

Installation, Operation and Maintenance Manual

CAMERON[®] TYPE 31 FULLY WELDED BODY BALL VALVE



CAMERON[®]

TABLE OF CONTENTS**CAMERON TYPE 31
FULLY WELDED BODY BALL VALVE**

Bill of Materials	1
Scope	2
Nameplate Information	2
Storage	2
Installation	3
Maintenance	6
Trouble Shooting	8
Injection Procedures	10
Valve Cleaning	11
Sealant Injection	12
Stem Designs	15

Bill of Materials

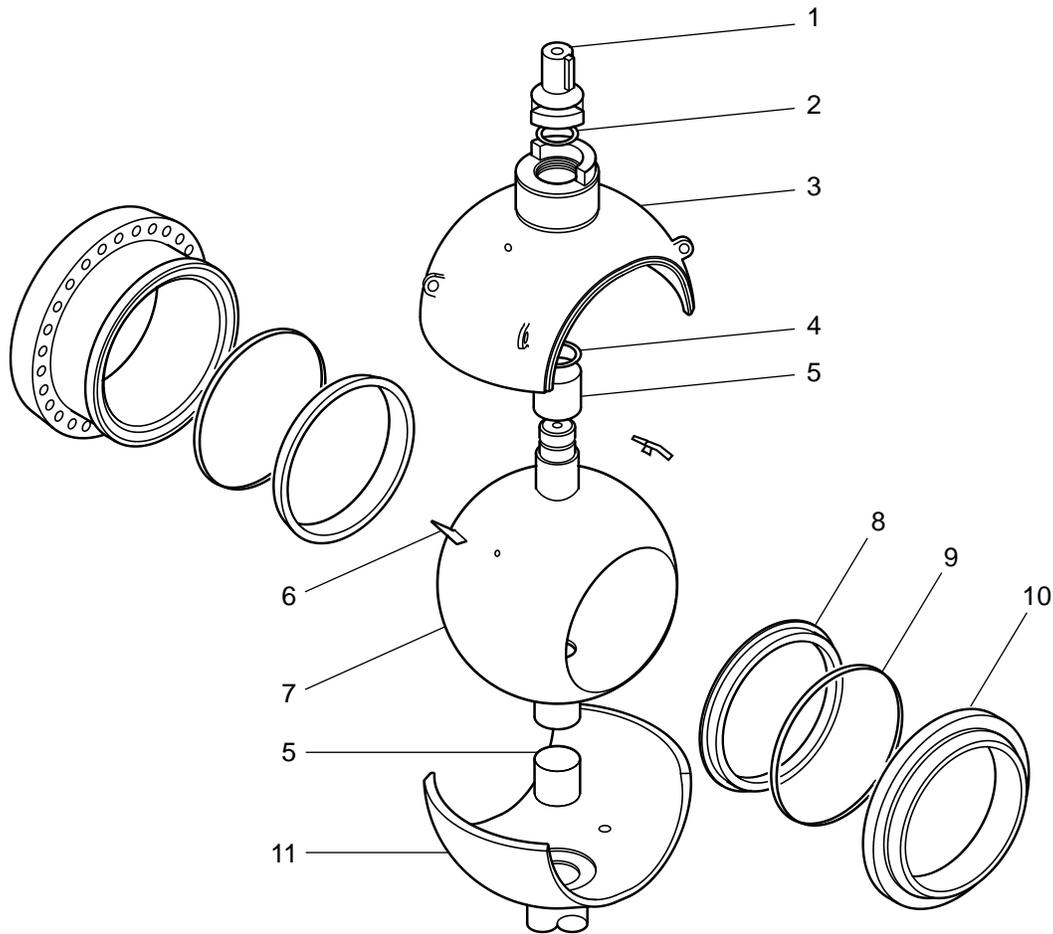


Figure 1 - Cameron Fully Welded Body Ball Valve Components.

ITEM	DESCRIPTION
1	Keyed Shaft
2	Upper Stem Seal*
3	Upper Body
4	Lower Stem Seal
5	Stem Bearing
6	Dog
7	Ball
8	Seat Ring
9	Lip Seal
10	End Connection
11	Lower Body

*Details of stem are on pages 15 and 16.

Scope

One of the most trusted valves in the petroleum industry, the CAMERON T31 Fully Welded Body Ball Valve combines the strength of forged components with a lightweight and compact spherical design. CAMERON T31 Fully Welded Body Ball Valves satisfy ASME 150 through 2500 (PN 20 through PN 420) and API 2000 through 10000 standards. Made of forged steel to assure uniform fine grain structure and toughness, they may be specified in sizes from 2" to 56" (DN 50 to DN 1400).

Engineered for heavy-duty service and minimal maintenance, the CAMERON T31 Fully Welded Body Ball Valve is commonly selected for a number of applications. The distinctive design of the CAMERON T31 Fully Welded Body Ball Valve gives it maximum strength and minimum weight as well as maximum resistance both to pipeline pressure and stresses. The compact, spherical design also eliminates body flanges, thus reducing overall size and leak paths.

Nameplate Information

ITEM	STAMP
1	Nominal Valve Size x Actual Bore Size.
2	Maximum Temperature
3	Minimum Temperature
4	Body Material Symbol
5	Seat Insert Material Symbol
6	Assembly Part Number
7	Valve Length
8	API Class Designation
9	Maximum Working Pressure
10	Maximum Operating Pressure
11	Seat Material Symbol
12	Ball Material Symbol
13	Valve Assembly Serial Number
14	Month and Year of Manufacture

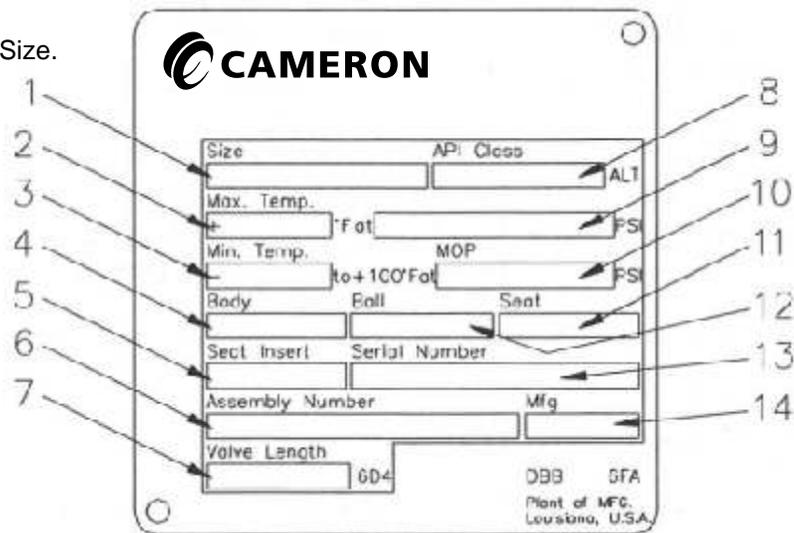


Figure 2 - Typical Valve Nameplate.

Storage

The valves are conditioned for a storage period of approximately six months. The following care should be taken when storing valves.

1. Make sure the valve end connection covers remain in place during storage.
2. If the valve does not have an operator already installed and the valve will be stored outside, the open stem extension or the stem adapter should be covered to avoid water buildup.
3. If long-term storage is required, the valve should be conditioned using a corrosion inhibitor and end connection covers. Follow the guidelines found in CAMERON Engineering Bulletin 476B for long term storage. Obtain a copy from your Cameron Valves & Measurement representative.

Installation

Handling of Valves

1. The valve should be lifted in such a way that the body supports the load.

CAUTION: The journal and the end connection necks are suitable places to attach lifting slings. Never use handwheels or other protruding parts of the gearbox or actuator not designated for this purpose.

2. If the valve is equipped with lifting lugs, these should be used for handling.
 3. The end protector covers should be kept in place on the end connections during all handling. Remove only during final installation of the valve.
-

CAUTION: During handling, protect the end connection faces and fittings against damage from the lifting devices. Failure to cover faces and fittings could cause damage to the valve.

Position of Valve

The ball valve may be installed in any position. Either end of the valve may be installed as the upstream end.

Protection of Ball

CAUTION: The ball should be fully open during the installation of the valve. Failure to keep the ball fully open during installation could cause damage to the valve.

If the ball must remain in the closed position during installation of the valve, coat the exposed surfaces of the ball with grease. This will protect the plug from damage due to weld splatter.

CAUTION: Do not leave the valve in the partially open position for an extended period of time.

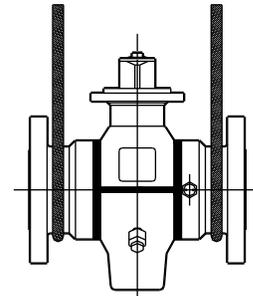


Figure 3 - Correct valve lifting using End Connection Necks.

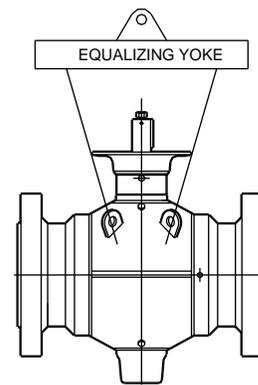


Figure 4 - Correct lifting using the valve Lifting Lugs.

CAUTION: A weld end valve without pup pipes should never be installed in the closed position.

Welding Instructions

When preheating, welding or stress relieving, body temperatures must not exceed 400°F (200°C) at any point beyond 3" (75 mm) from the weld. Use tempil sticks to check temperatures. Before CAMERON T31 Fully Welded Body Ball Valves are welded into final position in the pipeline, cover the valve seal areas (ball-to-seat area and seat-to-end connection area) with 1" wide masking tape from the 3 o'clock to the 9 o'clock position. This will help prevent any foreign material from becoming lodged in these areas. The piping system should also be pigged before operation or pressure testing to remove any foreign material from the pipeline.

Hydrostatic Testing

When CAMERON T31 Fully Welded Body Ball Valves are installed in a piping system that requires hydrostatic testing of the adjoining pipe, follow these procedures to minimize any damage that could occur to the sealing surfaces and seat seals inside the valve.

1. Valve should be in the fully open position when the injection of test fluid begins. This will allow any pipeline debris to be flushed through the valve bore and out of the piping.
2. Once the piping system has been purged of debris and the system has been filled completely with the test fluid, the ball valve should be placed in the partially open position (approximately 10° from the fully open position). This allows test fluid into the body cavity of the valve.
3. The valve is now ready to be pressure tested.
4. Upon completion of hydrostatic testing, the valve should be returned to the fully open position before removing the test fluid from the piping system. The test fluid in the body cavity can be drained through the body drain port located on the lower portion of the valve body.
5. Once the valve and piping system have been pigged and customer product is injected into the piping system, the valve should be moved to the partially open position (approximately 10° from the fully open position). Any remaining test fluid trapped in the valve body cavity can then be vented through the body bleed plug, located on the lower portion of the valve body. If the valve has been fitted with a stem extension, the vent fitting will be located below the mounting flange on top of the extension.
6. Opening the body bleed fitting will force trapped test fluid out of the body cavity. Keep the bleed plug open until all fluids have been exhausted through the body bleed plug.
7. Close the valve body bleed fitting and return the valve to the fully open position or the required operating position.
8. The valve seat pockets should be filled with an approved valve flush product to displace any test fluid. Refer to Routine Seat Cleaning which appears on page 7.

Mounting the Gear/Actuator

To mount a gear or power operator on a valve, use the following guidelines. **Note: The guidelines given are for typical gear and actuator designs.**

Specific instructions for each design should be obtained from the gear / actuator manufacturer.

1. Make sure the valve is in the fully open or closed position and position the actuator to match.

2. Depending on the valve stem and the actuator/gear mounting kit, it is possible that the actuator may be installed in multiple positions. If this is the case, determine where the customer desires the handwheel or actuator control panel and install it accordingly. (A thin layer of antiseize on the valve stem is recommended.)
3. Once the operator is mounted, secure it with the appropriate bolts. If the bolt holes do not line up, slightly operate to the open or closed to match the mounting flange. If you are unable to operate the operator, performing steps 2 and 3 of Setting Stops may need to be conducted.
4. It is now necessary to set the operator stops as outlined in the following section.

Setting Stops

Gear Operator with Stops

1. Make sure that operating the valve to the fully open and fully closed position will not disrupt current operation of line.
2. Loosen the open and closed stop screw locknuts.
3. Turn stop screws counter-clockwise to increase gear travel.
4. Operate the valve to the fully open position.
5. Utilize the stem stop viewports to verify valve position. (Refer to Open and Closed Viewports on page 6.)
6. Turn the open stop screw clockwise until it stops, then tighten the locknut. If the stop screws will not turn, repeat steps 3 and 4.
7. To set the closed stop, conduct steps 3 - 6, operating the valve to the closed position and utilize the closed stop.

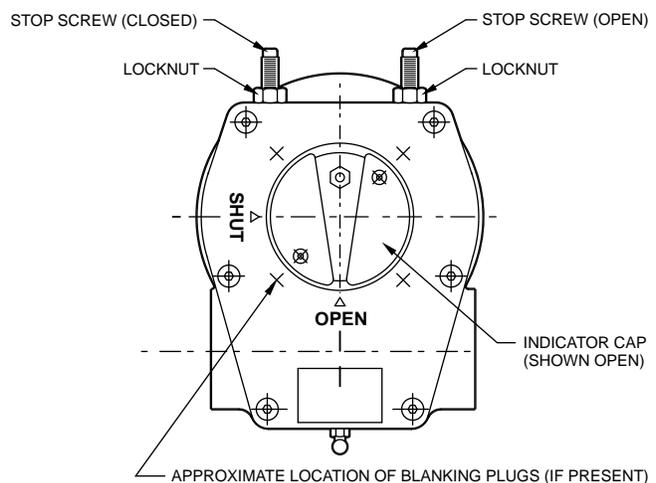


Figure 5 - Typical Gear Box with Stops.

Rotary Vane Style Operator (4 Bar Type)

1. Make sure that operating the valve to the fully open and fully closed position will not disrupt current operation of line.
2. Loosen the open and closed stop screw locknuts.
3. Turn stop screws clockwise to increase travel.
4. If equipped with a manual override, use it to operate the valve to the fully open position.
5. Check the stem stop viewports to verify valve position. (Refer to Open and Closed Viewports on page 6.)
6. Turn the open stop screw counter-clockwise until it stops and tighten the locknut.

CAUTION: Once the stop makes contact with the vane, do not continue to turn the screw. Continuing to turn the screw could move the valve off the stops.

7. If the stop screws will not turn repeat steps 3 and 4.
8. To set the closed stop, repeat steps 3 - 6, operate the valve to the closed position and use the closed stops.

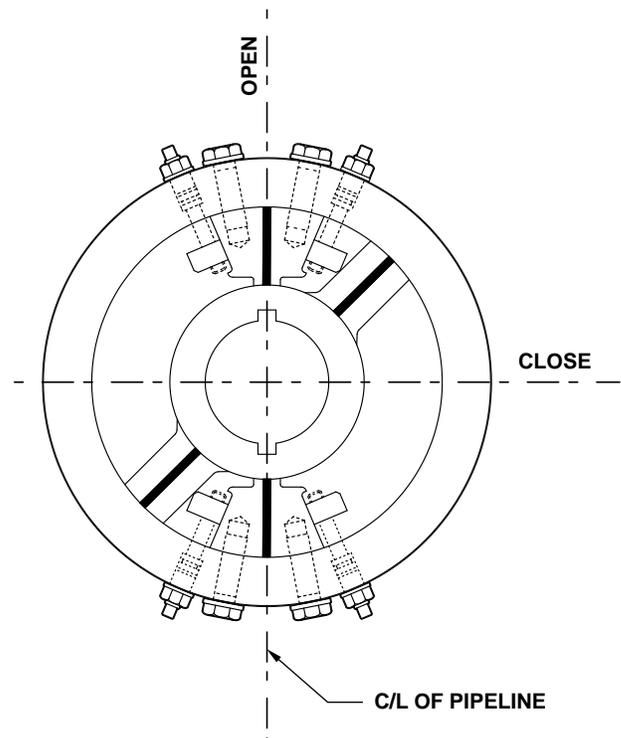


Figure 6 - Rotary Vane-Style Operator.

Scotch Yoke Style Operator

1. Make sure that operating the valve to the fully open and fully closed position will not disrupt current operation of line.
2. Loosen the open and closed stop screw locknuts.
3. Turn stop screws counter-clockwise to increase piston travel.
4. If equipped with a manual override, use it to operate the valve to the fully open position.
5. Check the stem stop viewports to verify valve position. (Refer to Open and Closed Viewports on page 6.)
6. Turn the open stop screw clockwise until it stops and tighten the locknut.

CAUTION: Once the stop makes contact with the vane, do not continue to turn the screw. Continuing to turn the screw could move the valve off the stops.

7. If the stop screws will not turn repeat steps 3 and 4.
8. To set the closed stop, repeat steps 3 - 6, operate the valve to the closed position and use the closed stops.

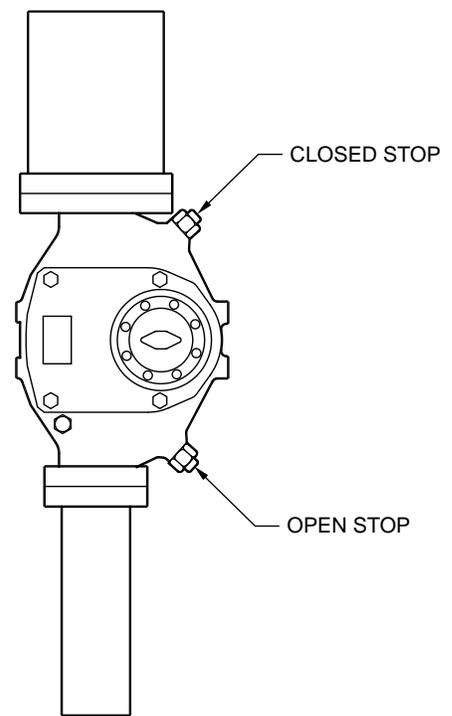


Figure 7 - Scotch Yoke-Style Operator.

Open and Closed Viewports

Once the pipe plug and relief plug are removed from the valve mounting flange, the position of the keyshaft stop relative to the valve stops can be observed on valves with nominal stem sizes of 3" and larger.

The valve is fully opened when the keyshaft stop butts against the valve stop as viewed through the "open viewport" and is fully closed when the keyshaft stop butts against the valve stop as viewed through the "closed viewport".

Figure 8 shows the viewport locations for valves with a 3" stem size and figure 9 shows the viewport locations for valves with 4" and larger stem sizes.

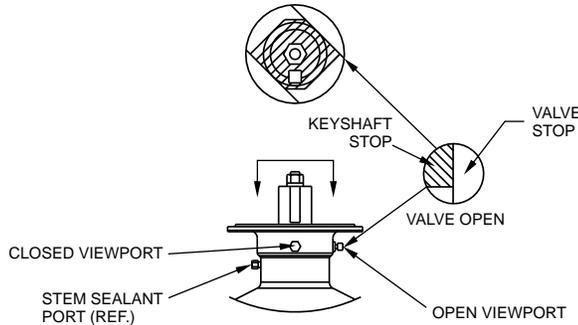


Figure 8 - Open and Closed Viewport Location for Valves with 3" Stem Size: Valve shown in Open Position.

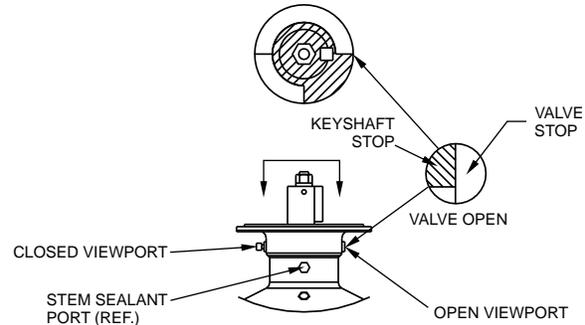


Figure 9 - Open and Closed Viewport Location for Valves with 4" and Larger Stem Sizes: Valve shown in open Position.

Operating Times

Quick Operating Time

Opening or closing a valve quickly induces loads in addition to the normal torsion load. It is therefore necessary to limit valve operating times in order to prevent over stressing of the valve.

Valves can be safely operated with an operating time given by the formula:

$$*Quick\ operating\ time = \frac{Valve\ nominal\ bore}{2}$$

If a faster operating time is required, please call your Cameron Valves & Measurement Representative.

Longest Operating Time

When the valve is being operated, the seat face is exposed. Therefore, to minimize the amount of time in which the seat face is exposed, Cameron Valves & Measurement group recommends a maximum operating time as follows:

$$*Longest\ Operating\ Time = 5 \times Valve\ nominal\ bore$$

(i.e., one minute
per foot of nominal
bore)

*The time is in seconds and the bore size is in inches.

CAUTION: Failure to follow these operating times could cause damage to the valve.

Maintenance

The CAMERON T31 Fully Welded Body Ball Valve requires a minimum of maintenance. In order to optimize the life of the valve, the maintenance procedures on pages 6 and 7 should be followed.

Operation

Operating the valve is an important part of routine maintenance. Operation of the valve will help to break-up any buildup on the seat face and/or ball and, if so equipped, will rotate the seat rings 15°, distributing the wear on the insert.

Double-Block-and-Bleed

Whether in the open or closed position, pressure on each side of the ball is blocked from the body cavity by the seat ring. The body cavity can then be blown down or drained through the body port. Take the following steps when block-and-bleeding a valve:

WARNING: Make sure proper safety garments are worn, and follow all customer safety procedures. Failure to do so could injure you or others.

1. The CAMERON bleed fittings have one or two exhaust ports. You should be aware of their orientation. Any debris in the valve or fitting will be exhausted at a high velocity.
2. If necessary, tighten the fitting to reorient the exhaust ports.
3. With the valve fully open or fully closed, open the bleed fitting all the way. When opening the bleed fitting, a backup wrench may be used to prevent accidental removal of bleed fitting.

The process of block-and-bleeding the valve is intended to test the valve integrity. If the valve does not blow down, this indicates that the seats are leaking. Consult the Troubleshooting section.

WARNING: Never try to block-and-bleed the valve in the partially open position. Failure to do so could injure you or others.

Seat Cleaning

The seat pocket area is the primary area where any valve can be affected by contaminants in the lines. To insure the seat's free movement, it is recommended that the valve seat pockets be cleaned routinely with an approved product. (The frequency of routine cleaning depends on the severity of service, but once a year is a good guideline. Contact your Cameron Valves & Measurement group representative for assistance). Cleaning procedures can be found on page 10.

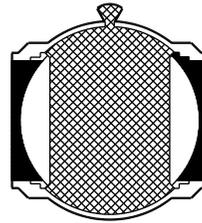


Figure 10 - Valve Closed.

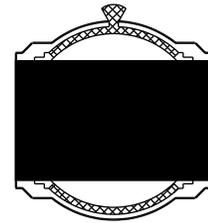


Figure 11 - Valve Open.

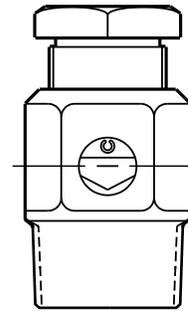


Figure 12 - Typical Bleed Fitting.

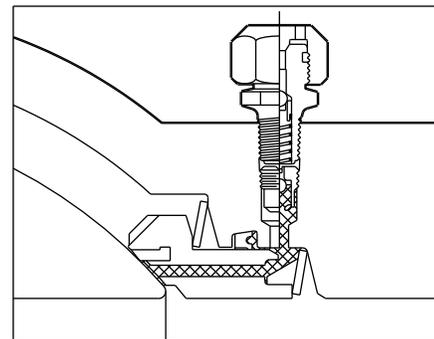


Figure 13 - Cameron T31 Seat Section.

Gear Maintenance

The following gear maintenance should be performed along with the valve maintenance:

1. Inspect housing for damage and wear.
2. Inspect weather seal and replace, if damaged. This will prevent water from entering the gearbox and causing corrosion.
3. Lubricate gear, using an approved lubricant.

Troubleshooting

Trouble	Probable Cause	Remedy
The seats are leaking.	The valve is not closed completely.	Operate the valve to the fully closed position. Block-and-Bleed the valve to insure that the leakage has stopped. Refer to Block-and-Bleed procedure on page 7.
	Operator stops are incorrectly adjusted.	Properly adjust the operator stops. Refer to Setting Stops on page 4. Block-and-Bleed the valve to insure that the leakage has stopped. Refer to the Block-and-Bleed procedure on page 7.
	The seat rings are malfunctioning.	Clean and flush the seat rings. Refer to the Injection Procedure section on pages 10 - 12.
The stem is leaking.	Stem screw or nut is loose.	Tighten the stem screw or nut tightly enough to stop the leak. Do not exceed torque value for stem screw. Contact your Cameron Valves & Measurement group representative to obtain torque values. Operate the valve to make sure the stem is causing the leak.
	The stem seal is damaged.	Replace stem seal. Contact your Cameron Valves & Measurement group representative for assistance. Inject a small amount of sealant into the stem injection fitting.

Troubleshooting (continued)

Trouble	Probable Cause	Remedy
The valve is difficult to operate.	The operator is malfunctioning. (Worm gear operators only)	Perform gear maintenance outlined on page 7.
	There is a build up in the seat area due to line contaminates.	Clean the seat area as outlined on page 7.
	Stem capscrew or nut is too tight.	Loosen the stem screw or nut. Operate the valve. Tighten the stem screw or nut to the appropriate torque value. Contact your Cameron Valves & Measurement group representative to obtain torque values.
Sealant fitting is leaking.	Trash in fitting.	Inject a small amount of cleaner into fitting to dislodge trash.
	Fitting seal is damaged.	Install an auxiliary fitting. Replace fitting when line is depressurized.
Fitting leaks between coupler and button head.	Paint or trash is on the surface of the button head fitting.	Clean surface of button head fitting.
	Coupler seal is damaged.	Replace seal as per manufacturer's instructions.

Injection Procedures

Routine Cleaning

Steps	Procedure
1. Inspect valve.	Inspect: Seat injection fittings. Stem injection fitting. (Do not inject into this fitting.) Body / bleed fitting
2. Inspect equipment.	Make sure the grease gun / pump is in working order and loaded with the appropriate product.
3. Inject standard valve flush.	Inject full seat capacity into each seat, utilizing the seat injection ports. (Refer to capacity chart on page 13.) If this is the first time maintenance has been performed, and the valve has been in service over two years, perform Valve Cleaning procedures on page 11.
4. Operate valve.	Make sure it is safe to operate the valve. Fully operate valve three times.
5. Inspect valve.	Make sure the valve is in the correct position. Clean the grease fittings. Replace fitting caps.

Valve Cleaning

Steps	Procedure
1. Inspect valve.	Inspect: Seat injection fittings. Stem injection fitting. (Do not inject into this fitting.) Body / bleed fitting
2. Inspect equipment.	Make sure the grease gun / pump is in working order and loaded with the appropriate product.
3. Inject flush.	Inject full seat capacity into each seat, utilizing the seat injection ports. (Refer to capacity chart on page 13.)
4. Operate valve.	Make sure it is safe to operate the valve. Fully operate valve three times.
5. Inject cleaner / flush.	Inject full seat capacity into each seat, utilizing seat injection ports. (Refer to capacity chart on page 13.)
6. Allow valve to soak.	Wait one to six hours to allow cleaner to penetrate the buildup and contaminates.
7. Inject flush.	Inject full seat capacity into each seat, utilizing seat injection ports. (Refer to capacity chart on page 13.)
8. Operate valve.	Fully operate the valve three times.
9. Test valve.	Block-and-bleed valve. (Refer to Block-and-Bleed procedure on page 7.) If the valve will not bleed down, follow the sealant injection procedure on page 12.

Sealant Injection

Steps	Procedure
1. Prior steps.	Be sure to follow steps found within Troubleshooting section under Seats are Leaking on page 8 prior to proceeding. All nine steps found in Valve Cleaning on page 11 should be conducted prior to proceeding.
2. Verify valve position.	Confirm valve is in the fully closed position. Use the Open and Closed View Ports (page 6) when available.
3. Inject standard sealant.	Inject full seat capacity into each seat, utilizing the seat injection ports.
4. Test valve.	Block-and-Bleed valve. (Refer to Block-and-Bleed procedure on page 7.) If the valve will not bleed down, continue to the next step.
5. Operate valve.	Operate valve to the fully open position. Use the Open and Closed View Ports on page 6 to verify valve position.
6. Inject standard sealant.	Inject 1/2 seat capacity into each seat, utilizing seat injection ports.
7. Test valve.	Block-and-Bleed valve. (Refer to Block-and-Bleed procedure on page 7.) If the valve will not bleed down, continue to the next step. If the valve leaks in the closed but not in the open position: - The valve is not going fully closed. (use the Open and Closed View Ports on page 6 to verify valve position) - Possible ball damage. Contact your Cameron Valves & Measurement group representative.
8. Operate valve.	Cycle valve open/close 6 times and return to fully closed position. Use the Open and Closed View Ports on page 6 to verify valve position.
9. Inject standard sealant.	Inject 1/2 seat capacity into each seat, utilizing seat injection ports.
10. Test valve	Block-and-Bleed valve. (Refer to Block-and-Bleed procedure on page 7.) If the valve will not bleed down, continue to the next step.
11. Inject severe leak sealant.	Inject full seat capacity into each seat, utilizing seat injection ports.
12. Test valve	Block-and-Bleed valve. (Refer to Block-and-Bleed procedure on page 7.) If the valve will not bleed down, continue to the next step.
13. Operate valve	Cycle valve open/close 3 times and return to fully closed position.
14. Inject severe leak sealant.	Inject 1/2 seat capacity into each seat, utilizing seat injection ports.
15. Test valve	Block-and-Bleed valve. (Refer to Block-and-Bleed procedure on page 7.) If the valve will not bleed down, continue to the next step.
16. Contact your Cameron Valves & Measurement group Representative.	When Contacting your Cameron Valves & Measurement group representative for assistance, please have the following information available: - Valve Size -Assembly Number - ASME Class -Manufacture Date - Serial Number (Refer to nameplate on page 2) The Cameron Valves & Measurement group representative may be able to provide additional information or schedule an on-site consultation.

Injection Capacity Chart

Valve Size	Volume per Seat (oz)	Volume per Valve (oz)	Volume per Seat (cm ³)	Volume per Valve (cm ³)
2"	1	2	25	50
3"	1	2	35	65
4"	2	3	50	100
6"	2	4	65	130
8"	3	6	80	160
10"	3	6	90	180
12"	5	10	135	270
14"	5	10	155	310
16"	6	12	170	335
18"	9	18	265	525
20"	10	20	295	585
22"	11	22	330	655
24"	12	24	350	695
26"	13	26	395	785
28"	13	26	400	800
30"	15	30	445	890
34"	17	34	495	990
36"	21	42	620	1240
40"	32	64	960	1920
42"	34	68	995	1990

Extended Sealant Lines Capacity Chart

Nominal Line Size	Outside Diameter of Pipe	Volume of Sealant Per Length of Pipe	
		oz/ft	cm ³ /m
1/4" (6 mm)	.540" (13.7 mm)	.5	46
1/2" (12 mm)	.840" (21.3 mm)	1.6	150

Approved Flush / Sealant

The following products are recommended by the cleaner / sealant manufacturers for the indicated service and condition. Contact your Cameron Valves & Measurement group representative for availability through Cameron Valves & Measurement.

Product	Service Conditions	Cleaner / Sealant Manufacturer		
		Val-Tex	Sealweld	Lubchem
Natural Gas	Flush	Valve Flush	Valve Cleaner Plus	Valve Saver
	Standard Valve Lubricant	2000 Light Lube	Equa-Lube 80	Lubchem "50-400"
	Standard Sealant	80 bulk / 80-H stick	Total Lube 911 *	Everlast No. 1
	Standard Low Temp	750 bulk / stick	Winterlub 7030 *	Everlast No. 1 AG
	Severe Leak Sealant	80+FTFE bulk / stick *	Sealweld #5050 *	Formasil RS
Sour Gas	Flush	Valve Flush	Valve Cleaner Plus	Valve Saver
	Standard Valve Lubricant	2000 Light Lube	Equa-Lube 80	Lubchem "50-400"
	Standard Sealant	700 bulk / stick	Total Lube 911 *	Lubchem "50-400"
	Standard Low Temp	750 bulk / stick	Winterlub 7030 *	Lubchem "50-300"
	Severe Leak Sealant	700 FTFE bulk / stick *	Sealweld #5050 *	Formasil RS
Dry CO ₂	Flush	Valve Flush	Valve Cleaner Plus	Valve Saver
	Standard Valve Lubricant	2000 Light Lube	Sealweld Silicone Lubricant	Everlast WR
	Standard Sealant	700 bulk / stick	Sealweld Silicone Lubricant	Everlast WR
	Standard Low Temp	750 bulk / stick	Sealweld Silicone Lubricant	Everlast WR
	Severe Leak Sealant	700 FTFE bulk / stick *	Sealweld Silicone Sealant	Formasil CO ₂
Crude Oil	Flush	Valve Flush	Valve Cleaner Plus	Valve Saver
	Standard Valve Lubricant	2000 Light Lube	Equa Lube 80	Lubchem "50-400"
	Standard Sealant	700 bulk / stick	Total Lube 911 *	Lubchem "50-400"
	Standard Low Temp	750 bulk / stick	Winterlub 7030 *	Lubchem "50-300"
	Severe Leak Sealant	700 FTFE bulk / stick *	Sealweld #5050 *	Formasil WR

* Note: Contains PTFE.

Valve Cleaner / Sealant Manufacturers

Val-Tex

Valves Incorporated of Texas
 10600 Fallstone Rd.
 Houston, TX 77099
 281/530-4848
 800/627-9771

Sealweld

6450 Skyview Drive
 Houston, TX 77041
 713/466-7373
 800/624-4301

Lubchem Inc.

P.O. Box 2626
 Spring, TX 77383
 281/350-9600
 800/929-0244

Stem Designs

1", 1.5" and 2" Stem Design

ITEM	DESCRIPTION
1	Capscrew
2	Disc Spring
3	Stop Nut
4	Stem Seal Washer
5	Stem Seal

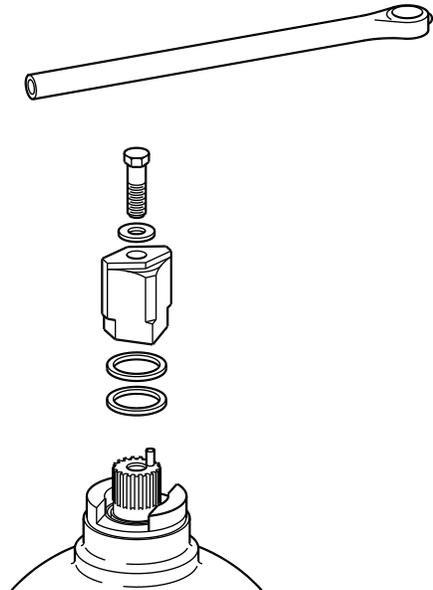


Figure 14 - 1", 1 1/2" and 2" Stem Design.

3" Stem Design

ITEM	DESCRIPTION
1	Nut
2	Disc Spring
3	Keyed Shaft
4	Stud
5	Stem Seal Washer
6	Stem Seal

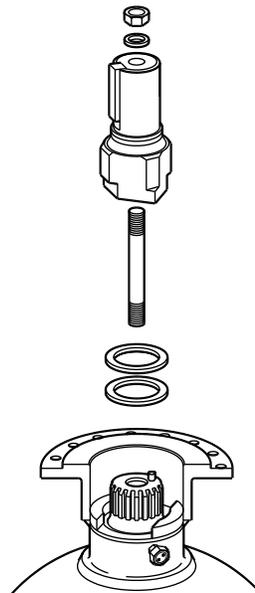


Figure 15 - 3" Stem Design.

Contact your Cameron's Valves & Measurement group representative for a Repair Manual



3250 Briarpark Drive, Suite 300
Houston, Texas 77042
USA Toll Free 800 323 9160

For the most current contact and location information go to: www.c-a-m.com/valvesandmeasurement

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