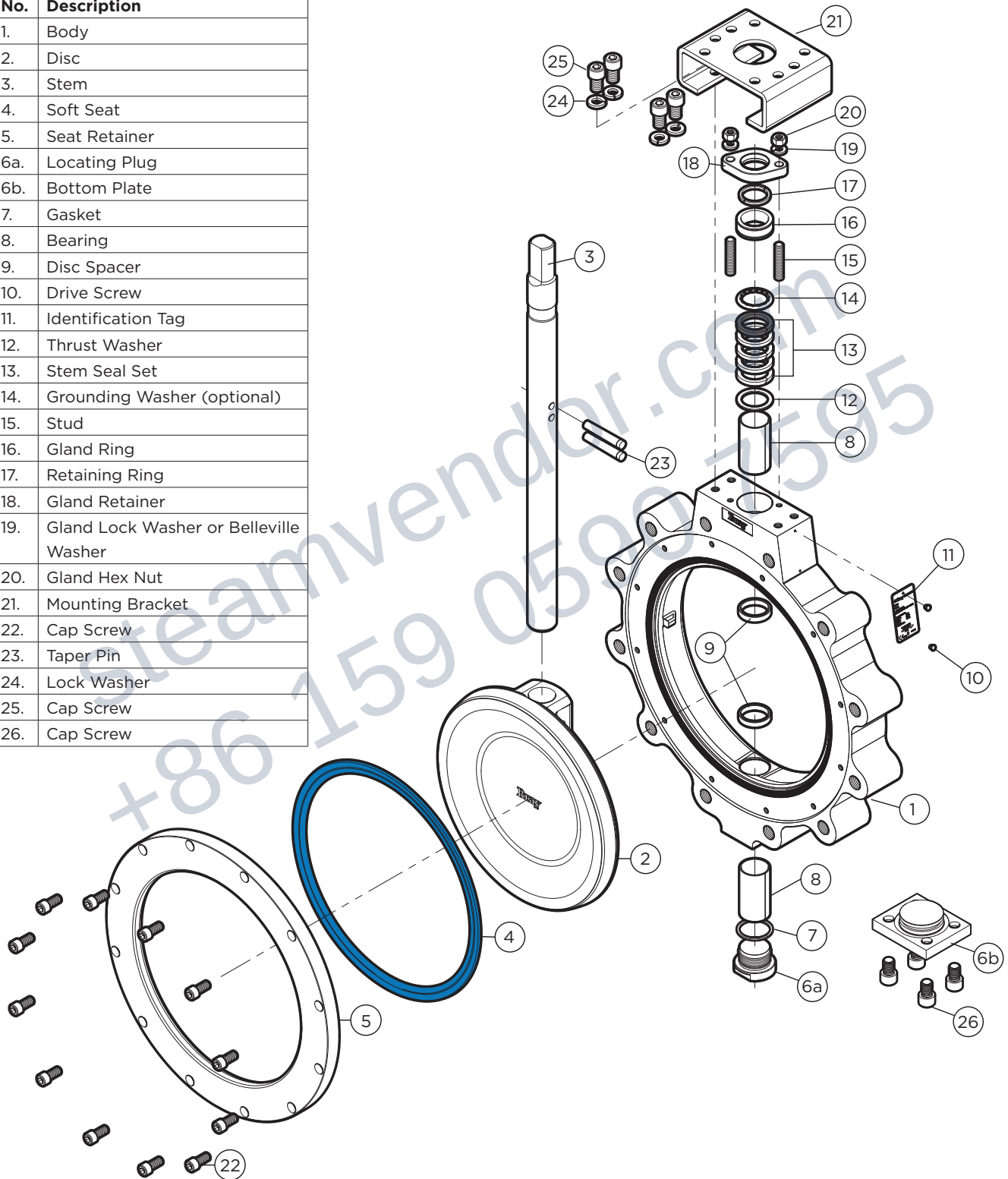
The McCannalok High Cycle configuration provides longer service life than the standard McCannalok valve and is suitable for applications including hydrogen, nitrogen, water, and other clean medias. High cycle performance is dependent on process temperature, pressure, and line media.

2.3 For additional information about McCannalok butterfly valves – including application data, engineering specifications and actuator selection visit www.bray.com or contact your Bray distributor or sales representative.

For additional information on certification documentation (PED, CE, etc.) please visit www.bray.com or contact your local Bray sales representative.

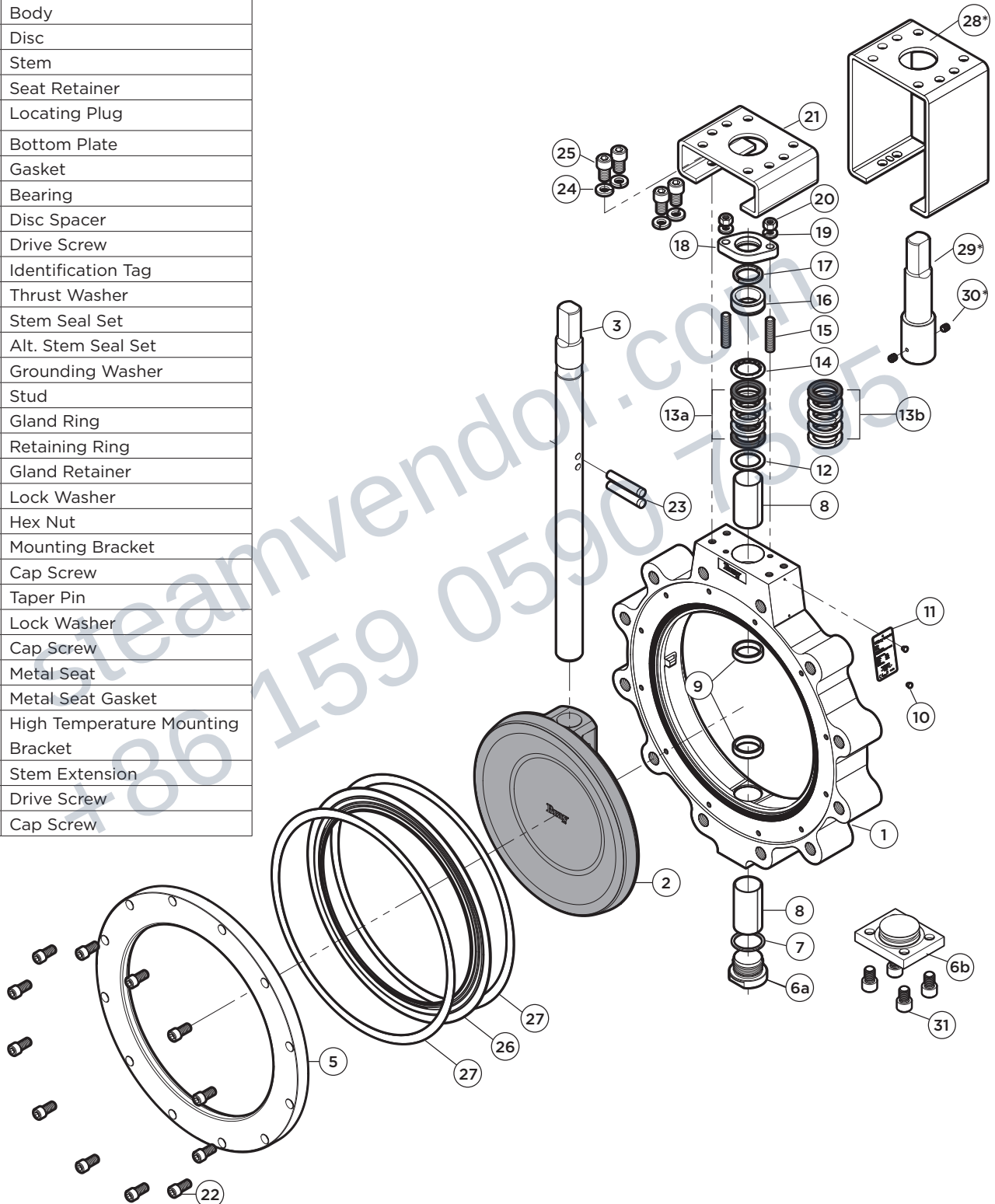
3.0 PARTS DIAGRAM - STANDARD MCCANNALOK AND HIGH CYCLE MCCANNALOK

No.	Description
1.	Body
2.	Disc
3.	Stem
4.	Soft Seat
5.	Seat Retainer
6a.	Locating Plug
6b.	Bottom Plate
7.	Gasket
8.	Bearing
9.	Disc Spacer
10.	Drive Screw
11.	Identification Tag
12.	Thrust Washer
13.	Stem Seal Set
14.	Grounding Washer (optional)
15.	Stud
16.	Gland Ring
17.	Retaining Ring
18.	Gland Retainer
19.	Gland Lock Washer or Belleville Washer
20.	Gland Hex Nut
21.	Mounting Bracket
22.	Cap Screw
23.	Taper Pin
24.	Lock Washer
25.	Cap Screw
26.	Cap Screw



4.0 PARTS DIAGRAM - METAL SEATED MCCANNALOK

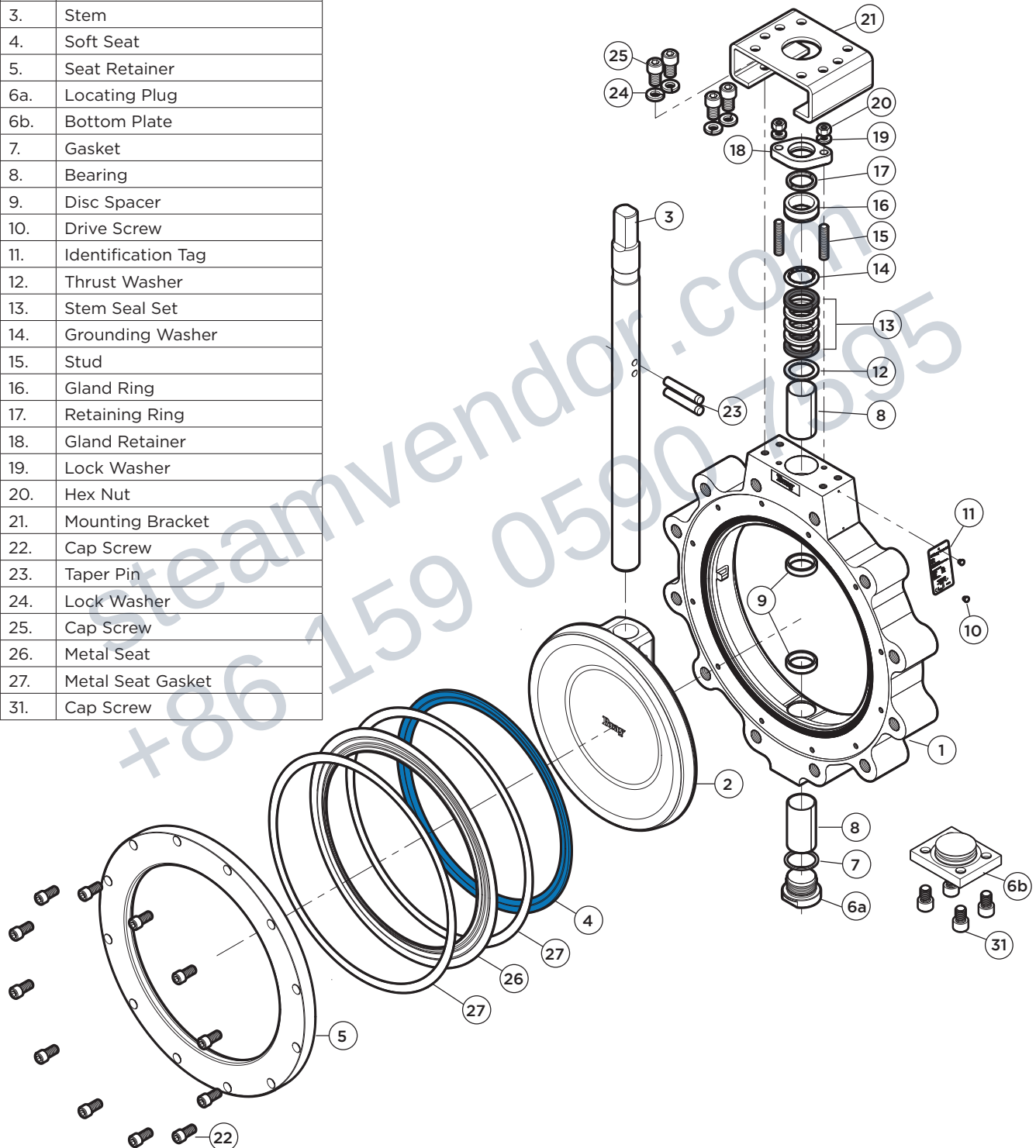
No.	Description
1.	Body
2.	Disc
3.	Stem
5.	Seat Retainer
6a.	Locating Plug
6b.	Bottom Plate
7.	Gasket
8.	Bearing
9.	Disc Spacer
10.	Drive Screw
11.	Identification Tag
12.	Thrust Washer
13a.	Stem Seal Set
13b.	Alt. Stem Seal Set
14.	Grounding Washer
15.	Stud
16.	Gland Ring
17.	Retaining Ring
18.	Gland Retainer
19.	Lock Washer
20.	Hex Nut
21.	Mounting Bracket
22.	Cap Screw
23.	Taper Pin
24.	Lock Washer
25.	Cap Screw
26.	Metal Seat
27.	Metal Seat Gasket
28.*	High Temperature Mounting Bracket
29.*	Stem Extension
30.*	Drive Screw
31.	Cap Screw



*Optional mounting for high temperature applications

5.0 PARTS DIAGRAM - FIRE SAFE MCCANNALOK

No.	Description
1.	Body
2.	Disc
3.	Stem
4.	Soft Seat
5.	Seat Retainer
6a.	Locating Plug
6b.	Bottom Plate
7.	Gasket
8.	Bearing
9.	Disc Spacer
10.	Drive Screw
11.	Identification Tag
12.	Thrust Washer
13.	Stem Seal Set
14.	Grounding Washer
15.	Stud
16.	Gland Ring
17.	Retaining Ring
18.	Gland Retainer
19.	Lock Washer
20.	Hex Nut
21.	Mounting Bracket
22.	Cap Screw
23.	Taper Pin
24.	Lock Washer
25.	Cap Screw
26.	Metal Seat
27.	Metal Seat Gasket
31.	Cap Screw



6.0 HANDLING REQUIREMENTS

6.1 Packed Valves

- 6.1.1 **Crates:** Lifting and handling of the packed valves in crates will be carried out by a fork lift truck, by means of the appropriate fork hitches.
- 6.1.2 **Cases:** The lifting of packed valves in cases will be carried out in the lifting points and in the center of gravity position which has been marked. The transportation of all packed material must be carried out safely and following the local safety regulations.

6.2 Unpacked Valves

- 6.2.1 Lifting and handling of valves should be carried out by using appropriate means and observing the carrying limits. Handling must be carried out on pallets, protecting all machined surfaces to avoid any damage.
- 6.2.2 With large bore valves, rigging the load must be carried out by using the appropriate tools to prevent the valve from falling or moving during the lifting and handling.



For valve handling and/or lifting, the lifting equipment (fasteners, hooks, etc.) must be sized and selected while taking into account the valve weight indicated in our packing list and/or delivery note. Lifting and handling must be made only by qualified personnel.

Fasteners must be protected by plastic covers in sharp corner areas.

Caution must be taken during the handling to avoid this equipment passing over workers or over any other place where a possible fall could cause injury or damage. In any case, local safety regulations must be respected

7.0 LONG TERM STORAGE

7.1 If valves are to be stored before installation, storage must be carried out in a controlled manner as follows:

7.1.1 Valves must be stored in a closed, clean and dry environment.

7.1.2 Valve disc to be in closed position and the body end faces must be covered with appropriate flange protection. Flange protectors should only be removed at the time of installation.

7.1.3 Valves should be stored indoors with a preferred temperature range from 40°F (4°C) to 85°F (29°C).

7.1.4 The valves should be checked to ensure the above conditions are maintained every three months.

7.2 These are general guidelines for valve storage. Please consult the factory for information regarding specific requirements.

8.0 INSTALLATION

- 8.1** Special instructions for Fire Safe and Metal Seated valves appear in Section 10.
- 8.2** The McCannalok valve is designed to be mounted between ANSI flanges. When the valve is open, the disc (2) will extend into the pipe on both sides of the valve (further on the body side than the seat retainer side of the valve). Piping must be large enough to allow the disc (2) to clear the pipe. Tables 1 and 2 show the minimum pipe ID allowable and standard pipe IDs. In general, Class 150 valves will clear Schedule 40 pipe and Class 300 valves will clear Schedule 80 pipe. Class 600 will clear Schedule 80 pipe in sizes 3, 4 and 6 and Schedule 100 pipe in sizes 8, 10, 12, 14 and 16.

CAUTION

If handle or actuator has been removed do not rotate disc beyond full open or closed position as this could cause damage to sealing surfaces.

- 8.3** **NOTE:** McCannalok valves are equipped with travel limiters to prevent over closure. The valve is opened by turning the shaft counterclockwise, closed by turning the shaft clockwise. The double "D" flats or keyway at the top of the stem is parallel to the disc edge.

NOTICE

For maximum service life, install the valve with the seat retainer upstream. Positive shutoff will be obtained with the valve in either position; however, installation with the seat retainer upstream will give longer service life, especially in erosive services.

- 8.4** With the disc (2) in the closed position, carefully center the valve between the flanges. Guide holes (wafer pattern valve) or tapped holes (lugged valves), which match the ANSI pipe flange holes assist in positive alignment.
- 8.5** Use standard flange torques when bolting valve into the line. The seat is sufficiently compressed by the seat retainer and additional force from flange bolting is not required.
- 8.6** Gaskets should conform to the requirements of API 601 3rd Edition for ASME B16.5 class flanges. Spiral wound gaskets, such as Flexitallic CG or CGI series, conforming to ASME B16.20 are acceptable.

9.0 STEM SEAL REPLACEMENT

9.1 Refer to Standard McCannalok Parts Diagram for part identification.

NOTICE

Note assembly positions before removal.

9.2 If required, remove handle assembly. Remove socket head cap screws (25) and lock washers (24). Remove mounting bracket (21). For actuated valves, unbolt mounting bracket from body (1) and lift actuator assembly off stem.

9.3 Remove gland retainer nuts (20) and lock washers (19). Remove gland retainer (18) anti-blowout retaining ring or split ring (17) (depending on size) and gland ring (16).

NOTICE

The Class 600 valves have stem seal sets located at the upper and lower portions of the shaft. These instructions apply to both the upper and lower stem seals.

9.4 Remove the grounding washer (14) if present. Remove stem seals (13). Do not remove thrust washer (12) unless further valve disassembly is required.



CAUTION

When removing stem seals, care should be taken not to scratch stem or body packing box bore.

9.5 Examine body packing box bore and stem, clean as necessary to remove any corrosion or foreign matter before installing new stem seals.

9.6 Install new stem seals in body packing box one at a time, TFE (white) stem seals first, with the carbon fiber ring at the top. Stagger stem seal joints 180° apart when installing. Tamp each stem seal to bottom before installing next stem seal. Table 3 shows the correct number of stem seals to install in each valve.

NOTICE

On the larger valves it will be necessary to compress each stem seal before adding the next.

- 9.7 Install a new grounding washer (14) if required. Slide gland ring (16) over stem on top of seals (13). Install anti-blowout retaining ring or split ring (17) (depending on valve size). Slide gland retainer (18) over stem and onto gland studs (15). Place lockwashers (19) and hex nuts (20) on studs (15) and tighten finger tight. Tighten gland nuts (20) evenly and alternately to the proper torque value given in Table 4.
- 9.8 Remount actuator, or mounting bracket (21) with lock washers (24) and cap screws (25), or handle assembly. Ensure that mounting bracket cap screws are tightened to the correct torque per Table 7.
- 9.9 Operate valve open and closed several times to check for binding and to set the stem seals. Loosen gland nuts (20) and retighten to torque value given in Table 4.

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10.0 SEAT REPLACEMENT

- 10.1** Refer to Standard McCannalok Parts Diagram for part identification.
- 10.2** With the disc (2) in the closed position, remove the valve from service.
- 10.3** Lay the valve down with the disc (2) in the closed position and the seat retainer side facing up.
- 10.4** Remove the socket head cap screws (22), the seat retainer (5) and seat (4).
- 10.5** Carefully clean the seat area in the body (1) and seat retainer. Remove foreign material, dirt, etc. Check disc seating area for nicks or scratches.
- 10.6** With the disc (2) in the CLOSED position, place the new seat (4) on disc (2), carefully centering it in the recess in the body (1).



CAUTION

Do not shift the retainer in order to align holes. It may shift the seat from its correct position.

- 10.7** Align the holes in the seat retainer (5) with matching holes in body (1) and carefully place in position on top of seat (4).
- 10.8** Lightly grease cap screw (22) threads and bearing areas.
- 10.8.1** Install the cap screws and tighten all cap screws finger tight.
- 10.8.2** Tighten the cap screws to approximately 30% of the torque value listed in Table 4 in a crisscross pattern.
- 10.8.3** Repeat Step 2, increasing the torque value to approximately 60% of the final torque value.
- 10.8.4** Repeat Step 3, increasing the torque value to the final required torque value.
- 10.8.5** Open the disc (2). Re-torque all cap screws to the final required torque value given in Table 4.
- 10.9** A final tightening should be performed/checked prior to installation. Operate valve several times and examine seat for any damage before reinstalling the valve in service.

11.0 DISC AND STEM REPLACEMENT

11.1 Refer to Standard McCannalok Parts Diagram for part identification.

NOTICE

Stem and disc are supplied as a matched set with taper pins and are to be replaced as a set.

11.2 For handle-operated valves remove handle assembly. Remove socket head cap screws (25) and lock washers (24). Remove mounting bracket (21). For actuated valves, unbolt mounting bracket from body (1) and lift actuator assembly off stem.

NOTICE

Note assembly positions before removal.

11.3 Remove gland retainer nuts (20) and lock washers (19). Remove gland retainer (18), anti-blowout retaining ring or split ring (17) (depending on valve size) and gland ring (16). Remove grounding washer (14) if present.

11.4 Remove stem seals (13).



CAUTION

Take care not to scratch stem or packing box bore.

11.5 Remove locating plug or bottom plate (6) and gasket (7).

11.6 Remove cap screws (22), seat retainer (5) and seat (4).

11.7 Turn disc (2) to the full open position and drill out tack welds on large end of taper pins (23).



CAUTION

Take care to support valve so that disc surfaces are not scratched.

11.8 Drill sizes to remove tack welds as given in Table 5. Use center-punch to dimple center of tack welds prior to drilling.

11.9 Place valve in flat position, with flat face of disc (2) up. Support disc (2) and body (1) on wooden blocks to protect disc (2) and body (1) surfaces. Disc (2) will rest in partially open position.

- 11.10** Knock out taper pins (23) using a rod or punch on small end of pin (opposite tack weld). It may be necessary to lift body (1) and rotate disc (2) slightly to do this. Make sure disc (2) is resting on wood block since it will swing freely on stem with pins removed. When pins (23) are out, lay body (1) down so disc (2) and body (1) are evenly supported on flat surface.
- 11.11** Using a brass bar or drift punch, knock stem (3) loose and pull from body (1). After long or severe service this may take considerable force.



CAUTION

Be careful not to damage bearings (8), spacers (9) or body (1).

- 11.12** Disc spacers (9) are used at top and bottom of disc (2) to properly position disc (2) in body (1). Proper spacers were selected at initial assembly and rarely require replacement. The location of these spacers should be noted and the spacers marked at disassembly so that they are reinstalled in the same positions, top and bottom.
- 11.13** Separate body (1) from disc (2) and remove thrust washer (12) from packing bore.
- 11.14** Examine stem bearings (8) for excessive wear. If removed from body (1), **note position and mark to reinstall in same location.** If bearing liner is worn through to the shell, or severe damage is evident they should be replaced. Replacement is rarely needed.
- 11.15** Clean body (1) thoroughly to remove all dirt, foreign matter, rust, etc.
- 11.16** Place the body (1) flat, seat retainer side up and support it on wooden blocks sufficiently above the work surface as to facilitate insertion of the new disc (2) in open position. Lower the disc (2) into position, aligning the bores in body (1) and disc (2).
- 11.17** Insert new stem (3) in body (1) with large end of the taper pin holes toward the top. Assemble disc spacers (9) as stem (3) is inserted, making sure that spacers are returned to original locations as marked.
- 11.18** Align taper pin holes in disc (2) and stem and install taper pins (23). Drive pins in tightly with rod or punch and tack weld each pin (23) to disc (2) at large end of pin.
- 11.19** Install new gasket (7) on locating plug (6a) or bottom plate (6b) and install plug or plate in body (1). See Table 7 for locating plug and bottom plate torques.
- 11.20** Install new stem seals, following instructions in “Stem Seal Replacement” section.
- 11.21** Install new seat, following instructions in “Seat Replacement” section.

- 11.22** Remount handle assembly or actuator and operate valve several times to verify proper operation. Examine disc (2) and seat (4) for any damage before reinstalling in line. Ensure mounting bracket cap screws (25) are tightened to torques listed in Table 7.

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12.0 SPECIAL INSTRUCTIONS FOR MCCANNALOK FIRE SAFE AND METAL SEATED INSTALLATION

- 12.1** The McCannalok Fire Safe valve will provide fire safe shutoff with flow in either direction, meeting API 607 and British Standard 6755 part 2 criteria, as well as bubble-tight shutoff in either direction in normal service. However, installation with the seat retainer upstream provides maximum protection to the soft seat and will increase seat life, especially in erosive services.
- 12.2** The McCannalok Metal Seated valve has been extensively performance tested in our state-of-the-art technology center and test laboratory. The Inconel® 718 metal seat has been contoured to provide control, strength and flexibility in high temperature applications.
- 12.3** Installation bolting information given for the standard McCannalok valves is also applicable to the Fire Safe and Metal Seated versions.

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13.0 STEM SEAL REPLACEMENT - FIRE SAFE AND METAL SEATED

- 13.1** The procedure for stem seal replacement in Section 7 also applies to Metal Seated valves that use TFE (white) seals. For Fire Safe and Metal Seated valves that use graphite stem seals, use the following exceptions.
- 13.2** Graphite stem seals are used in the Fire Safe valves and as an option for Metal Seated valves. The arrangement of the two types of stem seals when installed is:
- > bottom seal - carbon fiber braided ring
 - > center seals - graphite rings
 - > top seal - carbon fiber braided ring.
- 13.3** Table 3 shows graphite only stem seal quantities for class 150 and 300 valves.
- 13.4** Table 6 shows gland nut torques to be used for graphite only stem seal sets.

14.0 SEAT REPLACEMENT - FIRE SAFE AND METAL SEATED

14.1 Fire Safe valves will have both a soft seat (4) and metal seat (26) while the Metal Seated valves have only a metal seat (26). Ignore soft seat instructions for Metal Seated valves.

14.2 With the disc (2) in the closed position, remove the valve from the line.



WARNING

Verify line is depressurized prior to removal.

14.3 Lay the valve down with the disc (2) in the closed position and the seat retainer side facing up.

14.4 Remove socket head cap screws (22), seat retainer (5), metal seat (26), gaskets (27) and soft seat (4).

14.5 Carefully remove graphite gaskets (27) from metal seat (26). Do not bend or crimp metal seat. All traces of the old gaskets must be removed.

14.6 Clean seat retainer (5) and body (1) surfaces to remove any adhering gasket material, corrosion, or other foreign material. Examine disc (2) seating surfaces for damage and examine seating surface of metal seat and soft seat for wear or damage. Replace if damaged.

14.7 Place new soft seat (4) on disc (2), carefully centering in body (1) recess.



CAUTION

Handle the graphite gaskets (27) carefully as they are thin and are easily torn or scratched.

14.8 Place new graphite gasket (27) on the body (1). Position metal seat (26) over the disc (2), lip facing out, on top of the soft seat (4). Place another graphite gasket (27) on top of the metal seat. Graphite gaskets can be first attached to the metal seat to simplify the assembly. Spray a suitable adhesive, like 3M Super 77 general purpose adhesive or similar, in 3 or 4 spots on both sides of the metal seat to hold the gaskets in position.



CAUTION

Be careful that seat does not shift when retainer is installed.

14.9 Align holes in seat retainer (5) with holes in body (1) and seat and carefully place seat retainer in position, on top of seat.

14.10 Lightly grease cap screw threads and bearing areas.

- 14.10.1 Step 1: Install the cap screws and tighten all cap screws finger tight.
- 14.10.2 Step 2: Tighten the cap screws to approximately 30% of the torque value listed in Table 4 in a crisscross pattern.
- 14.10.3 Step 3: Repeat Step 2, increasing the torque value to approximately 60% of the final torque value.
- 14.10.4 Step 4: Repeat Step 3, increasing the torque value to the final required torque value.
- 14.10.5 Step 5: Open the disc (2). Re-torque all cap screws to the final required torque value given in Table 4.
- 14.11** Lubricate the disc (2) edge with molybdenum disulfide spray or similar lubricant, if available. As a minimum, lubricate the disc edge with light machine oil or light grease. Operate valve several times and examine seat for damage before reinstalling in line.

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15.0 DISC AND STEM REPLACEMENT - FIRE SAFE AND METAL SEATED

- 15.1** The same procedures apply to Fire Safe and Metal Seated valves as to the Standard valves, with the addition of the special requirements for stem seal and seat replacement.

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16.0 SPECIAL INSTRUCTIONS FOR MCCANNALOK HIGH CYCLE INSTALLATION

- 16.1** The McCannalok High Cycle valve is designed for high cycle, critical applications such as pressure swing absorption, modulating control, and air separation.
- 16.2** The McCannalok High Cycle valve has been extensively performance tested in our state-of-the-art technology center and test laboratory. Validated to 1,000,000 mechanical cycles with rigorous testing, the McCannalok High Cycle option provides a high level of reliability that meets the challenging needs of high cycle applications.
- 16.3** Installation bolting information given for the standard McCannalok valves is also applicable to the High Cycle version.
- 16.4 Stem Seal Replacement**
- 16.4.1** The procedure for replacement listed in Section 9.0 also applies to High Cycle valves that use Chevron (V shaped) seals with the following exceptions:
1. The orientation of the Chevron stem seals when installed is:
 - bottom seal - carbon and graphite filled TFE male adapter
 - center seals - carbon and graphite filled TFE V rings
 - top seal - carbon and graphite filled TFE female adapter
 2. Table 3 shows total stem seal quantities for Class 300 valves.
 3. Table 4 shows gland nut torques to be used for Chevron stem seal sets.

17.0 FIELD ADJUSTMENTS - ALL VALVES

- 17.1 **Stem Seal Leakage** – Should leakage occur at the stem seals, it may be stopped by retightening the gland retainer nuts (20) to the values specified in Table 4 or Table 6. Class 600 valves have both an upper and lower stem seal set.

NOTICE

Do not overtighten gland nuts (20), as this may cause increased operating torque and improper valve operation or closure.

- 17.1.1 If the leakage cannot be stopped by this action, the stem seals require replacement.
- 17.2 **Adjusting Valve Closure** – Valves with gear operators or electric/pneumatic actuators may require adjustment of the travel stops in the actuator to properly close valve for tight shut off. The following procedure should be followed to set travel or limit stops. (It is recommended that the valve be removed from line for this procedure).
- 17.2.1 Using a straight-edge and vernier or depth caliper, measure the distances from the face of the seat retainer to the disc (2) (valve closed) face at the 3 o'clock and 9 o'clock positions (stem is at 12 o'clock position). The measurements must agree within 1/16" (0.062").
- 17.2.2 If they do not agree, disc must be rotated in the direction of the larger dimension. If the 3 o'clock dimension is larger, the disc is not fully closed and must be rotated in the "close" direction more. If 9 o'clock dimension is larger, disc is over-closed and must be opened slightly.
- 17.2.3 The valve disc (2) is at the full open position when the disc (2) is perpendicular to the body (1). Set the "open" actuator stop for this position.

CAUTION

Do not allow the valve to over open as this may damage the disc seating surfaces by hitting body (1) or attached piping.

- 17.2.4 On gear operators, loosen and adjust the closing stop screw to permit proper disc positioning. Adjust and lock down when disc (2) closure is within measured tolerance in Step 1. Open and close valve; recheck measurements before reinstalling in line.

NOTICE

The setting of the actuation device's close travel stop is important. The valve has an internal travel limiter to ensure valve disc cannot be over closed. To ensure that the valve travel limiter is not damaged, the actuator close travel stop bolt must be at a position just before valve disc contacts its travel limiter.

- 17.2.5 For other power actuators, consult the manufacturer's instructions for setting travel stops, as these vary with actuator model and type.
- 17.2.6 If removing the valve from the line is not practical, as a crude remedy the disc (2) can be placed into a position in the seat at which the leakage stops and travel stops are adjusted to this position.

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18.0 MAINTENANCE

- 18.1 Reasonable precautions should be taken before beginning work on the valve. Protective clothing, as required by the specific line fluid, should be worn.



WARNING

Before removing handle or the actuator from the valve, or before removing seat retainer from a valve in dead end service, close the valve and depressurize the line.

- 18.2 The eccentric design of the McCannalok may allow line pressure to open the valve if the handle/actuator is not in place while the valve is under pressure.



WARNING

Do not pressurize the line without a handle or actuator on the valve.

- 18.3 The McCannalok valve must be in the closed position to be removed from the line.
- 18.4 Begin all work on a valve that has been removed from service by cleaning the valve, removing any grit or scale.



CAUTION

When handling the valve, care should be taken not to scratch the disc edge or seat.

- 18.5 Replacement seats, seals and other parts are available from authorized distributors. Contact your distributor or sales representative for details on price and delivery.

APPENDIX A - TABLES

IMPERIAL VALUES

TABLE 1: NOMINAL INSIDE DIAMETER OF PIPE - INCHES - IMPERIAL			
Valve Size	Pipe Schedule		
NPS	40	80	100
2	2.067	1.940	
2.5	2.469	2.323	
3	3.068	2.900	
4	4.026	3.826	
5	5.047	4.813	
6	6.065	5.761	
8	7.981	7.625	7.439
10	10.020	9.564	9.314
12	11.938	11.376	11.064
14	13.124	12.500	12.126
16	15.000	14.314	13.938
18	16.876	16.126	
20	18.814	17.938	
24	22.626	21.564	

TABLE 2: MINIMUM INSIDE DIAMETER OF PIPE WITH THE RECOMMENDED CLEARANCE - INCHES - IMPERIAL			
Valve Size	Class		
NPS	150	300	600
2	1.90	1.90	
2.5	2.28	2.28	
3	2.86	2.86	2.75
4	3.72	3.72	3.56
5	4.80	4.80	
6	5.88	5.75	5.38
8	7.80	7.56	6.88
10	9.78	9.44	8.50
12	11.74	11.31	10.12
14	12.90	11.38	10.88
16	14.68	14.31	12.62
18			14.40
20			15.86
24	22.50	20.68	
30	28.55	27.06	
32	30.69		
36	34.50	33.63	
40	37.55	36.59	
42	39.55	38.67	
44		38.67	
48	46.59	45.13	
54	52.95		
60	58.25		

NOTES:

Minimum ID of pipe with recommended clearances (per API 609) have been calculated by adding the minimum ID with zero clearance to a minimum recommended diametric clearance for each pipe size.

These charts assume that the pipe is on the body side of the valve and that the pipe is perfectly centered. The seat retainer side of the valve will always have more clearance than the body side.

A minimum of 1/16" thick gasket is used between the pipe flange and valve body face.

When using a pipe whose ID is smaller than the recommended minimum inside diameter of pipe with adequate clearance, a chamfer of 45° should be provided on the end of the pipe so that it clears the disc.

IMPERIAL VALUES

TABLE 3: TOTAL NUMBER OF STEM SEALS - IMPERIAL							
Valve Size	Class 150		Class 300			Class 600	
NPS	Material CF/TFE	Material CF/G	Material CF/TFE	Material CF/G	High Cycle Option*	Material CF/TFE	Material CF/G
2	1 / 3	2 / 2	1 / 3	2 / 2			
2.5	1 / 3	2 / 2	1 / 3	2 / 2			
3	1 / 3	2 / 2	1 / 3	2 / 2	5	2 / 10	4 / 8
4	1 / 3	2 / 2	1 / 3	2 / 2	5	2 / 10	4 / 8
5	1 / 3	2 / 2	1 / 3	2 / 2			
6	1 / 3	2 / 2	1 / 3	2 / 2	5	2 / 14	4 / 12
8	1 / 4	2 / 3	1 / 4	2 / 3	5	2 / 14	4 / 12
10	1 / 4	2 / 3	1 / 4	2 / 3	5	0 / 18	4 / 14
12	1 / 4	2 / 3	1 / 4	2 / 3	5	0 / 18	4 / 14
14	0 / 6	2 / 4	0 / 6	2 / 6	5	0 / 18	4 / 14
16	0 / 6	2 / 4	0 / 9	2 / 7	6	0 / 16	4 / 12
18	0 / 9	2 / 7	0 / 10	2 / 8	6	0 / 16	
20	0 / 10	2 / 7	0 / 11	2 / 10	6	0 / 18	
24	0 / 10	2 / 8	0 / 8	2 / 6	5	4 / 16	
30	0 / 8	2 / 6	0 / 9	2 / 7			
32	0 / 8	2 / 6					
36	0 / 8	2 / 6	0 / 9	2 / 9		0 / 16	
40	0 / 9	2 / 7	0 / 9				
42	0 / 9	2 / 7	0 / 9				
44			0 / 9				
48	0 / 9	2 / 7	0 / 9				
54	0 / 9	2 / 7					
60	0 / 9	2 / 7					

CF = Carbon Fiber G = Formed Graphite

*Total stem seal quantity includes bottom male adapter seal plus center V-ring seals plus top female adapter seal

IMPERIAL VALUES

TABLE 4: GLAND RETAINER NUT (PTFE STEM PACKING) AND SEAT RETAINER SCREW TORQUES - LB-IN - IMPERIAL

Valve Size	Gland Nut			Seat Retainer Screws		
NPS	150	300	600	150	300	600
2	60	100		100	100	
2.5	60	100		100	100	
3	60	100	80	100	100	100
4	60	100	100	175	175	175
5	80	100		100	175	
6	80	120	140	100	175	300
8	80	140	200	175	175	300
10	110	190	200	175	300	300
12	130	220	200	300	300	300
14	130	200	240	300	300	500
16	150	220	300	300	300	750
18	150	220	400	300	300	1500
20	190	220	480	300	500	1500
24	190	240	550	500	500	
30	210	310	600	500	750	
32	210	310	600	750		
36	240	360		500	1500	
40	280	420		500	1500	
42	280	420		500	1500	
44	280	420			1500	
48	300	600		750	1500	
54	360				1500	
60	500				1500	

IMPERIAL VALUES

TABLE 5: DRILL SIZE TO REMOVE TAPER PIN - INCHES - IMPERIAL

Valve Size	Class		
NPS	150	300	600
2	15/64	15/64	
2.5	15/64	15/64	
3	15/64	15/64	1/4
4	15/64	15/64	9/32
6	15/64	15/64	11/32
8	15/64	15/64	19/32
10	15/64	15/64	45/64
12	15/64	15/64	45/64
14	15/64	15/64	45/64
16	19/32	15/64	11/32
18	45/64	45/64	11/32
20			11/4
24	45/64	11/32	
30	11/32	11/4	
32	11/32		
36	11/32	11/4	
40	11/4	117/32	
42	11/4	117/32	
44		117/32	
48	11/4	117/32	
54	117/32		
60	117/32		

TABLE 6: GLAND NUT (GRAPHITE STEM PACKING) TORQUE - LB-IN - IMPERIAL

Valve Size	Class		
NPS	150	300	600
2	35	45	
2.5	35	45	
3	35	45	60
4	35	45	90
5	45	65	
6	45	65	110
8	45	80	150
10	65	100	130
12	65	100	130
14	80	125	180
16	100	150	180
18	100	150	200
20	100	150	240
24	150	200	300

IMPERIAL VALUES

TABLE 7: LOCATING PLUG, BOTTOM PLATE AND MOUNTING BRACKET CAP SCREW TORQUE - LB-IN - IMPERIAL

Valve Size	Locating Plug		Bottom Plate		Mounting Bracket Cap Screws		
NPS	150	300	150	300	150	300	600
2	480	540			175	175	
2.5	480	540			175	175	
3	480	540			175	175	300
4	480	540			175	175	300
5	720	780			300	300	
6	720	940			300	300	750
8	840	1080			300	750	1500
10	960	1200			750	750	2600
12	1080	1440			750	1500	2600
14	1200			750	1500	2600	6444
16			750	1500	2600	2600	6444
18			750	1500	2600	6444	23148
20			1500	1500	2600	6444	23148
24			1500	1500	6444	23148	23148
30			1500	2600	23148	23148	
32			1500		23148		
36			2600	2600	23148	23148	23148
40			2600	4400	23148	23148	
42			2600	4400	23148	23148	
44							
48			2600	6444	23148	23148	
54			4400	6444	23148	23148	
60			6444		23148		

METRIC VALUES

TABLE 1: NOMINAL INSIDE DIAMETER OF PIPE - MM - METRIC

Valve Size	Pipe Schedule		
DN	40	80	100
50	53	49	
65	63	59	
80	78	74	
100	102	97	
125	128	122	
150	154	146	
200	203	194	189
250	255	243	237
300	303	289	281
350	333	318	308
400	381	364	354
450	429	410	
500	478	456	
600	575	548	

TABLE 2: MINIMUM INSIDE DIAMETER OF PIPE WITH THE RECOMMENDED CLEARANCE - MM - METRIC

Valve Size	Class		
DN	150	300	600
50	48	48	
65	58	58	
80	73	73	70
100	95	95	90
125	122	122	
150	149	146	137
200	198	192	175
250	248	240	216
300	298	287	257
350	328	289	276
400	373	364	321
450			366
500			403
600	572	525	
750	725	687	
800	780		
900	876	854	
1000	954	929	
1050	1005	982	
1100		982	
1200	1183	1146	
1350	1345		
1500	1480		

NOTES:

Minimum ID of pipe with recommended clearances (per API 609) have been calculated by adding the minimum ID with zero clearance to a minimum recommended diametric clearance for each pipe size.

These charts assume that the pipe is on the body side of the valve and that the pipe is perfectly centered. The seat retainer side of the valve will always have more clearance than the body side.

A minimum of 1/16" thick gasket is used between the pipe flange and valve body face.

When using a pipe whose ID is smaller than the recommended minimum inside diameter of pipe with adequate clearance, a chamfer of 45° should be provided on the end of the pipe so that it clears the disc.

METRIC VALUES

TABLE 3: TOTAL NUMBER OF STEM SEALS - METRIC

Valve Size	Class 150		Class 300			Class 600	
DN	Material CF/TFE	Material CF/G	Material CF/TFE	Material CF/G	High Cycle Option*	Material CF/TFE	Material CF/G
50	1 / 3	2 / 2	1 / 3	2 / 2			
65	1 / 3	2 / 2	1 / 3	2 / 2			
80	1 / 3	2 / 2	1 / 3	2 / 2	5	2 / 10	4 / 8
100	1 / 3	2 / 2	1 / 3	2 / 2	5	2 / 10	4 / 8
125	1 / 3	2 / 2	1 / 3	2 / 2			
150	1 / 3	2 / 2	1 / 3	2 / 2	5	2 / 14	4 / 12
200	1 / 4	2 / 3	1 / 4	2 / 3	5	2 / 14	4 / 12
250	1 / 4	2 / 3	1 / 4	2 / 3	5	0 / 18	4 / 14
300	1 / 4	2 / 3	1 / 4	2 / 3	5	0 / 18	4 / 14
350	0 / 6	2 / 4	0 / 6	2 / 6	5	0 / 18	4 / 14
400	0 / 6	2 / 4	0 / 9	2 / 7	6	0 / 16	4 / 12
450	0 / 9	2 / 7	0 / 10	2 / 8	6	0 / 16	
500	0 / 10	2 / 7	0 / 11	2 / 10	6	0 / 18	
600	0 / 10	2 / 8	0 / 8	2 / 6	5	4 / 16	
750	0 / 8	2 / 6	0 / 9	2 / 7			
800	0 / 8	2 / 6					
900	0 / 8	2 / 6	0 / 9	2 / 9		0 / 16	
1000	0 / 9	2 / 7	0 / 9				
1050	0 / 9	2 / 7	0 / 9				
1100			0 / 9				
1200	0 / 9	2 / 7	0 / 9				
1350	0 / 9	2 / 7					
1500	0 / 9	2 / 7					

CF = Carbon Fiber G = Formed Graphite

*Total stem seal quantity includes bottom male adapter seal plus center V-ring seals plus top female adapter seal

METRIC VALUES

TABLE 4: GLAND RETAINER NUT PTFE STEM PACKING AND SEAT RETAINER SCREW TORQUES - N-M - METRIC

Valve Size	Gland Nut			Seat Retainer Screws		
DN	150	300	600	150	300	600
50	7	11		11	11	
65	7	11		11	11	
80	7	11	9	11	11	11
100	7	11	11	20	20	20
125	9	11		11	20	
150	9	14	16	11	20	34
200	9	16	23	20	20	34
250	12	21	23	20	34	34
300	15	25	23	34	34	34
350	15	23	27	34	34	56
400	17	25	27	34	34	85
450	17	25	45	34	34	169
500	210	25	54	34	56	169
600	21	27	62	56	56	
750	24	35	67	56	85	
800	24	35	67	85		
900	27	41		56	169	
1000	32	47		56	169	
1050	32	47		56	169	
1100	32	47			169	
1200	34	68		85	169	
1350	41				169	
1500	56				169	

METRIC VALUES

TABLE 5: DRILL SIZE TO REMOVE TAPER PIN - MM - METRIC

Valve Size	Class		
DN	150	300	600
50	6	6	
65	6	6	
80	6	6	6
100	6	6	7
150	6	6	9
200	6	6	15
250	6	6	18
300	6	6	18
350	6	6	18
400	15	6	26
450	18	18	26
500			32
600	18	26	
750	26	32	
800	26		
900	26	32	
1000	32	39	
1050	32	39	
1100		39	
1200	32	39	
1350	39		
1500	39		

TABLE 6: GLAND NUT GRAPHITE STEM PACKING TORQUE - N-M - METRIC

Valve Size	Class		
DN	150	300	600
50	4	5	
65	4	5	
80	4	5	8
100	4	5	10
125	5	7	
150	5	7	12
200	5	9	17
250	7	11	15
300	7	11	15
350	9	14	20
400	11	17	20
450	11	17	23
500	11	17	27
600	17	23	34

METRIC VALUES

TABLE 7: LOCATING PLUG, BOTTOM PLATE AND MOUNTING BRACKET CAP SCREW TORQUE - N-M - METRIC

Valve Size	Locating Plug		Bottom Plate		Mounting Bracket Cap Screws		
DN	150	300	150	300	150	300	600
50	54	61			20	20	
65	54	61			20	20	
80	54	61			20	20	34
100	54	61			20	20	34
125	81	88			34	34	
150	81	106			34	34	85
200	95	122			34	85	169
250	108	136			85	85	294
300	122	163			85	169	294
350	136			85	169	294	723
400			85	169	294	294	728
450			85	169	294	728	2615
500			169	169	294	728	2615
600			169	169	728	2615	2615
750			169	294	2615	2615	
800			169		2615		
900			294	294	2615	2615	2615
1000			294	497	2615	2615	
1050			294	497	2615	2615	
1100							
1200			294	728	2615	2615	
1350			497	728	2615	2615	
1500			728		2615		

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