

Installation, Operation and Maintenance Manual

**GROVE[®] API 6D
FABRICATED GATE VALVES**

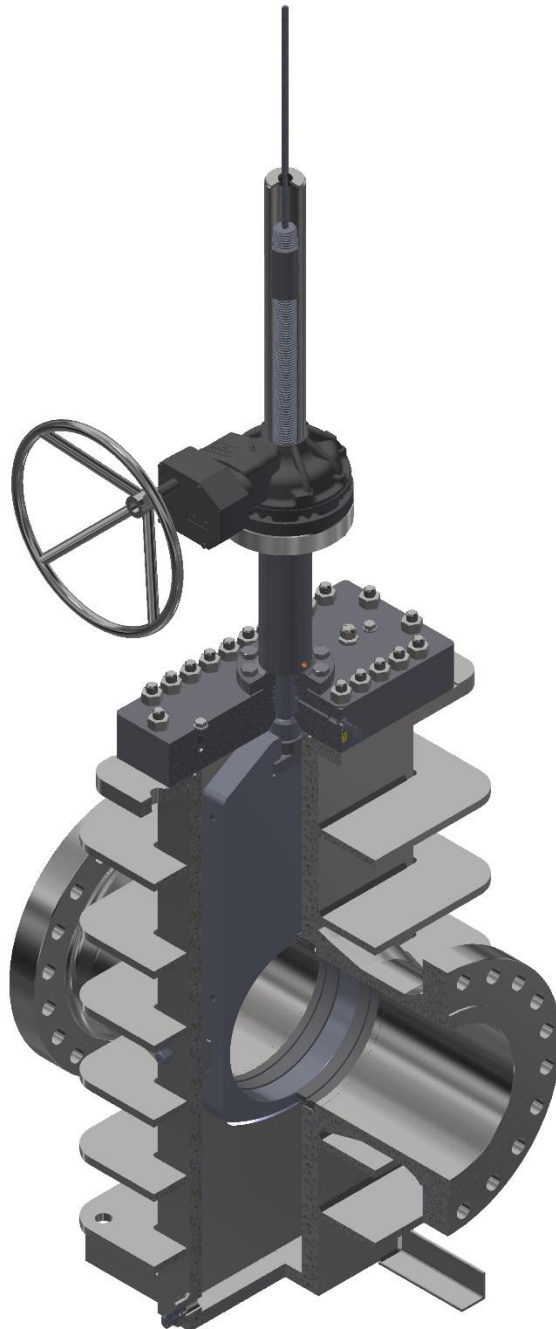


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6" – 48" CLASS 150-900 MODEL "G7"

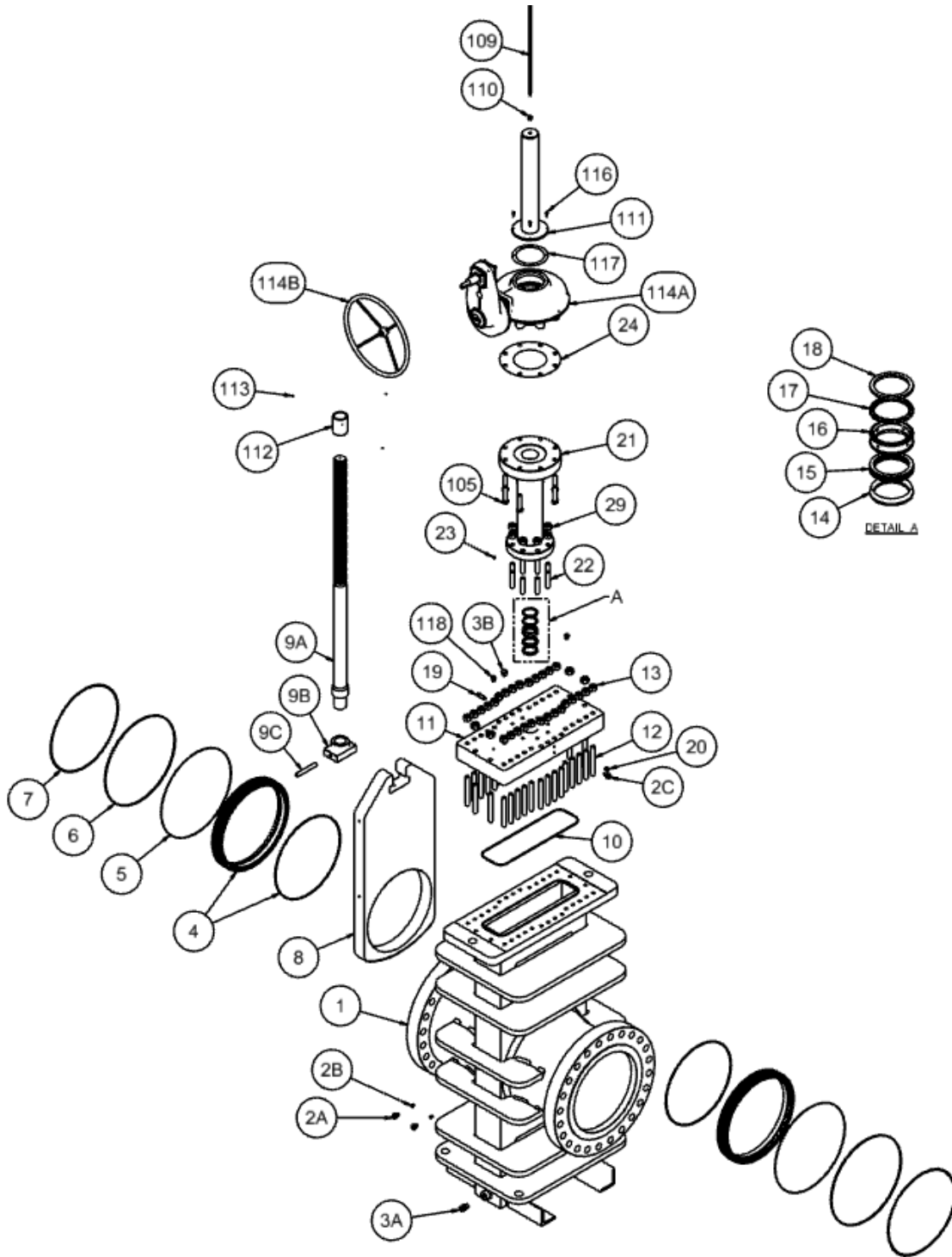


Figure 1A - Grove "G7" Fabricated Gate Valve 6"-48 Class 150-900 – Typical Layout View

Item	DESCRIPTION	QTY	SPARE
1	BODY	1	
2A	SEAT LUBE FITTING	2	
2B	BURIED CHECK VALVE	2	
2C	STEM BACKSEAT FITTING	1	
3A	DRAIN FITTING	1	
3B	VENT FITTING	1	
4	SEAT ASSEMBLY	2	✓
5	GREASE O-RING	2	✓
6	SEAT O-RING	2	✓
7	WAVE SPRING	2	✓
8	GATE	1	✓
9	STEM ASSEMBLY	1	✓
9A	STEM	1	
9B	STEM HEAD	1	
9C	DRIVE PIN	1	
10	BONNET SEAL	1	✓
11	BONNET	1	
12	BONNET STUD	--	
13	BONNET NUT	--	
14	PEDESTAL	1	✓
15	SLS SEAL	1	✓
16	LANTERN RING	1	
17	PRESSURE RING	1	✓
18	UPPER ADAPTER RING	1	
19	PACKING FITTING ASSEMBLY	1	
20	PACKING PLUG	1	
21	YOKE TUBE	1	
22	BOLT	--	
23	DRAIN PLUG	1	
24	GASKET	1	✓
25-29	NAMEPLATES and TAGS (Not shown)	--	
105	BOLT	--	
109	INDICATOR ROD	1	
110	ROD WIPER	1	
111	STEM PROTECTOR	1	
112	STOP RING NUT	1	
113	SET SCREW	3	
114	BEVEL GEAR OPERATOR WITH HANDWHEEL	1	
116	BOLT	--	
117	GASKET	1	
118	PLASTIC PLUG	2	

Figure 1B - Grove “G7” Fabricated Gate Valve 6”-48 Class 150-900 – Typical Item List

SCOPE

This manual covers the Grove Model “G7” Fabricated Gate Valve product line. Drawings shown are typical. The design of specific valves may vary slightly from the typical drawings.

The Grove “G7” Fabricated Gate Valve is a through-conduit slab gate valve. It utilizes two floating seats to provide a complete seal with the gate. The full-bore design has the same pressure drop as an equivalent length of pipe and allows passage of all types of scrapers (pigs). The valve stroke is established by a stop ring located on the stem and the stem backseat. The backseat is an added safety feature which allows for a seal between the stem and bonnet when in the up position. It also provides a means of stem retention in the body. The valve can be repaired while in line (pressure removed and valve drained).

The stem is sealed by spring-loaded lip seals. In an emergency, plastic packing can be injected into the packing box to establish a temporary seal while the valve is under pressure.

The valve does not depend on lubricant for sealing in normal operation. However, lubricants can be injected to promote smooth operation. Seat sealant can also be injected to establish a temporary seal in an emergency should the seats become damaged by foreign matter.

Excess body pressure is automatically vented to the upstream conduit by the self-relieving seat. External body cavity relief systems are not required.

Grove “G7” Fabricated Gate Valves are available in sizes, pressure classes, materials, and coatings to meet industry requirements. Valves are available with lubrication/packing/drain extensions and stem/yoke tube extensions.

NAMEPLATE INFORMATION

ITEM	STAMP
1	Nominal Valve Size
2	Maximum Cold Working Pressure (psig)
3	*Serial Number
4	API Class Designation
5	Minimum Temperature in °F
6	Maximum Temperature in °F
7	*Bill of Material Number
8	Body Material Designation
9	End Material Designation
10	Gate Material Designation
11	Seat Material Designation
12	Stem Material Designation
13	Seal Material Designation
14	(Maximum Operating Pressure at 250°F – if Applicable)
15	(API Monogram - if Applicable)
16	Model Designation
17	(Marking for Non-Standard End-to-End - if Applicable)
18	Date of Manufacture
19	(Impact Test Temperature - if Applicable)

() Description in parenthesis may be left blank in some cases

* Most important data for obtaining replacement parts

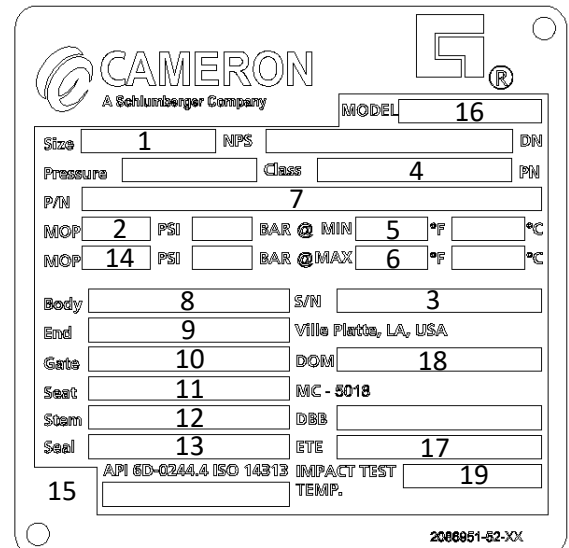


Figure 2 – Grove Fabricated Gate Valve Nameplate

SAFETY INFORMATION

Valves shall be operated and maintained strictly in accordance with these procedures. Operation or maintenance outside these procedures constitutes abuse of the product and voids all warranty and claims.

When special operation is required, a formal written request to the company must be made for approval to operate in this manner if warranty and product liability is to be maintained.

Personnel working on the installation shall always use safety precautions set forth by the law and any regulations required by the employer. Maintenance personnel doing the repairs should be well trained and familiar with all the information contained in this manual.

The valves shall be appropriately used for the purpose they are built for. Transport, unpacking, lifting, and connections to the different types of systems (electric, pneumatic, hydraulic systems, etc.) shall be made by expert and qualified personnel.

Do not carry out any actions when the results are uncertain. This includes lifting, repairing, or removing and reapplying pressure.

Do not remove or tamper with protections or safety devices of any type.

Do not use the valve before the efficiency of all safety devices has been restored.

STORAGE

After Grove "G7" Fabricated Gate Valves are assembled and tested, the valves are left in the open position, seats and bores are greased and end protectors are installed. These measures will provide protection for 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 and the valve will be stored outside, the exposed stem or

the stem adapter should be covered to avoid accumulation of water and debris.

If long-term storage is required, the valve should be conditioned by following Cameron procedure X-150771-01.

Ensure adequate end connection covers are in place. Request a copy of X-150771-01 from the Cameron Valves and Process Systems group.

INSTALLATION

Grove "G7" Fabricated Gate Valves are bi-directional and have no preferred pressure end. Overhaul and repair is easier with the valve in the "stem vertical" position. Before handling the valve, clearly identify and record the nameplate information. Check the weight with the packing list or relevant documents and use suitable handling equipment. When handling or installing the valve, keep the valve in the open position whenever possible to prevent foreign matter from damaging the gate and seat sealing surfaces. The valve should be lifted in such a way that the body supports the load. This can be done via lifting holes on the body ribs as illustrated in Figure 3. Special rigging will be necessary with installed automated system.

CAUTION: Do not use handwheels or other protruding parts of the valve, gearbox, or actuator to lift the valve. During handling, use care to avoid damaging the end connection faces, fittings, and accessories. The end connection necks on the valve body are suitable places to attach lifting slings, if lifting holes are not an option.

Flange End Valves may be bolted into line using two open boxed end wrenches. Power wrenches may be required for larger valves.

1. Use solvent to clean grease or rust inhibitor from the gate and/or bore of the valve.
2. Make sure the line flanges are properly aligned and will not distort or bind the valve. Use new flange gaskets.
3. Bolt and nut threads should be lubricated to obtain proper loading of bolt, as well as the bearing surface of the nut.
4. Finger-tighten all nuts first.
5. Tighten bolts, using the crisscross method, and torque each bolt to ASME or gasket manufacturer's specification.

Butt Weld End Valves should be welded into the line by qualified welders, using qualified procedures. Cameron's Valves and Process Systems group recommends that all welding procedures and welders be qualified per ASME Section IX.

CAUTION: Keep weld end valves open while installing/welding into the line. Weld slag created during the welding process could damage gate sealing surfaces.

1. Use solvent to clean grease or rust inhibitor from the gate and/or bore of the valve.
2. Make sure the line and valve weld bevels are properly aligned and will not bind the valve.
3. Electric welding equipment is preferred for all installations. However, if only oxygen-acetylene welding equipment is available, extreme caution should be taken regarding excess welding temperature to prevent damage to sealing components of the valve.
4. Weld with the gate in "Full Open" position.
5. Make sure temperature of the body/seat area does not exceed 250°F. (Check with Tempil® stick or equivalent).
6. Avoid rapid application of excess welding material. Weld each end of the valve with a continuous bead using a 1/8" maximum diameter electric welding rod.
7. Keep the valve in the "Full Open" position until the line has been thoroughly cleaned of weld slag in the valve bore and line (by pigging and/or flushing) before changing the position of the gate.

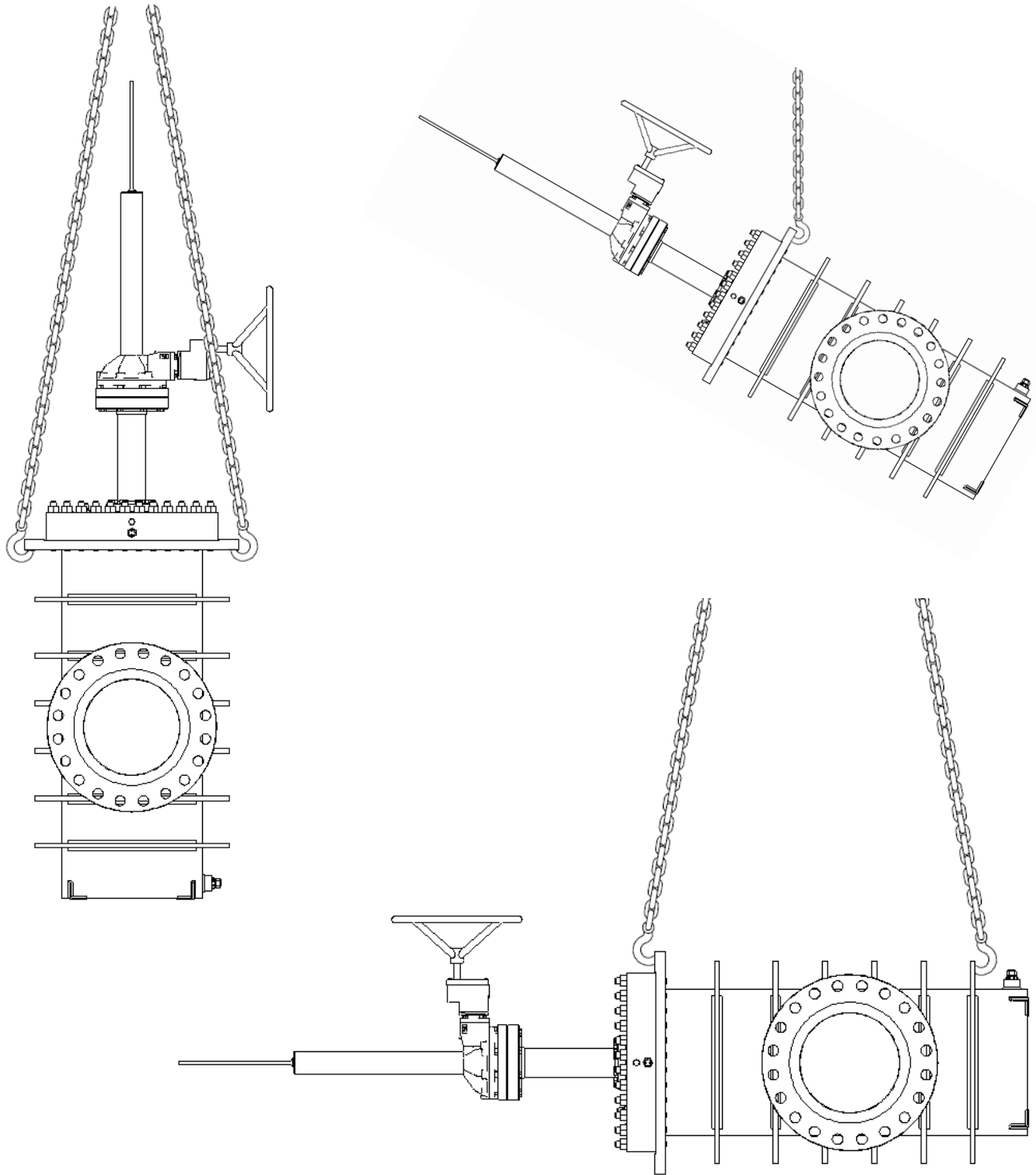


Figure 3 – Various Lifting Techniques

HYDROSTATIC TESTING

When Grove “G7” Fabricated Gate 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 surface and seat seals inside the valve.

CAUTION: Ensure that all test fluids contain corrosion inhibitors and that they are compatible with the valve seat and seal materials.

1. The valve should be in the fully open position when the injection of test fluids 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 gate should be placed in the partially open position to allow test fluid into the body cavity of the valve.
3. The valve is now ready to be hydrostatically pressure tested.

CAUTION: Do not exceed pressures listed on the table below. The Maximum Allowable Working Pressure (MAOP) is marked on the nameplate.

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 in the lower portion of the valve. (See Draining Valve, Page 11).
5. Once the valve body has been completely drained, close the body bleed fitting. (See Draining Valve, Page 11). After securing the safety cap back on the drain fitting, return the valve to required operating position, either fully open or fully closed.
6. The valve seat pockets should be filled with an approved valve lubricant to displace any test fluid from behind the seats.

Pressure Class	Hydrostatic Shell		Hydrostatic Seat	
	psig	(barg)	psig	(barg)
150	450	(31)	325	(23)
300	1125	(78)	825	(57)
600	2225	(154)	1650	(114)
900	3350	(231)	2450	(169)

Figure 4 – Test Pressures per ASME B16.34

OPERATION

The Grove "G7" Fabricated Gate Valve may be operated with a handwheel or may be power actuated. With either mode of actuation, open and close the valve completely. **DO NOT THROTTLE FLOW.**

The valve, in good condition, will seal at low pressures up to the maximum allowable working pressures as a block valve, single-block-and-bleed valve or a double-block-and-bleed valve.

Normal acting gate valves equipped with handwheels are **CLOSED** by turning the handwheel **CLOCKWISE** until a stop is felt. The stem and/or indicator rod at the top of the valve will move down (towards the valve bore), as the handwheel is turned **CLOCKWISE**.

Normal acting gate valves equipped with handwheels are **OPENED** by turning the handwheel **COUNTER-CLOCKWISE** until it contacts the stop. The stem and/or indicator rod at the top of the valve will move up (away from the valve bore), as the handwheel is turned **COUNTER-CLOCKWISE**.

When valves are equipped with power actuators, the movement of the stem and/or indicator rod will indicate if the valve is being opened or closed. Make sure all accessories recommended by the actuator manufacturer are installed before valve actuator installation. Should any maintenance be necessary, obtain the part number from the unit's nameplate and contact Cameron's Valves and Process Systems group or the nearest service representative.

Actuator Mounting

Actuators should only be installed by trained and experienced personnel. Follow the actuator manufacturer's instructions for installation on the valve and making of electrical connections. The following outlines basic procedures when not provided by the actuator manufacturer:

Side Mounted Actuator on a Bevel Gear Operator (BGO)

1. Suspend the BGO above the valve with a strap or chain in such a way that the base of the BGO is parallel with the mounting plate on the valve yoke.

2. Slowly lower the BGO onto the valve stem until the top of the valve stem makes contact with the bottom of the stem bushing.

3. Carefully rotate the BGO until the threads engage.

4. Slowly lower and rotate (counter-clockwise for Left Hand thread, clockwise for Right Hand thread) the BGO onto the valve stem until the base of the BGO rests on the mounting plate.

5. If the orientation of the BGO is incorrect at this point it is possible to rotate the BGO into the correct position by turning the hand-wheel/pinion shaft until the proper orientation is achieved.

6. Install and tighten the BGO mounting bolts.

7. Suspend the actuator so that the output shaft is in-line and parallel to the bevel gear operator pinion shaft.

8. Install the coupling, key or other means to connect the two shafts.

9. Slide the actuator onto the BGO and install the bolts.

10. Ensure that the valve is not seated in the down or closed position prior to installing and tightening actuator mounting bolts.

11. Tighten bolts securely following the actuator manufacturer's instructions.

Direct Mounted Actuator with a Removable Thrust Base

For non-removable stem nut or bushing:

1. Remove the thrust base from the actuator. Refer to the manufacturer's instructions or drawings for guidance.

2. Suspend the THRUST BASE above the valve with a strap or chain in such a way that the base of the THRUST BASE is parallel with the mounting plate on the valve yoke.

3. Slowly lower the THRUST BASE onto the valve stem until the top of the valve stem makes contact with the bottom of the stem bushing.
4. Carefully rotate the THRUST BASE until the threads engage.

5. Slowly lower and rotate (counter-clockwise for LH thread, clockwise for RH thread) the THRUST BASE onto the valve stem until the base of the THRUST BASE rests on the mounting plate.

6. Install and tighten the mounting bolts that attach the Thrust Base to the valve.

7. Reinstall the actuator on the Thrust Base verifying that the proper orientation is achieved and tighten the mounting bolts that attach the actuator to the Thrust Base.

For removable stem nut or bushing:

1. Remove the stem nut from the actuator.
2. Suspend the actuator above the valve with a strap or chain in such a way that the base of the actuator is parallel with the mounting plate on the valve yoke.
3. Slowly lower the actuator over the valve stem until the base of the actuator rests on the mounting plate.
4. Verify that the proper orientation is achieved.
5. Ensure that the valve is not seated in the down or closed position prior to installing and tightening actuator mounting bolts.
6. Install and tighten the actuator mounting bolts.
7. Carefully thread the stem nut onto the valve stem and rotate the nut until it is engaged with the drive sleeve.
8. Rotate the actuator hand-wheel in the open direction until the stem nut is fully engaged in the drive sleeve.
9. Install and tighten the stem nut locking nut.
10. Use a center punch to stake the threads of the stem nut locking nut to the actuator drive sleeve.

Procedure for Setting Down Stop

Install the stem thread stop nut as follows for gear boxes/operators with no limit switches:

Normal Acting gate (most common)

1. Move the valve to the OPEN position (stem up).
2. Thread the stop nut onto the stem until the distance between the bottom of the stop nut and the top of the stem nut in the actuator is equal to the total stem travel. The valve Operator Interface drawing (sometimes called a “Top Works” drawing), shows the stem travel from the OPEN to the CLOSED position.
3. Install the set screws and tighten securely.

Reverse Gate (unusual)

1. Move the valve to the CLOSED position (stem up).
2. Thread the stop nut onto the stem until the distance between the bottom of the stop nut and the top of the stem nut in the actuator is equal to the total stem travel. The valve Operator Interface drawing (sometimes called a “Top Works” drawing), shows the stem travel from the CLOSED to the OPEN position.
3. Install the set screws and tighten securely.

Procedure for Setting Limit Switches

Unless otherwise specified, set the electric actuator switches as follows:

Normal Acting gate (most common)

1. OPEN POSITION- Move the valve to the OPEN (stem up) position. Back off one-quarter stem turn. Follow the actuator manufacturer's instructions for setting the limit switch. The limit should be set so that the stem backseat does not engage the bonnet landing.

2. If the actuator has a torque switch, set it at no more than the Block and Bleed Torque value from the table. However, the limit switch must stop the valve at the top of the stroke. Do not use the torque switch to stop the valve in the open position. Do not let the actuator stall out on the up or back seated position.

3. CLOSED POSITION-Follow the actuator manufacturer's instructions for setting the limit switch so that the actuator stops as the valve reaches the CLOSED (stem down) position. The valve Operator Interface drawing (sometimes called a "Top Works" drawing), shows the stem travel from the OPEN to the CLOSED position. Use this to set the proper closing limits.

4. Keeping the gate in the CLOSED position, thread the stop nut onto the stem and thread down until it contacts the stem nut in the actuator. Back off the stop nut one-quarter (1/4) turn. Install the set screws and tighten securely.

Reverse gate (rare)

1. CLOSED POSITION- Move the valve to the CLOSED (stem up) position. Back off one-quarter stem turn. Follow the actuator manufacturer's instructions for setting the limit switch. The limit should be set so that the stem backseat does not engage the bonnet landing.

2. If the actuator has a torque switch, set it at no more than the Block and Bleed Torque value from the table. However, the limit switch must stop the valve at the top of the stroke. Do not use the torque switch to stop the valve in the open position. Do not let the actuator stall out on the up or back seated position.

3. OPEN POSITION-Follow the actuator manufacturer's instructions for setting the limit switch so that the actuator stops as the valve reaches the OPEN (stem down) position. The valve Operator Interface drawing (sometimes called a "Top Works" drawing), shows the stem travel from the CLOSED to the OPEN position. Use this to set the proper closing limits.

4. Keeping the gate in the OPEN position, thread the stop nut onto the stem and thread down until it contacts the stem nut in the actuator. Back off the stop nut one-quarter (1/4) turn. Install the set screws and tighten securely. value from the table. However, the limit switch must stop the valve at the bottom of the stroke. Do not use the torque switch to stop the valve in the open position.

5. CLOSED POSITION- Move the valve to the CLOSED (stem up) position. Back off one-quarter (1/4) stem turn. Follow the actuator manufacturer's instructions for setting the limit switch. The limit should be set so that the stem backseat does not engage the bonnet landing.

6. The valve Operator Interface drawing (sometimes called a "Top Works" drawing), shows the stem travel from the OPEN to the CLOSED position. Use this to set the proper closing limits. Do not let the actuator stall out on the up or back seated position.

Verify that the maximum allowable torque switch setting of the actuator is not exceeded. This setting may be indicated by the use of a torque limiter plate on the torque switch. If no limiter plate is installed on the torque switch then the maximum torque value will need to be determined from supporting documentation that came with the actuator, nameplate information, or by contacting the actuator manufacturer.

WARNING: Exceeding a limiter plate setting can result in reaching or exceeding stall torque of the actuator motor or maximum allowable torque for actuator. This can result in equipment damage and personnel injury. At no time should a limiter plate be removed without written approval from the actuator manufacturer.

ROUTINE MAINTENANCE

The following outlines the minimum scheduled maintenance required for Grove “G7” Fabricated Gate Valves to promote trouble-free service and long life. Some applications may require more maintenance. Visually inspect every six (6) months.

See troubleshooting section (Page 19) for a list of remedies to troubles that may arise. If remedies are not sufficient, contact local

Cameron Valves and Process Systems service representative.

Operate the valve once a month, if practical. A full open closed cycle is preferable. Operate a partial cycle as a minimum.

CAUTION: Verify compatibility of any sealant, lubricant, or anti-freeze with the trim of the valve and product in the line.

DRAINING AND FLUSHING VALVE

After lengthy service, there is a possibility of water, line scale, sediment or other foreign matter collecting in the lower body cavity. It is advisable to periodically drain the valve to discourage development of conditions that can possibly lead to valve damage or impair the operation of the valve. If draining is not regularly scheduled, it is strongly recommended to drain the valve at these times:

1. After hydrostatic testing.
2. After cleaning the line.
3. When valve cannot be fully opened or closed. (Foreign matter in the bottom of valve can not only prevent placing valve in a fully closed position, it can also cause permanent damage to the internal sealing surfaces).

CAUTION: A safety pressure releasing tool is required to simplify the procedure of releasing body pressure or draining the valve. To release body pressure or to drain valve, first place the valve in the closed position.

WARNING: To avoid injury by liquid or foreign solid matter, individuals should be safely positioned away from the direction of the outlet port of the grease fitting. (If the ball check is not holding pressure, pressure will blow through the safety holes in the cap.) Back-up the seat grease fitting using a wrench so only the safety cap will be removed from the fitting. Carefully remove the safety cap from the seat grease fitting.

NEVER remove the grease fitting with the valve under pressure!

1. Carefully remove the vented safety cap of the lower drain grease fitting, Figure 5. Contact your local Cameron Valves and Process Systems service representative for further assistance, if needed.
2. Back out the stinger of the pressure releasing tool until it stops.
3. Install the pressure releasing tool onto the uncapped grease fitting. The ball check on the grease fitting should still be closed, Figure 6.
4. Carefully screw the stinger of the releasing tool- (until the ball check in the grease fitting is pushed off its seat, Figure 7). This will allow the valve to drain or to release body pressure.
5. After completion, back out the stinger of the pressure releasing tool to allow the ball check in the grease fitting to reseat and permit easy removal of the pressure releasing tool.
6. Replace safety cap on the lower drain grease fitting.

For flushing of body, install a valve on the drain. Use internal procedures to flush water, anti-freeze, etc. from the body.

WARNING: Do not replace yoke tube plastic plug with a metal plug/fitting. There is a risk of pressure becoming trapped in the yoke tube which could cause injury.

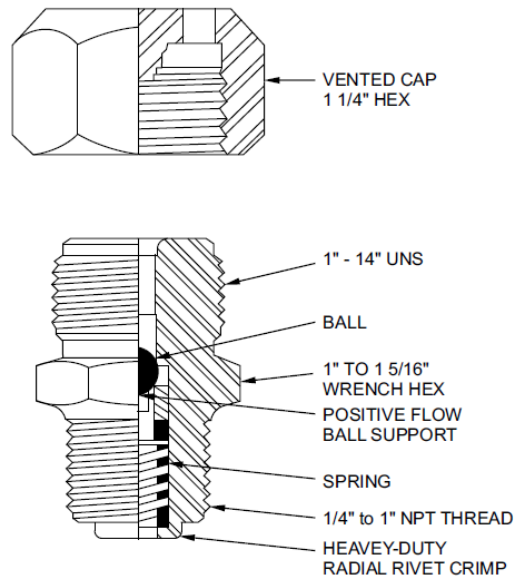


Figure 5 - Grease Fitting

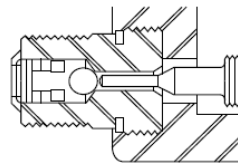


Figure 6 – Pressure Releasing Tool as Installed (Ball Check Closed).

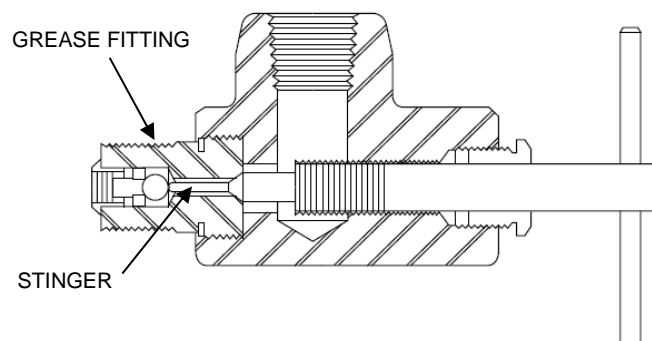


Figure 7 - Pressure Releasing Tool with Stinger Screwed In (Ball Check Open and Venting).
 Part Number K021960 for 1/2" fittings.
 Part Number K032287 for 1" fittings.

LOW TEMPERATURE PRECAUTIONS

Prior to exposure to freezing temperatures, it is highly recommended the valve be drained.

Water that may be trapped in the body cavity could freeze and impair the operation of the valve or damage the valve.

If the valve has a grease fitting in the lower drain, a sufficient amount of anti-freeze injected into the body cavity via the lower drain grease fitting will prevent accumulated water from

freezing. It is also advisable to inject a sufficient amount of valve lubricant into the grease fittings of the valve and operator (if present) prior to extended cold temperature exposure.

Trapped water should be drained from stem extensions. Some stem extensions in the field are equipped with plastic plugs that can be removed to drain trapped water from the piped extension.

Volume of Anti-freeze (Ethylene Glycol) to Prevent Freezing (Gallons)

Minimum Expected Temperature	18°F (-8°C)	13°F (-11°C)	7°F (-14°C)	-8°F (-22°C)	-28°F (-33°C)	-55°F (-48.5°C)	Body Volume in the Open Position	Body Volume in the Closed Position
Percent Anti-Freeze	18%	23%	28%	37%	48%	59%		
6" - 150#	0.5	1.0	1.0	1.0	1.5	1.5	2.0	2.2
6" - 300#	0.5	1.0	1.0	1.0	1.5	1.5	2.0	2.2
6" - 600#	0.5	1.0	1.0	1.0	1.5	1.5	2.0	2.2
6" - 900#	0.5	1.0	1.0	1.0	1.5	1.5	2.0	2.2
8" - 150#	1.0	1.0	1.5	1.5	2.0	2.5	3.3	3.6
8" - 300#	1.0	1.0	1.5	1.5	2.0	2.5	3.3	3.6
8" - 600#	1.0	1.0	1.5	1.5	2.0	2.5	3.2	3.6
8" - 900#	1.0	1.0	1.5	1.5	2.0	2.5	3.3	3.7
10" - 150#	1.0	1.5	1.5	2.0	3.0	3.5	4.7	5.3
10" - 300#	1.0	1.5	1.5	2.0	3.0	3.5	4.7	5.3
10" - 600#	1.0	1.5	1.5	2.0	3.0	3.5	4.7	5.3
10" - 900#	1.0	1.5	1.5	2.0	2.5	3.5	4.4	5.1
12" - 150#	1.5	2.0	2.5	3.0	4.0	4.5	6.3	7.3
12" - 300#	1.5	2.0	2.0	3.0	3.5	4.5	6.1	7.1
12" - 600#	1.5	2.0	2.5	3.0	4.0	4.5	6.3	7.3
12" - 900#	1.5	2.0	2.5	3.0	4.0	5.0	6.5	7.8
14" - 150#	2.0	2.5	3.0	3.5	4.5	5.5	8.0	9.2
14" - 300#	2.0	2.5	3.0	4.0	5.0	6.5	8.8	10.2
14" - 600#	2.0	2.5	3.0	4.0	5.0	6.5	8.8	10.2
16" - 150#	2.0	2.5	3.0	4.0	5.5	6.5	8.8	10.4
16" - 300#	2.0	2.5	3.0	4.0	5.5	6.5	9.0	10.6
16" - 600#	2.5	3.0	3.5	5.0	6.0	7.5	10.4	12.4

Minimum Expected Temperature	18°F (-8°C)	13°F (-11°C)	7°F (-14°C)	-8°F (-22°C)	-28°F (-33°C)	-55°F (-48.5°C)	Body Volume in the Open Position	Body Volume in the Closed Position
Percent Anti-Freeze	18%	23%	28%	37%	48%	59%		
18" - 150#	2.5	3.5	4.0	5.5	7.0	8.5	11.7	13.7
18" - 300#	2.5	3.5	4.0	5.5	7.0	8.5	11.7	13.7
18" - 600#	3.5	4.5	5.0	7.0	9.0	11.0	14.8	17.8
20" - 150#	3.5	4.5	5.5	7.0	9.0	11.0	15.7	18.2
20" - 300#	4.0	5.0	6.0	8.0	10.0	12.5	17.5	20.6
20" - 600#	5.0	6.0	7.5	9.5	12.5	15.0	21.0	25.1
24" - 150#	5.0	6.0	7.5	10.0	12.5	15.5	22.0	25.9
24" - 300#	5.5	7.0	8.5	11.0	14.5	18.0	24.8	29.7
24" - 600#	7.0	9.0	11.0	14.5	18.5	23.0	31.3	38.2
30" - 150#	8.0	10.5	12.5	16.5	21.0	26.0	37.6	43.7
30" - 300#	11.0	13.5	16.5	22.0	28.5	34.5	48.7	58.5
30" - 600#	13.5	17.0	20.5	27.5	35.5	43.5	59.7	73.1
36" - 150#	13.0	16.5	20.0	26.5	34.5	42.5	60.8	71.4
36" - 300#	17.5	22.0	27.0	35.5	46.0	56.5	78.3	95.1
36" - 600#	22.0	28.0	34.0	45.0	58.0	71.5	97.9	120.8
42" - 150#	17.0	21.5	26.0	34.5	44.5	55.0	70.4	92.5
42" - 300#	22.5	29.0	35.0	46.5	60.0	73.5	94.3	124.4
42" - 600#	28.5	36.5	44.0	58.5	75.5	93.0	119.0	157.0
48" - 150#	23.5	30.0	36.5	48.5	63.0	77.0	106.0	130.3

Volume of Anti-freeze (Ethylene Glycol) to Prevent Freezing (Liters)

Minimum Expected Temperature	18°F (-8°C)	13°F (-11°C)	7°F (-14°C)	-8°F (-22°C)	-28°F (-33°C)	-55°F (-48.5°C)	Body Volume in the Open Position	Body Volume in the Closed Position
Percent Anti-Freeze	18%	23%	28%	37%	48%	59%		
6" - 150#	2	2	3	4	4	5	8.3	7.5
6" - 300#	2	2	3	4	4	5	8.3	7.5
6" - 600#	2	2	3	4	4	5	8.3	7.5
6" - 900#	2	2	3	4	4	5	8.3	7.5
8" - 150#	3	4	4	6	7	9	13.7	12.4
8" - 300#	3	4	4	6	7	9	13.7	12.4
8" - 600#	3	4	4	6	7	9	13.6	12.2
8" - 900#	3	4	4	6	7	9	14.1	12.6

Minimum Expected Temperature	18°F (-8°C)	13°F (-11°C)	7°F (-14°C)	-8°F (-22°C)	-28°F (-33°C)	-55°F (-48.5°C)	Body Volume in the Open Position	Body Volume in the Closed Position
Percent Anti-Freeze	18%	23%	28%	37%	48%	59%		
10" - 150#	4	5	6	8	10	12	20.0	17.8
10" - 300#	4	5	6	8	10	12	20.0	17.8
10" - 600#	4	5	6	8	10	12	20.0	17.8
10" - 900#	4	5	6	8	10	12	19.4	16.8
12" - 150#	5	7	8	11	14	17	27.6	23.9
12" - 300#	5	7	8	10	13	16	27.0	23.2
12" - 600#	5	7	8	11	14	17	27.6	23.9
12" - 900#	6	7	9	11	15	18	29.3	24.6
14" - 150#	7	9	10	13	17	21	34.9	30.3
14" - 300#	7	9	11	15	19	23	38.6	33.5
14" - 600#	7	9	11	15	19	23	38.6	33.5
16" - 150#	8	10	12	15	19	24	39.5	33.5
16" - 300#	8	10	12	15	20	24	39.9	33.9
16" - 600#	9	11	14	18	23	28	46.9	39.3
18" - 150#	10	12	15	20	25	31	51.9	44.2
18" - 300#	10	12	15	20	25	31	51.9	44.2
18" - 600#	13	16	19	25	33	40	67.4	56.2
20" - 150#	13	16	20	26	34	41	68.9	59.2
20" - 300#	15	18	22	29	38	47	78.1	66.3
20" - 600#	18	22	27	36	46	56	94.9	79.5
24" - 150#	18	23	28	37	48	58	98.1	83.2
24" - 300#	21	26	32	42	54	67	112.4	93.9
24" - 600#	27	34	41	54	70	86	144.7	118.7
30" - 150#	30	39	47	62	80	98	165.6	142.5
30" - 300#	40	51	62	82	107	131	221.3	184.5
30" - 600#	50	64	78	103	133	164	276.6	226.1
36" - 150#	49	63	76	100	130	160	270.2	230.0
36" - 300#	65	83	101	134	173	213	359.9	296.6
36" - 600#	83	106	129	170	220	270	457.2	370.6
42" - 150#	64	81	99	130	169	207	350.2	266.5
42" - 300#	85	109	132	175	227	278	470.9	357.0
42" - 600#	108	137	167	220	286	351	594.5	450.3
48" - 150#	89	114	139	183	237	292	493.3	401.4

LUBRICATING HANDWHEEL AND OPERATOR ASSEMBLY

Handwheel Operated Valves-

Connect a grease gun containing NLGI grade 2 petroleum base grease to the 1/8" Alemite type grease fitting on the bearing housing. Pump in a small amount of grease. **DO NOT OVERFILL.**

Bevel Gear Operators-

Bevel gear operators are supplied by other manufacturers. Consult particular manufacturer's instructions. If these are not available, lubricate the same as Handwheel Operated Valves above.

Motor Operated Valves-

Motor operators are supplied by other manufacturers. Consult particular manufacturer's instructions.

Lubricating Stem

1. Remove the stem protector and inspect the stem thread for any damage.
2. Clean any visible debris prior to applying grease to the stem thread, see Recommended Lubricants and Sealants.
3. Cycle the valve to distribute the grease throughout the threading and stem nut in the operator.
4. If operation is smooth, remove any debris build-up on the stem protector and reinstall onto the operator.

LUBRICATING SEATS

Grove "G7" Fabricated Gate Valves are equipped with seat injection ports. For dry/gas service, lubricate once a year.

1. Only use grease guns that are equipped with a pressure gage.
2. Some seat sealants become very stiff or viscous in cold weather. It may be difficult to pump some sealants under these conditions. It is recommended that the grease gun be kept in a heated area until it is ready to be used. If this is not possible, contact the local Cameron Valves and Process Systems service representative for low temperature sealant recommendations.
3. Move the valve to the closed position.
4. Carefully, remove the safety caps on the seat lubrication fitting using a wrench.

WARNING: Back up the seat grease fitting using a wrench so only the safety cap will be removed from the fitting. Carefully remove the safety cap from the seat grease fitting. NEVER remove the grease fitting with the valve under pressure!

5. Connect the grease gun to the seat lubrication fitting(s). (Both sets may be lubricated at the same time).

6. Pump the sealant into the seat. Once the pressure rises above the valve rated pressure, hold for three (3) minutes to promote filling of the grease grooves.

Note: Grease guns can develop pressures far in excess of the valve working pressure. Use only grease guns, which are equipped with pressure gages. Do not exceed the valve maximum allowable working pressure.

7. Stroke the valve to spread the sealant on the seat surfaces. (Stem and/or Indicator rod should move approximated 1" or 25 mm).

8. Release the pressure in the grease gun and remove it from the grease fitting. The fitting ball check should prevent the release of the valve grease pressure.

9. Install the fitting safety cap and tighten securely.

10. Repeat for the other seat. Both seats may be lubricated at the same time, if desired.

RECOMMENDED LUBRICANTS AND SEALANTS

TRIM	NORMAL SEAT LUBRICANT	STEM/BEARING LUBRICANT	EMERGENCY SEAT SEALANT	EMERGENCY STEM PACKING
G-20 (Aromatic Hydrocarbons and refined products, non-sour)	WKM #58G or Val-Tex 700	NLGI Grade 2 Bearing Grease	WKM #58G	WKM #113 or Jim Ray Tiger Pak "FF"
G-21 (Aromatic Hydrocarbons and refined products, sour)	Val-Tex 700	NLGI Grade 2 Bearing Grease	WKM #102	WKM #109
G-23 (Low temperature produced hydrocarbons, sour)	Val-Tex 50	WKM #1	WKM #103	WKM #109

RECOMMENDED LUBRICANTS AND SEALANTS Continued

PRODUCT	MANUFACTURER
WKM #1 WKM #58G WKM #102 WKM #103 WKM #109 WKM #113 WKM #115	Cameron Valves and Process Systems Operation Services 8820 Meldrum Ln Houston, TX 77075 713-946-2122 Fax: 713-331-5813
Val-Tex 700 Val-Tex 50	Val-Tex 10600 Fallstone Road Houston, TX 77009 800-627-9771 281-530-4848 Fax: 281-530-5225
Jim Ray Tiger Pak FF	Jim Ray 10645 Richmond Ave. #130 Houston, TX 77042 713-785-5055 Fax: 713-785-5534

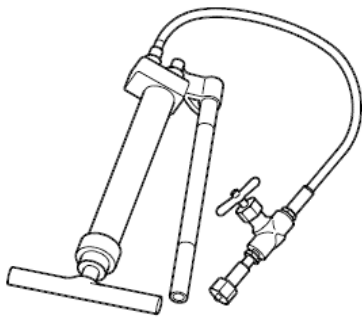


Figure 8 – Screw/Prime Hand Gun, Part Number 2122495-01. Exact configuration may vary from illustration.

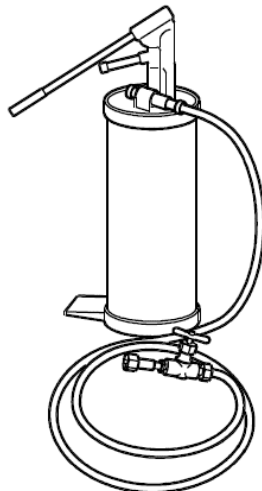


Figure 9 – Bucket-Type Gun, Part Number K065189. Exact configuration may vary from illustration.

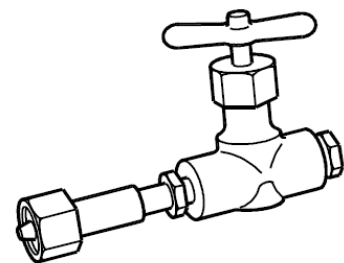


Figure 10 – Adapter Fitting, Part Number K296434.

TROUBLESHOOTING

Trouble	Probable Cause	Remedy
Leakage is occurring around the stem, yoke tube drain, or yoke tube to bonnet joint.	The stem seal is leaking due to a contaminated stem.	Cycle the valve several times.
	The stem seal is leaking due to damage or abnormal wear.	Close the valve to energize stem backseat.
	The stem seal is leaking due to damage or abnormal wear.	Inject plastic packing as follows: Remove the packing fitting screw and install a packing injection gun ¹ loaded with the proper plastic injectable. Refer to the "Recommended Lubricants and Sealants" table. Using the packing gun, pump plastic to energize the packing set. 4000-5000 psig (275-345 barg) is usually sufficient. DO NOT EXCEED 10,000 psig (690 barg). WARNING: THE INJECTION PRESSURE IS TWICE THE HYDRAULIC GAUGE PRESSURE. Hold for at least 3 minutes. Re-pressurize, as needed. Remove the packing gun. Lubricate the packing fitting screw thread with a good grade of bearing grease and thread it into the fitting. Tighten securely but do not exceed 7 ft-lbf (9.5 N-m) of torque. See "Appendix" for more information.
The grease fitting or bleed plug is leaking.	The safety cap or bleed plug screw is loose.	Tighten the safety cap or bleed plug screw.
The valve is leaking around the bonnet to body joint.	The bonnet seal is leaking.	Ensure that the bonnet nuts are tightened properly. Contact local Cameron Valves and Process Systems service representative if leakage persists.
A restriction is present in the valve bore.	The gate is not properly aligned with the seats.	HANDWHEEL OR BEVEL GEAR OPERATED VALVES: Open the valve fully by turning the handwheel counter-clockwise. Tighten securely. MOTOR OPERATED VALVES: Make sure the operator limit switches are set correctly. Do not exceed Maximum Allowable Stem Torque and Thrust.
The valve is hard to operate.	The lubrication is not sufficient.	Lubricate the seats per the "Lubricating Seats" section. Remove the stem protector to clean and grease the stem. Increase torque within allowable limit.

¹Contact local Cameron Valves and Process Systems Service Representative for current part number.

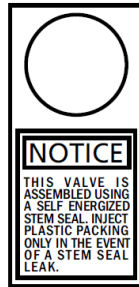
TROUBLESHOOTING continued

Trouble	Probable Cause	Remedy
(continued) The valve is hard to operate.	Ice is present in the yoke tube, handwheel unit, or operator.	Apply heat to melt ice. (Do not exceed 250°F)
	Line bind is present. (Pipeline bending moments distorting the valve body).	Relieve the bind or moment on the valve.
	Excessive stem packing pressure causing drag.	Relieve the excess packing pressure through the injection fitting using stinger tool.
The valve will not fully close.	Debris build up in the body.	Return valve to the open position. Flush the body cavity through the drain. See “Draining Valve” section.
	Debris build up in the seats.	Flush the seat pockets with lubricant per “Lubricating Seats” section.
	Excessive stem packing pressure causing drag.	Relieve the excess packing pressure through the injection fitting using stinger tool.
Motor operator will not actuate the valve.	Improperly sized motor operator.	Replace with properly sized motor operator.
	Improperly wired electric operator.	Verify wiring following instructions and schematics provided by the operator manufacturer.
Valve operation is erratic.	The bearings need lubrication.	Lubricate the operator per the manufacturer’s instructions.
	The stem, bearing or gear unit is broken or damaged.	Replace broken or damaged parts.
The valve seats will not seal.	Valve is not fully closed.	Fully close the valve. Turn the handwheel CLOCKWISE.
	Seat or seat seals are damaged.	Inject Seat Sealant per the “Lubricating Seats” section. Replace parts.

APPENDIX

INJECTING PACKING

1. Grove "G7" Fabricated Gate Valves use a self-adjusting stem seal identified by the following tag on the packing fitting. These require only periodic inspection.



2. Inspect the valve for evidence of stem leakage. This might be determined by paint

discoloration around the bonnet-yoke tube joint. If there is no evidence of leakage, no maintenance is required.

3. If leakage is evident, inject plastic packing as follows:

STICK METHOD	GUN METHOD
<p>Note: Packing is not damaged by cold. However, keep plastic packing in a warm place (like a heated room or vehicle cab) until ready for use to keep pliable.</p>	
<ul style="list-style-type: none"> • Remove the injection stinger from the packing fitting CAUTION: Pressure may be trapped in the packing box • Apply a good grade of earing grease to the threads • Place a stick of packing into the fitting and screw in the stinger until it seats. • Repeat as necessary. Use screw torques as follows: <ul style="list-style-type: none"> ▪ 3-4 ft-lb (40-50 in-lb, 4-5.5 N-m) for WKM packings ▪ 4-5 ft-lb (50-60 in-lb, 5.5-7 N-m) for thick packings ▪ Do not exceed 7 ft-lb (60 in-lb, 9.5 N-m) as this may exceed the 10,000 psig (689 barg) rating of the fitting • Back out the screw until the threads show, this allows the ball check to seat <p>CAUTION: Apply only enough packing to stop the leak</p>	<ul style="list-style-type: none"> • Remove the injection stinger from the packing fitting. CAUTION: Pressure may be trapped in the packing box • Assemble the packing gun with the appropriate plastic packing • Connect the gun to the packing fitting • Apply 4000-5000 psig (275-345 barg) to the packing gun. Thick packing may require 8000-9000 psi (551-620 bar). CAUTION: The WKM style packing gun applies twice the hand pump pressure • Hold for several minutes • Add more plastic if the pressure drops • Repeat until the packing pressure holds steady • Do not exceed 10,000 psi (689 bar) • Remove the packing gun • Dig out any excess packing from the packing fitting • Apply a small amount of bearing grease to the packing fitting screw • Install the packing fitting screw and tighten