



INSTALLATION INSTRUCTIONS  
STANDARD GATE VALVES  
SIZES 1.5"- 21.0"

READ ALL INSTRUCTIONS  
PRIOR TO INSTALLATION

KEEP INSTRUCTIONS WITH THE VALVE  
FOR FUTURE REFERENCE

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## NOTES

SPECIFICATIONS

310/410 Models	
Media	Air or inert gases
Pressure Range	0-125 psig (0-8.5 bar) 0-28" Hg vacuum (prefix "v" 3-way and all 4-way models)
Ambient temperature range	32 to 125° F (0 to 50°C)
Coil temperature rise (any voltage)	81° F (45° C)
Power consumption (AC/DC)	4.5 watts
Response time (on/off)	.012/.010 (DC), .012/.020 (AC) sec.
Voltage tolerance	Plus 10%, minus 15% of rated voltage
Coil voltages	12V DC, 24V DC, 24V AC, 100V AC, 120V AC, 200V AC, 240V AC
SCFM @ 100 psig	>10
C <sub>v</sub>	.144
Fill/exhaust time @ 100 psig (7.0bar)	1 cu. In. .020/.032 sec. 10 cu in. .20/.32 sec. 100 cu. In. 2.00/3.20 sec.
Leak rate (max. allowed)	4cc/minute @ 100 psig
Type of operation	Direct Solenoid
Effective area	Model 310 .0069-inch <sup>2</sup> Model 410 .0064-inch <sup>2</sup>
Stroke	.015-inch
Maximum cycle rate (cycles/min.)	2700 (DC), 1875 (AC)
Lubrication	None required, factory pre-lubed
Filtration	40 Micron recommended
Materials	Brass, Buna N, aluminum, stainless steel, acetal

**STANDARD GATE VALVE  
INSTALLATION INSTRUCTIONS**

**UNPACKING**

Inspect shipping container before unpacking for damage sustained during transit. Any visible damage/claims should be reported to the transportation company immediately. Remove the valve and make sure that the flange faces are free of knicks or scratches and there is no obvious damage to the actuator assembly and body.

Write the model number and serial number down for future reference. Model numbers and serial numbers are required when purchasing spare parts and when returning the valve for maintenance.

**PRE-INSTALLATION**

**WARNING:** Never put hands or any other object in the Gate Valve-serious bodily injuries will occur and valve will be damaged.

Determine that the valve and adjacent plumbing in the vacuum system will be adequately supported when installed. An excessive amount of weight mounted on the valve without adequate support may possibly impair sealing and operation of the valve. Confirm the mating flanges are in line, flat, parallel and the correct distance apart to minimize straining of valve body.

Remove the flange covers and wipe the flanges with a lint-free, dry wipe. If installing an o-ring seal flange, apply a light film of vacuum grease (Apiezon L Grease or an equivalent is recommended) to the o-ring, using extreme care to not stretch the o-ring, and install in the flange o-ring groove. Do not twist, cut or damage o-ring.

**VALVE OPERATION**

**IMPORTANT:** Air regulator must be used to confirm the valve actuates properly. Instructions must be followed in exact order or warranty is void.

**Valves shipping WITH a solenoid** (diagram 9 page 10): Connect the main air line to the air supply to solenoid (see diagram). Supply 5 psig, to the solenoid. This will insure the actuator is air loaded and ready to cycle and no damage will occur to valve.

**Valves shipping WITHOUT a solenoid** (diagram 8 page 9): Connect the normally closed airline to the air to CLOSE fitting/speed controller (see diagram). Supply 5 psig. This will insure the actuator is air loaded and ready to cycle and no damage will occur to valve.

Do not proceed if the valve is in the open position. Return to previous step. Continue if valve is in the closed position.

## VALVE OPERATION CONTINUED

Using minimum air pressure required (start at 5 psig), actuate the valve into the open position. Slowly close the valve using the minimum amount of air pressure required (start with 5 psig) until you visually see the gate o-ring make contact with the case. Increase air pressure in 5 psig increments, opening and closing the valve with each increment, until valve operating pressure has been achieved (see operating tag on valve). Opening and closing the valve using larger than 5 psig increments can damage the valve. **DO NOT EXCEED 80 PSIG.** If the valve does not close completely or the gate valve cycles faster than manufacturer set cycle time listed on page 11, General Information, contact the manufacturer.

## INSTALLATION

**Air Operated:** Connect the compressed air supply to the gate valve using teflon tape or an equivalent on the threads to ensure leak-proof connections. For continued trouble-free operation, it is recommended that an air filter/lubricator be used in the air line system. Refer to the solenoid nameplate for the correct voltage when connecting to the electric service. Check the valve opening for any obstruction.

It is preferable to install the valve with vacuum on the Carriage side of the valve so the valve body remains under vacuum at all times and the pump down of the valve body is eliminated.

**Valve Orientation:** Unless otherwise specified at time of order, all valve cycle times and closing pressures are calculated using 'horizontal' (diagram 10, page 12) valve orientation. The valve orientation for 1.5" (38mm) 21" (533mm) is any; for sizes 24" (610mm) - 50" (1270mm) and greater, contact factory.

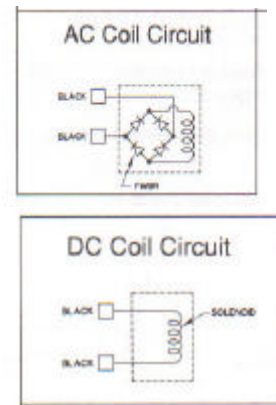
Making sure that no foreign particles enter the valve, proceed with installation. When installing a valve, it is imperative that proper length bolts be used. *Bolts longer than the combined thickness of both mating flanges will damage the body panels, destroy the seal surface area for the gate o-ring and restrict the carriage from moving to the open/close position. Always use bolts that are at least 1/4—inch (6.4 mm) shorter than the combined thickness of both mating flanges.* **IMPORTANT:** Lightly grease the flange bolts with high-temperature, non-galling type grease (Anti-Gall C-100, #51032 or an equivalent is recommended). Carefully tighten the bolts around the flange, see instructions and proper torque and torque sequence on page 4.

**WARNING: NEVER PUT HANDS OR ANY OTHER OBJECT IN THE GATE VALVE—SERIOUS INJURIES WILL OCCUR AND VALVE WILL BE DAMAGED.**

## TROUBLESHOOTING

If valve fails to function when electrical power is supplied: Check valve function using manual override. If valve functions by manual actuation, check line voltage to determine compliance with valve electrical rating. Check valve for inoperable (open) coil, measuring milliamps per Electrical Specification Chart. Check that air supply has been delivered in adequate volume and pressure for proper functioning of the device. Ensure that there are no blockages due to air line contamination or defective/blocked fittings. If valve continues to fail contact manufacturer.

## SOLENOID CIRCUIT SCHEMATICS



## MANUAL OVERRIDE

Push button/spring return manual override is standard. Manual override is located on top of coil. Push red button shifts armature which actuates valve's main stem. Release of manual force permits valve spring to return valve to normal position.

## TECHNICAL INFORMATION USING HUMPHREY 410-70 SOLENOID IN CONJUNCTION WITH GATE VALVE FACTORY SET FOR NORMALLY CLOSED

### GENERAL INFORMATION-Description—410

A 1/8-inch ported, 4-way, single solenoid, 2-position/spring return general purpose air valve, capable of being used in a variety of functions. Model 410-70 offers dual flow controls and is the standard solenoid. The 410-70 is shipped with every valve unless customer specifies otherwise. The solenoid is set for normally closed gate valve.

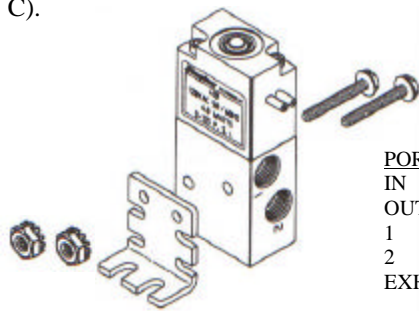
### Plumbing

310/410 solenoid valves are direct acting. When used with vacuum or low pressure, use largest possible tubing size and minimum tubing length for optimum performance. **NOTE: Before connecting fittings and tubing, remove all foreign material from these components. If using a sealant, take extra care that sealant does not enter the solenoid valve. This can potentially cause malfunction and/or leakage.**

**CAUTION: Compressed air is powerful and may be dangerous. Before attempting to remove a component from an air line or system, always disconnect the supply air and thoroughly exhaust the line or system. Never attempt to construct, operate, or service anything using compressed air unless you have been properly trained to do so. Failure to heed this warning could result in SERIOUS, EVEN FATAL, PERSONAL INJURY.**

### Installation

Solenoid valves can be mounted in any position in most environments, in keeping with the specifications. 310/410 valves Feature a Class B insulation system and molded coil for ambient temperatures from 32° to 125° F (0° to 50° C).



#### PORT IDENTIFICATION

IN	Pressure Supply port.
OUT	Delivery port for model 310
1	Normally Open Delivery port for model 410
2	Normally Closed Delivery port for model 410
EXH	Exhaust port, vent to atmosphere

**IMPORTANT:** Because of possible damage to the valve body due to the installation of improper length bolts or over torque of the bolts, carefully check the operation of the valve using 20 PSIG air pressure (required to achieve full closure). Do not continue to increase air pressure to 80 psig if the gate valve does not open/close properly. Begin trouble shooting by confirming the valve has been mounted properly and proper length bolts have been used. Bolts longer than the thickness of both mating flanges will damage the body panels, destroy the seal surface area for the gate o-ring and restrict the carriage from moving to the open/close position. Always use bolts that are at least 1/4—inch (6.4 mm) shorter than the thickness of both mating flanges. If the valve continues to open/close improperly return to the pre-installation section of the Installation Manual (page 1). If the gate valve opens/closes properly it is now set and ready for operation, do not exceed 80 psig.

**Position Indicators:** Position indicator switches, Reed or Micro, are preset and indicate when the valve is fully opened or fully closed. Wires are marked for open/closed indicators. See pages 6-8 for detailed Reed/Micro Switch information.

### REPLACEMENT PARTS

*For continued trouble free operation, keep the valve clean and free of contaminants. Valves are designed to run at 80 PSIG. Do not operate pneumatic valves above 80 PSIG. Higher PSIG will shorten the life of the valve. For higher actuator pressure requirements or to order parts/repair kits, contact your sales representative. A Serial Number is required when ordering replacement parts.*

**PORT FLANGE BOLT TIGHTENING SEQUENCE**

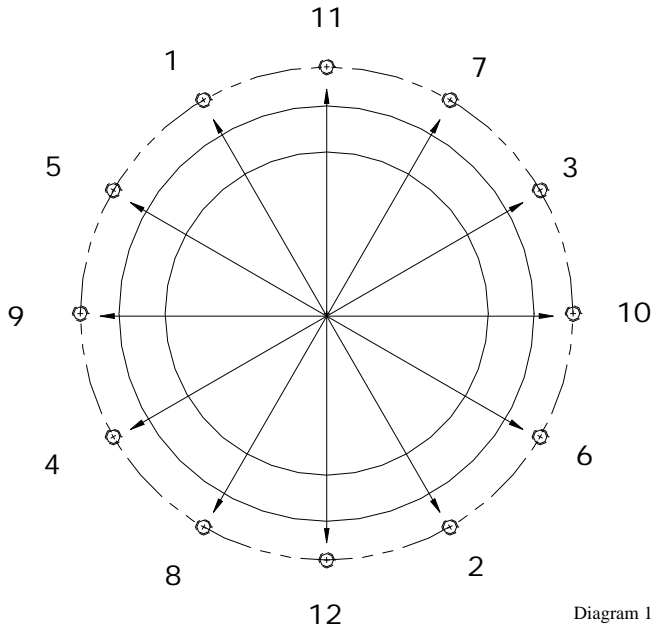


Diagram 1

**PORT FLANGE TORQUE RECOMMENDATIONS**

		VITON O-RING		COPPER GASKETS CFF FLANGES ONLY		
VALVE SIZE INCH	MM	FLANGE TYPE	TORQUE FT. LBS.	TORQUE N•m	TORQUE FT. LBS.	TORQUE N•m
5/8"	16	KF, ISO, ANSI, JIS, OTHERS	2-3	2.7-4.1	6-8	8.2-10.9
1 ½"	38	KF, ISO, ANSI, JIS, OTHERS	3-4	4.1-5.4	12-13	16.3-17.7
2" - 21"	51-533	KF, ISO, ANSI, JIS, OTHERS	3-6	4.1-8.2	12-15	16.3-20.4

Diagram 2

**DEFINITIONS**

**Gate Side of Valve:** O-ring sealing side of mechanism. Moving gate contains O-ring to provide vacuum seal to port.

**Carriage Side of Valve:** Side opposite the Gate.

**Lock Over Center:** The gate mechanically locks in the seal/closed position and remains sealed/closed in the event of air pressure loss to the air cylinder.

**No Lock Over Center:** The gate maintains the lock position via the check valve (fittings must be leak tight) ONLY when there is constant air pressure to the pneumatic air cylinder. The gate valve will not seal or remain in the closed position without air pressure.

**Solenoid:** Gate Valves are electro pneumatically controlled via a solenoid. The solenoid is an electronic on/off switch connected directly to the Gate Valve or mounted remotely by the customer. All standard\* 4" I.D. and larger Gate Valves ship with the solenoid mounted on the valve unless otherwise specified by the customer. The solenoid is not mounted on 3" I.D. and smaller Gate Valves or Metal Seal Bonnet Gate Valves. Standard solenoid is a Humphrey 4-way solenoid (model 410), non-latching type. In the event of a power loss the Humphrey 410 will automatically position the gate valve into the closed position and "hold" or "lock" the gate valve in the closed position until the main power supply is reactivated (all fittings/connections must be leak tight to ensure the solenoid will operate properly). Contact manufacturer for additional solenoid options.

**Check Valve:** Supplied with 8" and larger valves and non-lock over center valves. The check valve will hold the valve closed during a loss of air pressure until the main air supply is reactivated (all fittings/connections must be leak tight to ensure the check valve will operate properly).

**Speed Controls:** All valves are supplied with speed controls to the open and closed ports of the pneumatic cylinder. The function of the speed control is to regulate air flow to and from the air cylinder preventing damage to the gate valve from unrestricted air flow. Cycle speeds are preset at the Factory and should not be changed. Speed controls control exhaust side only.

**Reed Switch:** Also called proximity sensor or position indicator is a normally open switch that closes when a magnet is moved into its proximity via the air cylinder. The Reed switch is connected to lights or other devices to remotely indicate the open or closed position of the gate valve. Reed switches are the standard position indicator.

**Micro Switch:** Mechanical Switch, located in the air cylinder, to indicate open or closed position of the Valve. Mechanical switches make physical contact vs. sensing position.

\* non-MSB valves

## GATE VALVE GENERAL INFORMATION CONTINUED

### MSB (Metal Sealing Bonnet) Gate Valves:

All MSB valves are adjusted to MECHANICALLY LOCK OVER CENTER.

### 6" I.D. and smaller pneumatic Gate Valves-except Million Cycle

All 6" and smaller pneumatic gate valves shipped with or without a solenoid LOCK OVER CENTER, except the Million Cycle Series Gate Valves.

### 8" I.D. and larger pneumatic Gate Valves shipped with a solenoid:

All 8" I.D. and larger pneumatic gate valves shipped with a solenoid DO NOT LOCK OVER CENTER. The air pressure in the air cylinder is held by a check valve mounted on the air input of the solenoid valve (diagram 9, page 10).

CAUTION: REMOVAL OF THE SUPPLIED CHECK VALVE CAN CAUSE DAMAGE TO THE GATE VALVE AND YOUR SYSTEM. DO NOT REMOVE THE SUPPLIED CHECK VALVE. The check valve must be kept at the input of the solenoid valve during operation. The check-valve insures vacuum sealing integrity in the event of air pressure loss, provided all air lines and fittings are leak tight.

### Horizontal Valve Orientation

All viton bonnet Gate Valves are adjusted and tested in the Horizontal Orientation unless specified by the customer. All manual, MSB gate valves are tested Actuator up.

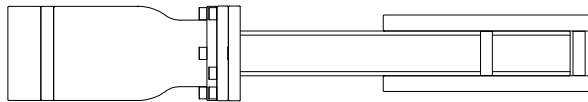


Diagram 10

Standard Valve Orientation—Horizontal

### Proper Torque Sequence:

To avoid damage or distortion to the valve port flanges or valve body a sequence of tightening port flange bolts 180° apart must be followed. The example shown in Diagram 3 is for illustration only as the number of bolts will vary depending on the valve size and flange type. **IMPORTANT:** Lightly grease the flange bolts with high-temperature, non-galling type grease (Anti-Gall C-100, #51032 or an equivalent is recommended). With the valve in position for connection to the vacuum system mating flange, start all attachment bolts by hand, working back and forth between bolts bringing the two flanges together. When the valve flange is within 1/8 inch of the mating flange, check that the flanges are parallel and not cocked. With a torque wrench set at 1/2 the final torque value move back and forth across the bolt circle to bring the flanges together. Reset the torque wrench to the final torque value and tighten bolts to full torque using a cross bolt circle sequence.

1. Finger tighten all bolts using the proper torque sequence.
2. Tighten snugly with a torque wrench set to 1/2 the required torque, using the proper torque sequence.
3. Tighten to recommended torque range listed on page 4. Use proper torque sequence.

## POSITION INDICATOR REED SWITCH WIRING DIAGRAM

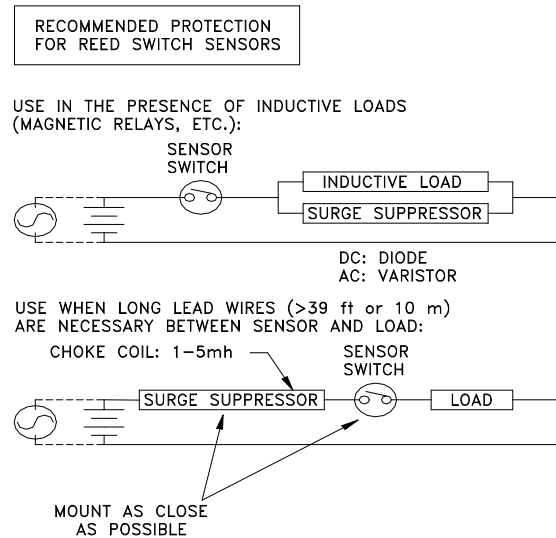


Diagram 3

Sensor Type: Two wire magnetic sensing normally open switch

### Max: Electrical Ratings

Contact Rating:	3 WATT-MAX.
Current Switching:	.25 A MAX.
Carry:	.5 A MAX.
Resistance Contact:	.15 Ohms-MAX.
Capacitance Contact:	.2 pT - TYP.
Voltage Switching:	100 V DC MAX.
Breakdown:	170 V DC MAX.
Shock Resistance:	11ms ½ SINE WAVE
Vibration Resistance:	150 G MAX
Environment:	30G 50-2000 HTZ
Protection:	IP66 (IEC STANDARD)
Lead Wire:	PVC INSULATED 2 X 24 AWG
Cycle Life:	5 MILLION MIN.
Temperature Range:	-40° TO 212°F (-40° TO +100°C)
Storage Temperature:	-85° TO 257°F (-65° TO +125°C)

### Operational Characteristics

Operate Time:	.35 MS MAX.
Release Time:	.1 MS MAX.

## GATE VALVE GENERAL INFORMATION

### Gate Valve Operation Description

Pneumatically actuated gate valves are opened and closed by applying air pressure to either side of a piston located in the air cylinder of an actuator housing. The Gate Valve cycle time is controlled by air pressure entering into and exhausting out of the air cylinder simultaneously. Speed controls control this air pressure and are set for optimum operation and speed. The gate/carriage assembly (seal surface assembly) travels into the closed position via internal links when air is introduced into the upper chamber of the air cylinder through the air to close fitting and exhausting out of the lower chamber of the air cylinder through the air to open fitting. Internal links extend as the piston travels to internal stops, positioning the gate/carriage assembly into the sealing position. The extension of internal links continues causing compression of the seal surface assembly into the valve case creating a vacuum tight closure.

### Warranty Information

Every valve is individually adjusted, tested and inspected for reliable and continuous operation. Adjustments made to any operating component after shipment will void the warranty. Gate/carriage assemblies switched from their original case require adjustments for proper valve operation. The warranty is void when Gate/Carriage assemblies are removed and/or replaced from their original case.

### Manufacturer Set Cycle Time

1 ½" - 3" ID	1.5-2.0 seconds to open/1.5-2.0 seconds to close
4" - 8" ID	2.5-3.0 seconds to open/2.5-3.0 seconds to close
10" - 14" ID	4.5-5.0 seconds to open/4.5-5.0 seconds to close
16" - 21" ID	6.5-9.0 seconds to open/6.5-9.0 seconds to close

**IMPORTANT:** Do not exceed the manufacturer set cycle time. Removal/Adjustment of speed controls voids warranty. Do not exceed 80 PSIG air pressure. Contact factory for faster cycle time requirements.

### Pneumatic Gate Valves Shipped without a solenoid

All Gate Valves shipping without a solenoid will **MECHANICALLY LOCK OVER CENTER** unless customer specifies 'no lock over center'. Plastic Port Plugs are installed in each speed controller. The port plugs will ensure the threads and ports are protected during shipping. Remove and discard the port plugs after receipt and installation of the valve.



## PNEUMATIC GATE VALVE WITH SOLENOID

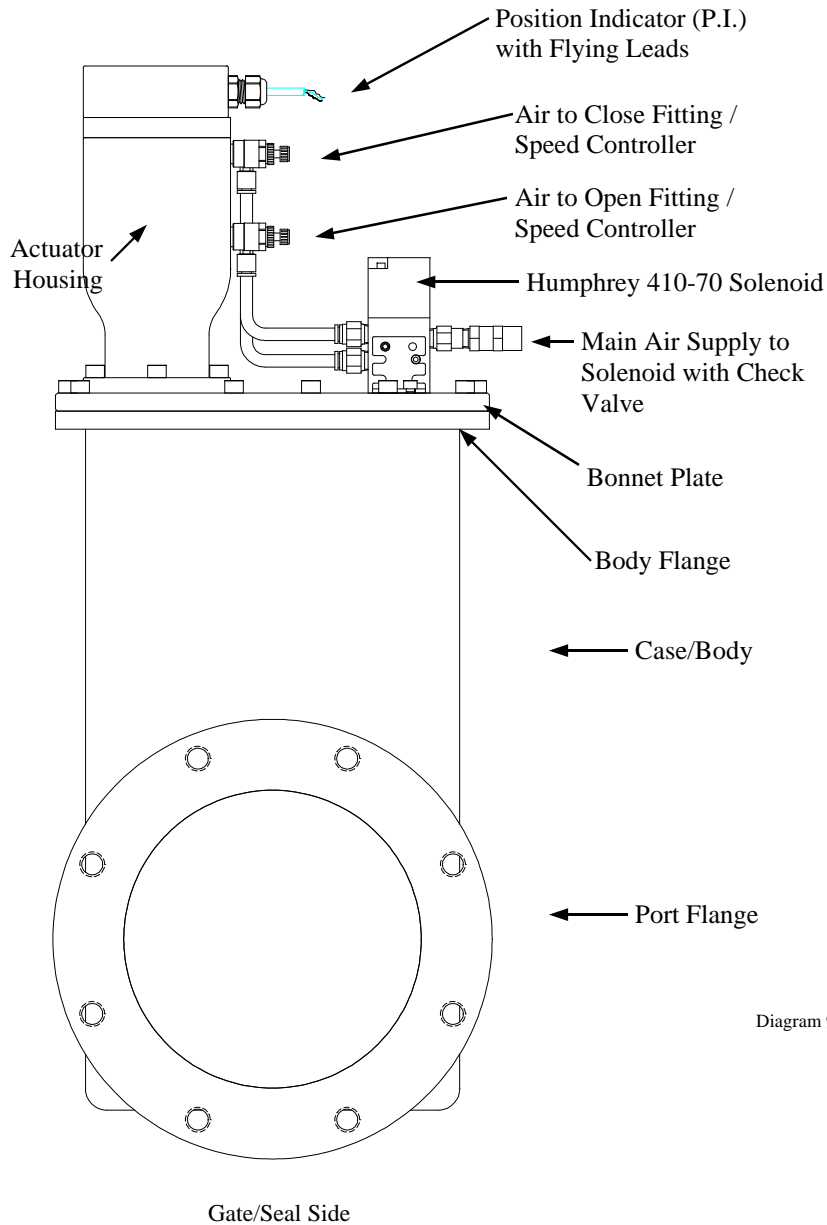


Diagram 9

## POSITION INDICATOR REED SWITCH WIRING DIAGRAM

### STANDARD REED SWITCH WITH OPEN LEADS

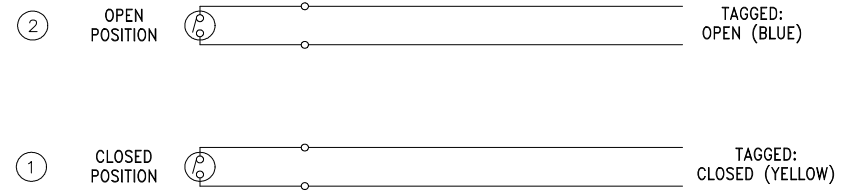


Diagram 4

### STANDARD REED SWITCH WITH 6-PIN CONNECTOR

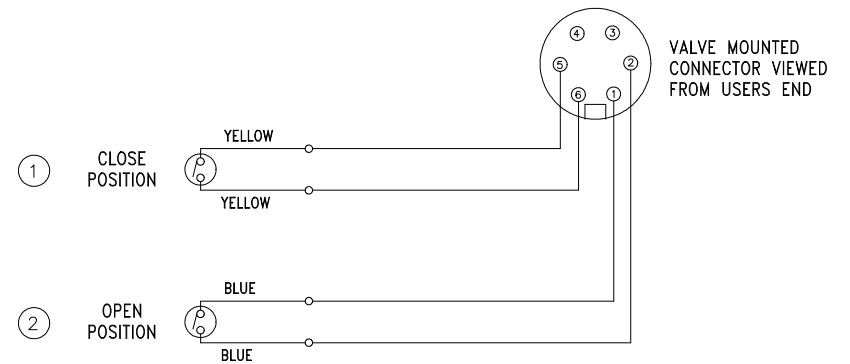


Diagram 5

Reed Switches are magnetic sensors. See definitions page 13.

## POSITION INDICATOR MICRO SWITCH WIRING DIAGRAM

### STANDARD MICRO SWITCH WITH OPEN LEADS

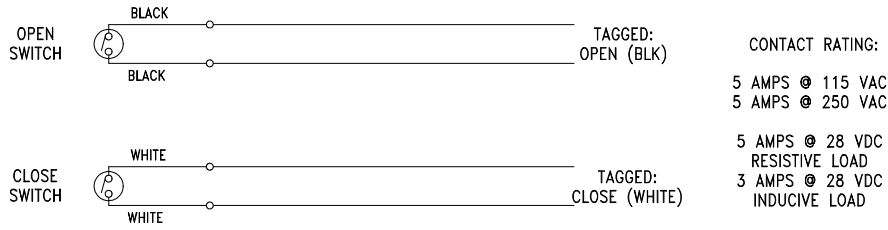


Diagram 6

### STANDARD MICRO SWITCH WITH 6-PIN CONNECTOR

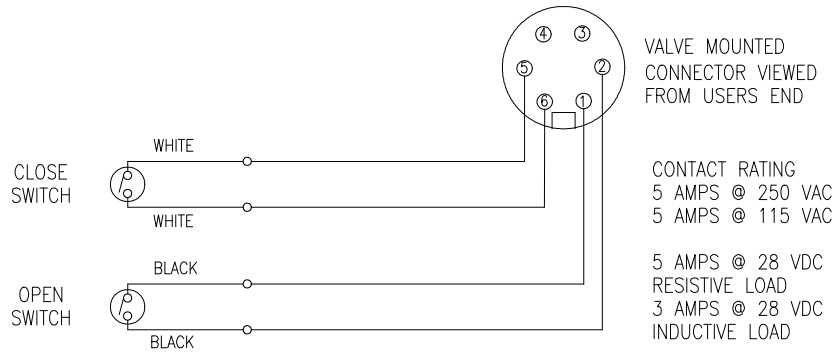


Diagram 7

Micro Switches are mechanical sensors. See Definitions page 13.

## PNEUMATIC GATE VALVE WITHOUT SOLENOID

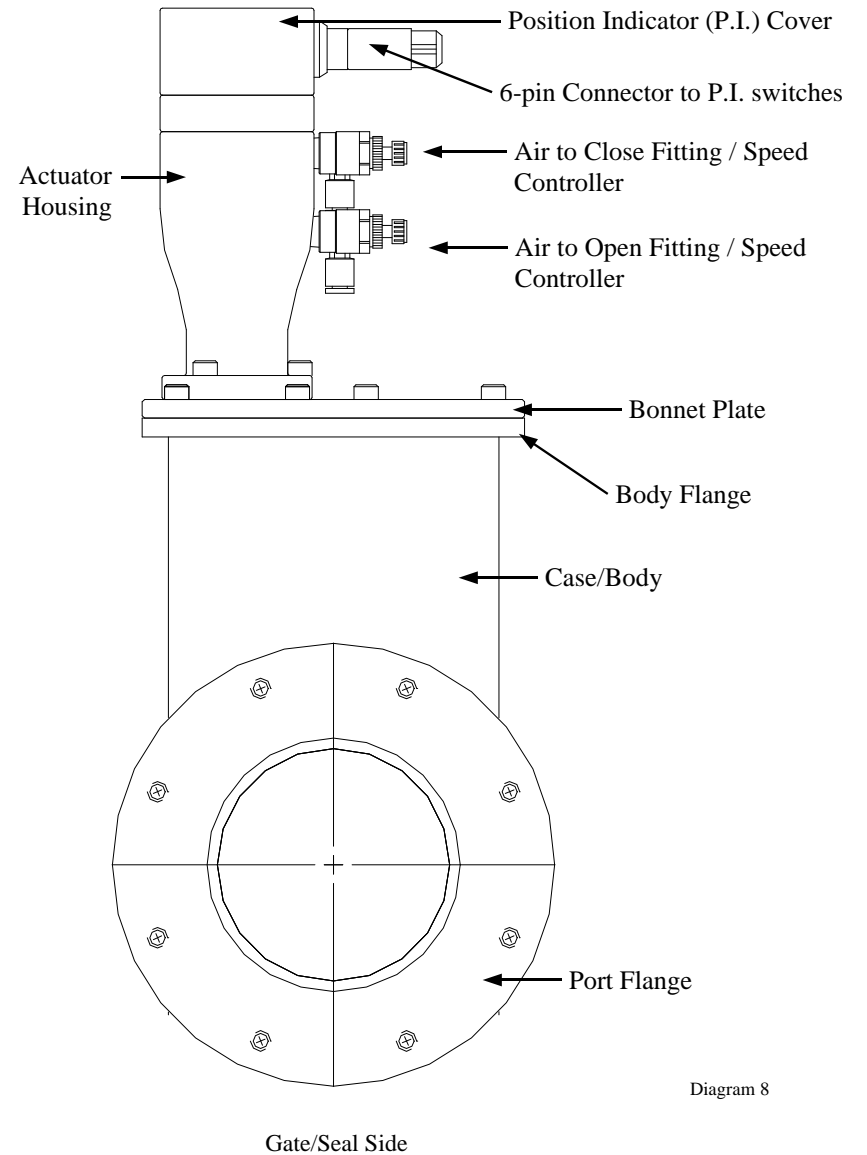


Diagram 8

# **GATE VALVE MAINTENANCE AND ADJUSTMENT PROCEDURES**

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## I. VITON GATE AND BONNET O-RING

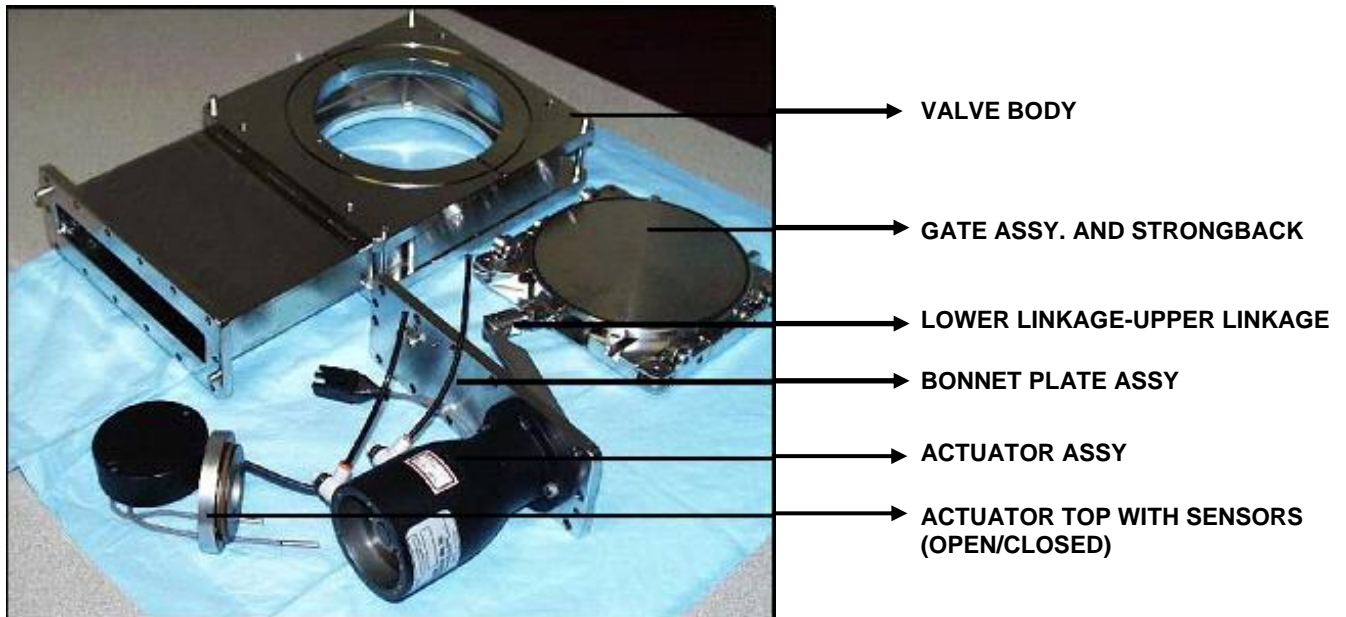
STD AND MSB 0.625" – 21" GATE VALVES

A. Tools and Materials Required:

1. Allen Wrench for 1 ½"—14" Gate Valves
2. ½" Box Wrench for 16"—21" Gate Valves
3. O-Ring Pick
4. Rubber Gloves
5. Grease – *Apezion L* O-Ring Type
6. IPA

B. Procedure: Always wear Rubber Gloves when handling the Gate Valve

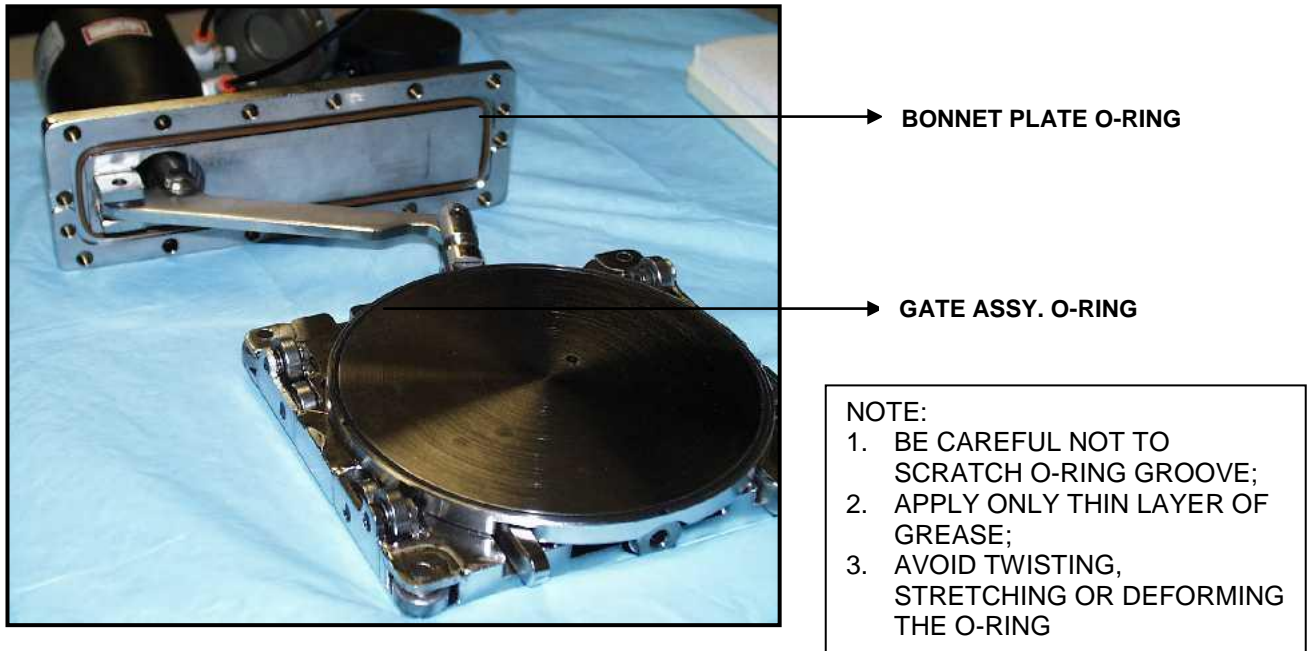
1. Vent station and pump corresponding to Gate Valve to atmosphere;
2. Actuate valve to Gate Open position;
3. For safety, remove air to actuator;
4. Remove bolts that hold Bonnet Actuator Assembly to body; or for Quick-Clamp Bonnet, undo the clamp;
5. Pull out the Bonnet Actuator Carriage Assembly, taking care not to move adjustment of linkage;



**Figure 1 BONNET ACTUATOR CARRIGE ASSY. SEPARATED FROM VALVE BODY**

## GATE VALVE MAINTENANCE AND ADJUSTMENT PROCEDURE

6. Remove O-Ring or Gasket from Bonnet Assembly and discard;
7. Remove Gate O-Ring with the plastic pick, taking care not to scratch the O-Ring groove; Discard the O-Ring;
8. Clean O-Ring groove with IPA and dry out with Nitrogen or CDA;
9. Apply a light coat of *Apezion L* Grease to the new Gate O-Ring;( It is very important that gloves are worn for this step)
10. Install new O-Ring on gate, taking care to avoid twisting or deforming the O-Ring;
11. Apply a light coat of *Apezion L* Grease to the new Bonnet assembly Viton O-Ring; Copper Gasket install dry
12. Install new O-Ring/Gasket on Bonnet assembly, taking care to avoid twisting or deforming the O-Ring
13. Replace Bonnet Actuator Assembly into valve body;
14. Install bolts and tighten. (For MSB, Copper gasket type, tighten side to side 20-25ft-lb)



**Figure 2 GATE O-RING AND BONNET PLATE O-RING**

## II. BELLOWS, PNEUMATIC STD CYCLE ONLY

0.625" – 21" GATE VALVES

A. Tools and Materials Required:

1. Spanner Wrench
2. Allen Wrench Set
3. O-Ring Pick
4. Pick (for R-Ring removal)
5. Needle-Nose Pliers
6. Small Standard Screw Driver
7. Actuator O-Rings
8. Grease for Bellows O-Ring: *Apezion L*
9. Vacuum Grease
10. IPA
11. Heat Gun
12. *Lock-Tite*

B. Procedure:

1. Vent station and pump corresponding to Gate Valve to atmosphere;
2. Actuate valve to Gate Open position;
3. For safety, remove air to actuator;
4. Remove Actuator Cover ( 2 screws);
5. Remove Actuator Top ( 6 screws);
6. Measure the distance between the top of the Piston and the top of the Drive Shaft. (This will be helpful later during reassembly and adjustment)
7. Remove the Jam Nut from the Drive Shaft. (Heat gun may be needed to melt the *Lock-Tite* on the thread)

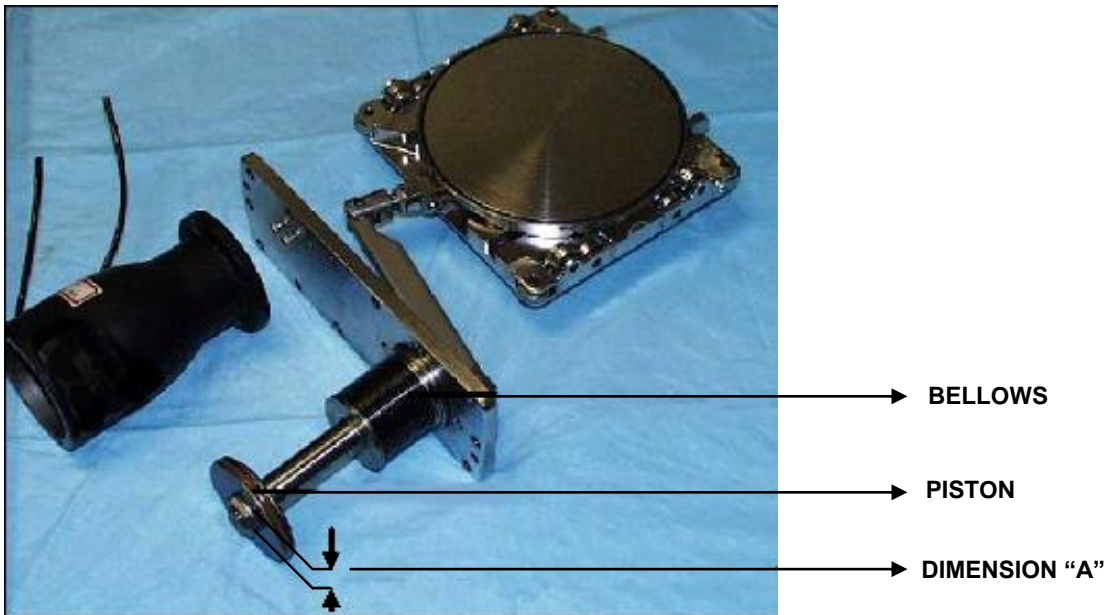
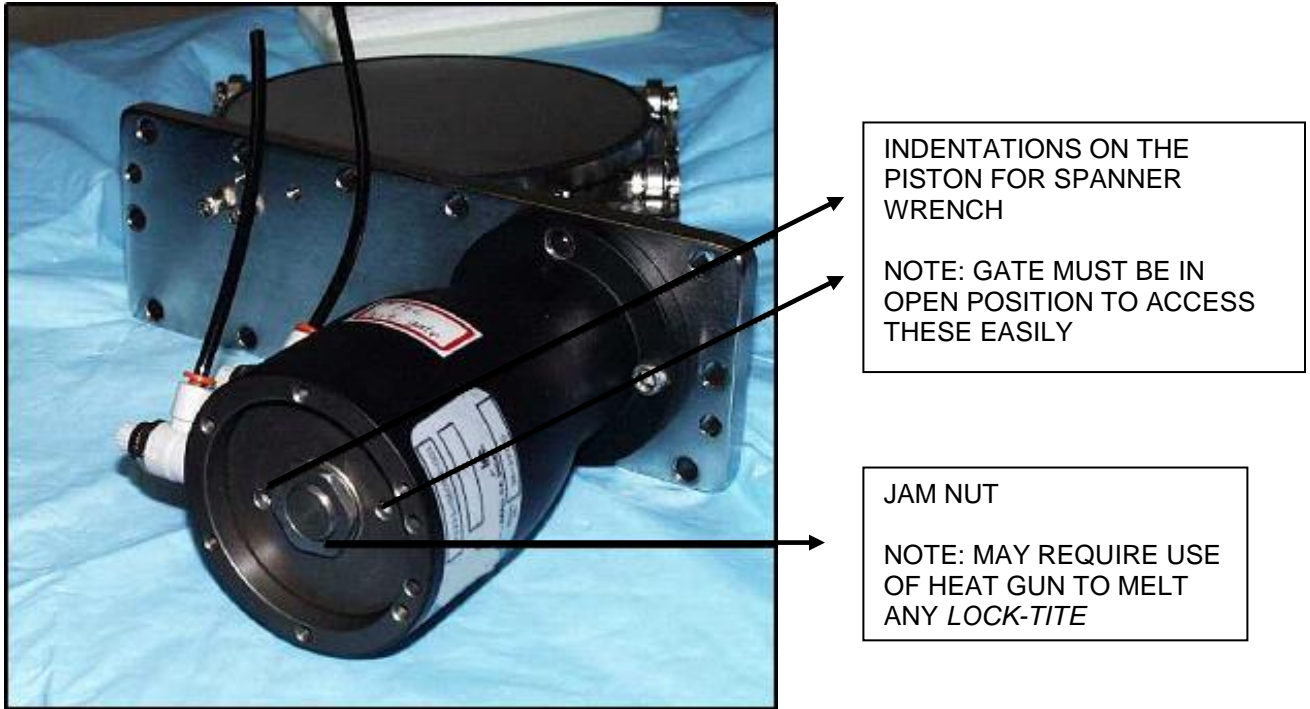


Figure 3 BELLOWS AND PISTON SHOWN WITH ACTUATOR HOUSING REMOVED

## GATE VALVE MAINTENANCE AND ADJUSTMENT PROCEDURE



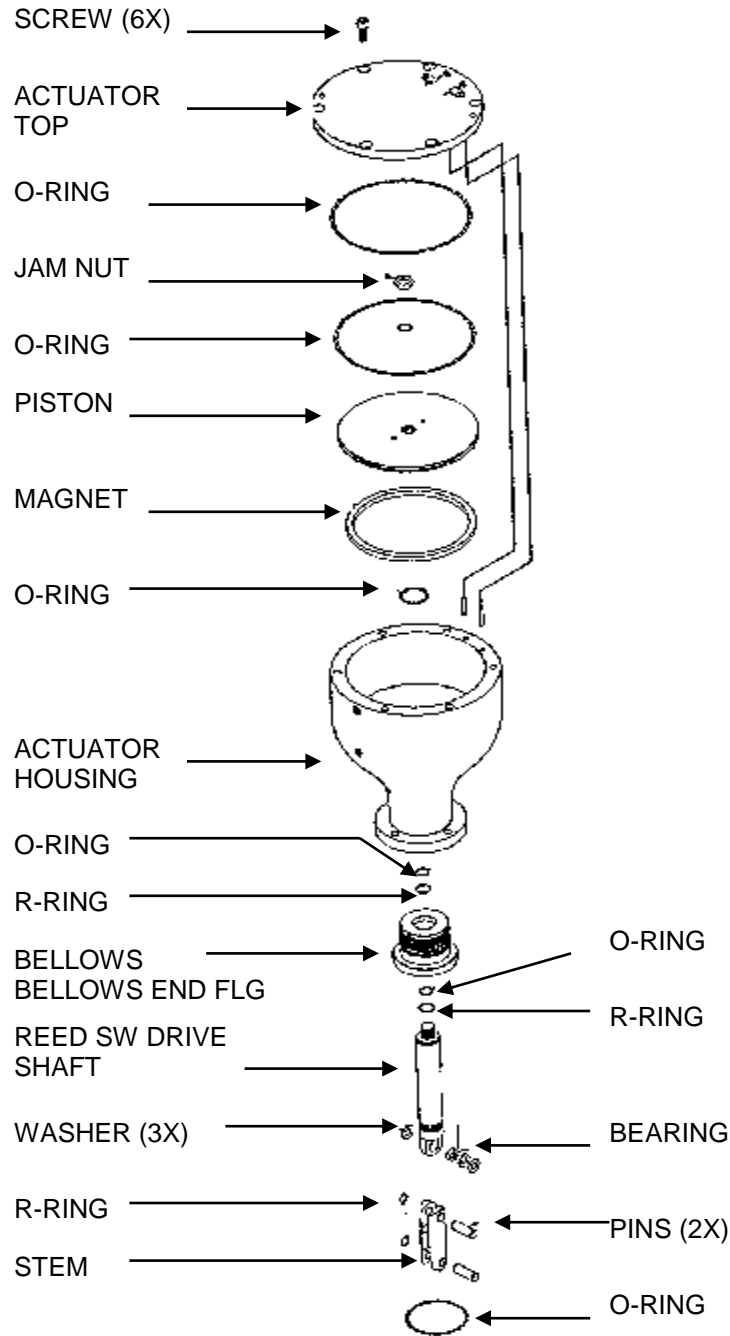
**Figure 4 PISTON CLOSE-UP FOR SPANNER WRENCH POSITIONING**

8. Using a spanner wrench, turn Piston counterclockwise to remove from Actuator Housing;
9. Remove O-Ring from top of Drive Shaft;
10. Remove remaining screws holding the Actuator Housing to the Bonnet Plate (2 screws)
11. Remove the Actuator Housing;
12. Remove R-Ring from Drive Shaft, using a pick. If a replacement is NOT available, use care to preserve the R-Ring. Otherwise, pull out using the needle nose pliers and discard;
13. Remove bellows by pulling and twisting slightly. Discard;
14. Remove O-Ring in the Bellows drive shaft area and discard;
15. Clean Drive Shaft groove and Bellows area with IPA;
16. Apply a thin coat of grease (*Apezion L*) on the O-Ring for the Drive Shaft in Bellows area;
17. Install O-Ring;
18. Apply a thin coat of grease (*Apezion L*) on the O-Ring for the Bellows base Flange;
19. Install O-Ring;
20. Replace Bellows assembly on the Drive Shaft, pushing and twisting slightly to go over the O-Ring;
21. Install R-Ring on the Drive Shaft, using a screw driver and a pick. Make sure it clicks into the groove next to the top of the Bellows.
22. Apply a thin coat of Vacuum Grease to the Drive Shaft;
23. Install Actuator Housing on the Bonnet plate;
24. Apply a thin coating of Vacuum Grease to the O-Ring for the top of the Drive Shaft;
25. Install O-Ring on the top of the Drive Shaft;
26. Apply a thin coating of vacuum Grease to the Piston area, if necessary;
27. Install Piston on Drive Shaft; using a spanner wrench, turn clockwise until the measurement in step # 5 is achieved;



GATE VALVE MAINTENANCE AND ADJUSTMENT PROCEDURE

28. Install Jam Nut, using *Lock-Tite* and tighten;
29. Install Actuator Top and tighten screws;
30. Install Actuator Cover and tighten screws;
31. Install air line and test operation of Valve and Actuator.



**Figure 5 BELLOWS AND ACTUATOR ASSEMBLIES DRAWING**

### III. ACTUATOR O-RING

0.625" – 21" GATE VALVES STD AND MSB

A. Tools and Materials Required:

1. Spanner Wrench
2. Allen Wrench Set
3. O-Ring Pick
4. Pick (for R-Ring removal)
5. Needle-Nose Pliers
6. Small Standard Screw Driver
7. Actuator O-Rings
8. Grease for Bellows O-Ring: *Apezion L*
9. Vacuum Grease
10. IPA
11. Heat Gun
12. *Lock-Tite (Def Pro #51574 for high temp applications or Lock-Tite 242-31 for standard applications recommended)*

B. Procedure:

1. Actuate valve to Gate Open position;
2. For safety, remove air to actuator;
3. Remove Actuator Cover ( 2 screws);
4. Remove Actuator Top ( 6 screws);
5. Measure the distance between the top of the Piston and the top of the Drive Shaft. (This will be helpful later during reassembly and adjustment)
6. Remove the Jam Nut from the Drive Shaft. (Heat gun may be needed to melt the Lock-Tite on the thread)
7. Using a spanner wrench, turn Piston counterclockwise to remove from Actuator Housing;
8. Remove O-Ring from top of Drive Shaft;



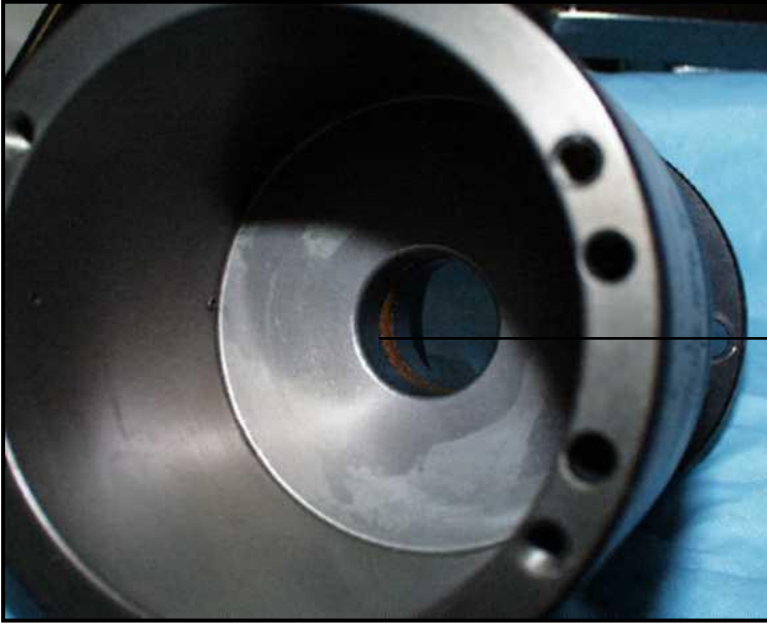
DRIVE SHAFT O-RING

NOTE: REMOVE THIS O-RING FIRST BEFORE REMOVING THE ACTUATOR HOUSING

Figure 6 DRIVE SHAFT O-RING

## GATE VALVE MAINTENANCE AND ADJUSTMENT PROCEDURE

9. Remove remaining screws holding the Actuator Housing to the Bonnet Plate (2 screws)
10. Remove the Actuator Housing;
11. Remove O-Ring in Actuator Housing, using a pick and using care to not scratch the groove surface;



ACTUATOR O-RING

NOTE:  
1. REMOVE THIS O-RING BEFORE REMOVING ACTUATOR HOUSING;  
2. BE CAREFUL NOT TO SCRATCH O-RING GROOVE

**Figure 7 ACTUATOR O-RING**

12. Apply a thin coat of vacuum grease on the new O-Ring;
13. Install O-Ring;
14. Inspect the drive shaft; clean and lubricate as necessary;
15. Install Actuator Housing on the Bonnet plate; Tighten screws;
16. Apply a thin coat of Vacuum grease on the O-Ring for the top of the Drive Shaft;
17. Install O-Ring;
18. Inspect actuator housing; clean and lubricate as necessary;
19. Apply a thin coat of vacuum grease on the O-Ring for the Piston;
20. Install O-Ring on the Piston;
21. Install Piston on Drive Shaft, using a spanner wrench and turning clockwise until the measurement in step # 5 is achieved;
22. Install Jam Nut, using *Lock-Tite (Def Pro #51574 for high temp applications or Lock-Tite 242-31 for standard applications recommended)* and tighten;
23. Apply a thin coat of vacuum grease to the O-Ring for the Actuator Top;
24. Install O-Ring on the Actuator Top;
25. Install Actuator Top and tighten screws;
26. Install Actuator Cover and tighten screws;
27. Install air line and test operation of Valve and Actuator.

## IV. SEAL PLATE ASSEMBLY/ PINS BEARING

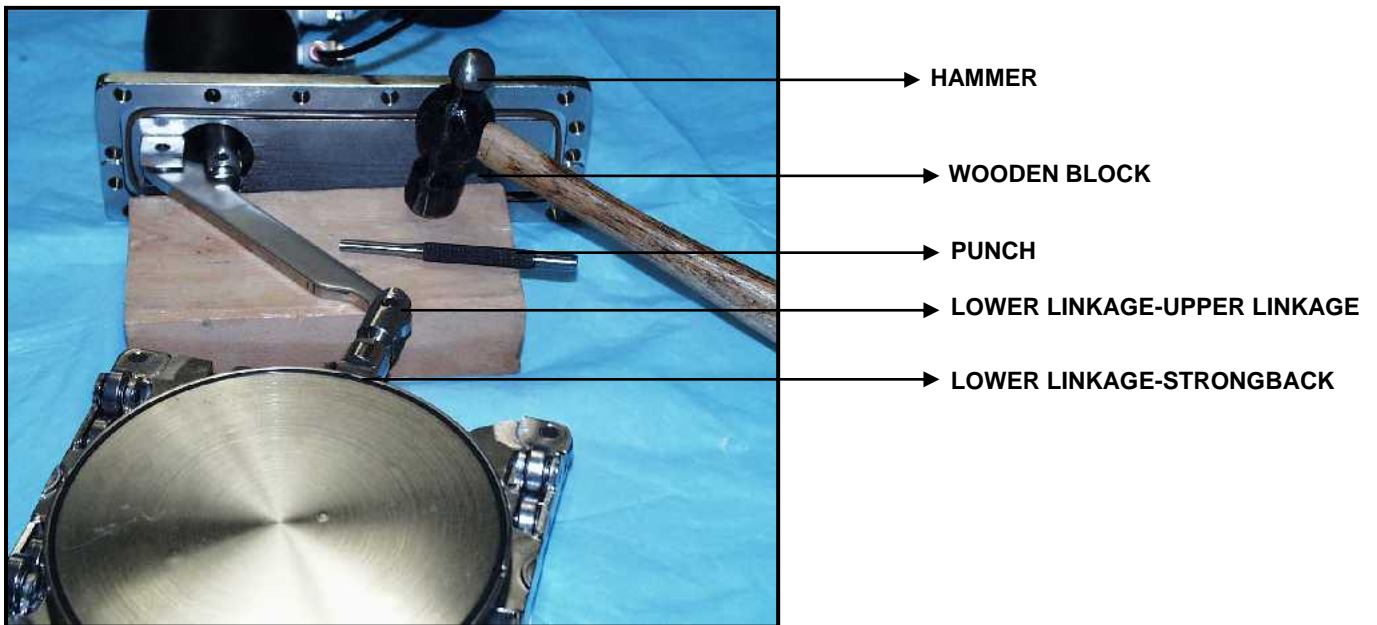
0.625"—21"

### A. Tools and Materials Required:

1. Allen Wrench Set
2. Arbor Press
3. Punch
4. Hammer
5. Wrenches (Box or Open)
6. R-R Pliers
7. Vacuum Grease
8. IPA
9. Latex Gloves

### B. Procedure 4" – 21"

1. Actuate valve to gate Open position;
2. For safety, remove air to actuator;
3. Remove bolts that hold Bonnet Actuator Assembly to body; For Quick-Clamp Bonnet, undo the clamp;
4. Pull out the Bonnet Actuator Carriage Assembly;
5. Using a punch and hammer, remove the pin that holds the Upper Linkage to the Lower Linkage-Upper Linkage of Strongback; (Three washers and an R-Ring should be recovered) **Note: If the pin does not move, flip the assembly over and try from the other side.** *Caution: Be careful not to bend the Upper Linkage; the use of a wooden block for support is recommended)*



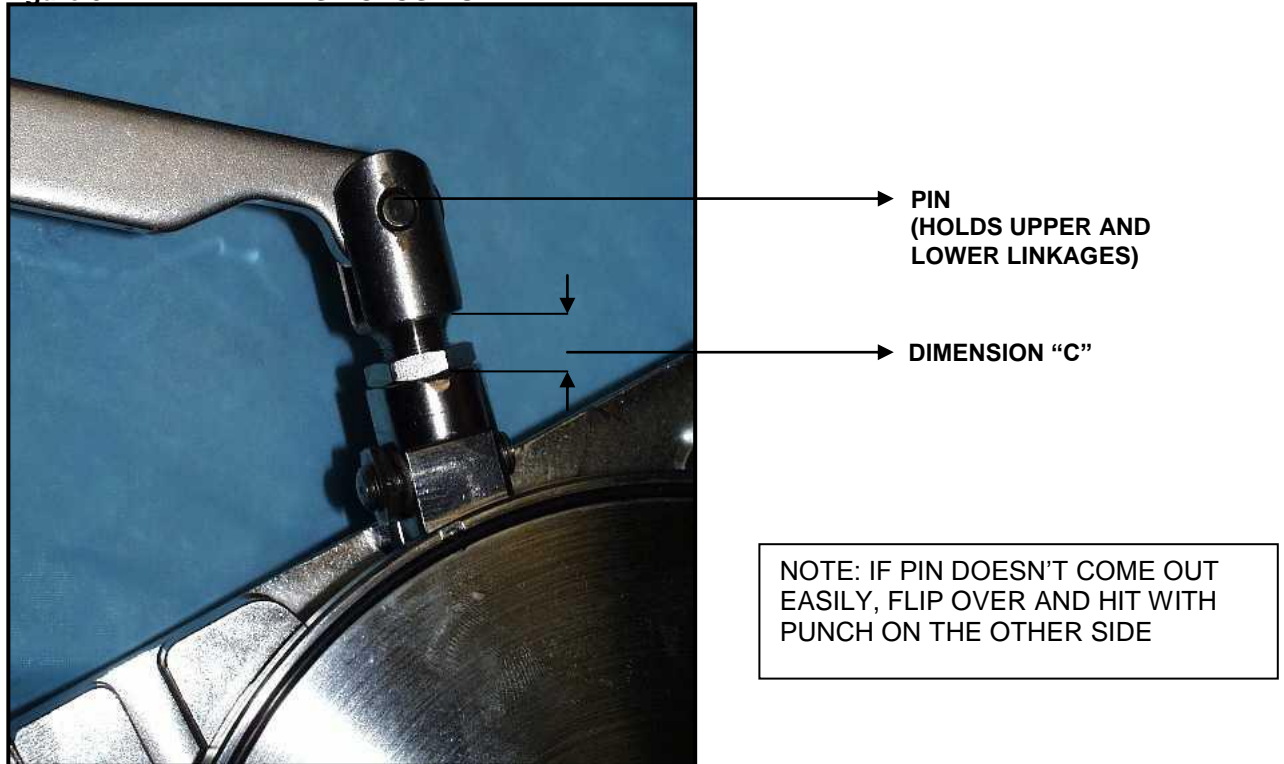
**Figure 8 LINKAGE REMOVAL**

6. Separate the Bonnet Upper Linkage Assembly from the Carriage Assembly;

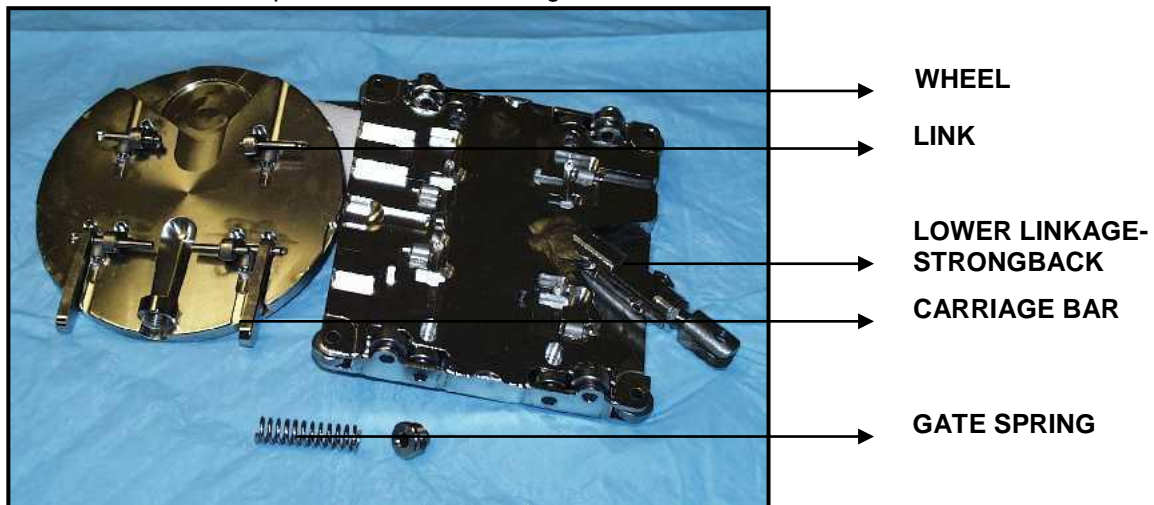
## GATE VALVE MAINTENANCE AND ADJUSTMENT PROCEDURE

7. Measure the distance between the Strongback Lower Linkage and the Upper Linkage-Lower Linkage; (This will be helpful later during reassembly and valve adjustment)

**Figure 9 PIN AND LINKAGE CLOSE-UP**



8. Move Carriage assembly to a suitable work place for disassembly and the replacement of Pins, Bearings and R-Rings;
9. Remove Gate Spring by removing one set screw (Allen Wrench);
10. Remove four set screws( Allen-3/32") that hold Gate and Strongback together;
11. Separate Gate from Strongback.

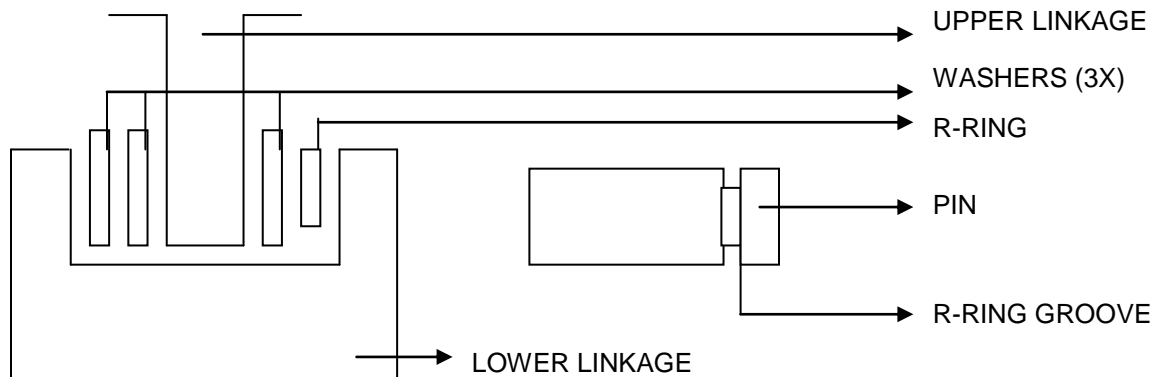


**Figure 10 GATE AND STRONGBACK ASSEMBLIES OPENED**

12. Remove Set Screws, Links, Washers, Pins, and Carriage Bars; Discard Washers;

## GATE VALVE MAINTENANCE AND ADJUSTMENT PROCEDURE

13. Using a punch and hammer, remove wheels from their pin. **Note: If the pin does not move, try from the other side.**
14. Using an arbor press, remove the bearings from the links and wheels; Discard expendable parts;
15. Clean all reusable parts such as the gate, Strongback, Links, Carriage Bars, and Gate Spring with IPA;
16. Press new Bearings in using an arbor press; For Viton Bonnet sealing valves, ensure that the Bearings are properly lubricated with the appropriate vacuum grease( *Micro Coat 601* recommended); For Copper sealing bonnet valves run bearings dry
17. Verify that all bearings spin freely;
18. Install Washers, Pins and R-Rings into Strongback;
19. The recommended technique is as follows:
  - a) Slide long side of pin through hole first (the side without the groove);
  - b) Install R-Ring close to the end of the pin, not in the groove;
  - c) Add on the pin one Washer, then the Wheel, then the other two Washers;
  - d) Push Pin in until the R-Ring snaps into its groove;



NOTE; THE SAME TECHNIQUE IS USED TO REMOVE AND REINSTALL THE WHEELS IN THE STRONGBACK ASSY.

**Figure 11 PIN, WASHERS AND R-RING REMOVAL DRAWING**

20. Verify that all wheels spin freely;
21. Set Strongback aside for later assembly;
22. Install Links, Washers, and Pins into Gate Slots;
23. Adjust Pins to correspond to Strongback Pin Pockets;
24. Install Gate to Strongback; Verify that all Pins fit into Strongback pockets;
25. Tighten the set screws loosened in step # 10;
26. Verify that Gate moves freely up and down and is flush with the Strongback in the down position;
27. Install Gate Spring;
28. Install and tighten set screw removed in step # 9;
29. Reattach Upper Linkage to Strongback Lower Linkage-Upper Linkage, using the technique detailed in step # 19;
30. Replace complete assembly into valve body;



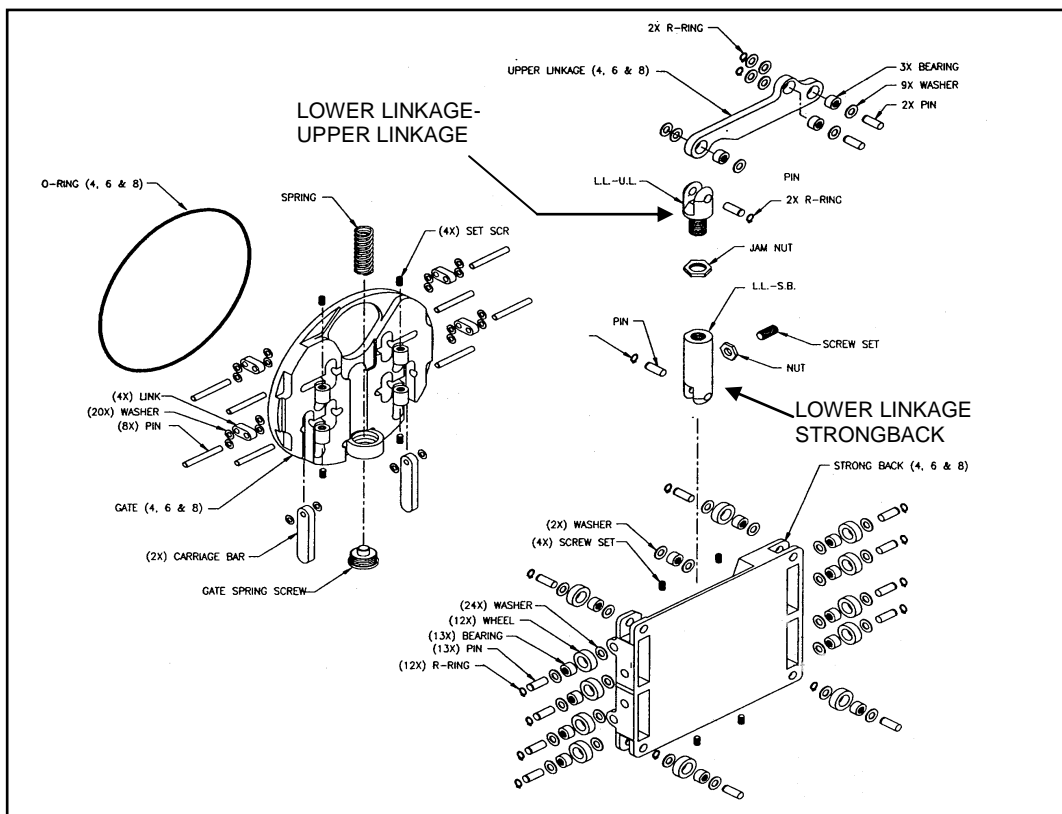
## GATE VALVE MAINTENANCE AND ADJUSTMENT PROCEDURE



AFTER REASSEMBLY, CHECK THAT THE GATE ASSY SITS FLUSH ON THE STRONGBACK AND MOVES FREELY UP AND DOWN. DO THIS BEFORE INSTALLING THE GATE SPRING.

**Figure 12 GATE AND STRONGBACK ASSYS AFTER REASSEMBLY**

31. Verify the measurement in step # 7, and adjust as necessary;
32. Tighten bolts or install Quick-Clamp as appropriate;
33. Test Valve operation;
34. If necessary, refer to Valve Adjustment Procedure.



**Figure 13 STRONGBACK AND GATE ASSYS DRAWING**

## V. VALVE ADJUSTMENT

### COMPRESSION AND OVER-CENTER 0.625" – 21"

A. Tools and Materials required:

1. Allen Wrench Set
2. Wrench Set (Box and Open)
3. Air Regulator
4. Heat Gun
5. Latex Gloves

B. Procedure:

**Steps 1 – 8 apply to 0.625" – 3" Gate Valves Only**

1. Actuate Valve to Open Gate position;
2. For safety, remove air from Actuator;
3. Remove Actuator Cover (2 screws);
4. Remove Actuator Top (6 screws);
5. Loose Jam Nut on Drive Shaft ( This may require the use of the heat gun to melt the *Lock-Tite* (*Def Pro #51574 for high temp applications or Lock-Tite 242-31 for standard applications recommended*) on the thread);
6. Check Dimension A on Chart for specific valve size;(This is only the starting adjustment)
7. Adjust and tighten Jam Nut; (Do not use *Lock-Tite* at this point, as adjustment may be needed later);
8. Install Actuator Top, using only 2-4 screws;
9. Remove bolts holding the Bonnet Actuator Assembly to valve body; For Quick-Clamp Bonnet, undo the clamp;
10. Pull out Actuator Bonnet Carriage Assembly from valve body;
11. Check Dimension C on Chart for specific valve size;
12. To adjust, loosen Jam Nut, then turn Lower Linkage-Upper Linkage counter clockwise to increase dimension for more compression; or turn clockwise to decrease the dimension for less compression.(More Compression means more air pressure to lock valve; Less Compression means less air pressure to lock valve);
13. After adjusting, tighten Jam Nut;
14. Reassemble Bonnet Carriage Assembly on valve body;
15. Using an in-line air regulator, check the air pressure required to lock valve. Refer to Chart for Recommended Locking Air Pressure per size of gate valve.
16. Adjust Dimension C until the correct Locking Air Pressure is achieved;

**Steps 17 – 20 apply to 4" – 12" Gate Valves Only**

17. Check Dimension B on Chart for specific valve size, depending on Over center or No Over center requirement. (Note: Proper Over center means that the Gate does not drop when air pressure is removed from the Actuator)
18. If necessary, loosen nut and adjust Dimension B by turning screw counter clockwise to increase dimension for less Over center or turn clockwise to decrease dimension for more Over center. Less Over center means less travel for the Linkage; more Over center means more travel;
19. Check for Over center adjustment: If gate drops after removal of air pressure for valves that require over center, go back to Step # 18.
20. Tighten nut;
21. Install all bolts and tighten;
22. Test valve operation.



## VI. VALVE ADJUSTMENT CHART

INSTRUCTION FOR VALVE ADJUSTMENT					
VALVE SIZE	DIMENSION "A" PISTON ADJUST *	DIMENSION "B" OVERCENTER ADJUST	DIMENSION "B" NO OVERCENTER ADJUST	DIMENSION "C" COMPRESSION ADJUST	RECOMMENDED LOCKING AIR PRESSURE
1.50	.110 **	N/A	N/A	.210	20-30 PSI
2.00	.120 **	N/A	N/A	.360	35-50 PSI
2.50	.125 **	N/A	N/A	.190	35-55 PSI
3.00	.125 **	N/A	N/A	.390	60-65 PSI
4.00	N/A	.278	.360	.420	20-35 PSI
6.00	N/A	.085	.160	.350	35-45 PSI
8.00	N/A	.365	.465	.260	55-70 PSI
10.00	N/A	.770	.800	.500	25-35 PSI
10.75	N/A	.770	.900	.650	30-40 PSI
12.00	N/A	.690	.950	.520	30-40 PSI
14.00	N/A	--	--	--	45-55 PSI
16.00	N/A	.550	.730	.730	65-80 PSI
18.00	N/A	.400	.730	.730	--
21.00	N/A	.550	.850	.550	--
32.00	N/A	.950	1.10	.975	--

ALL DIMENSIONS IN INCHES  
 \* = STARTING ADJUSTMENT  
 \*\* = PISTON ADJUSTMENT CONTROLS OVER-CENTER ADJUSTMENT

as of 12/13/2012

Figure 14 VALVE ADJUSTMENT TABLE

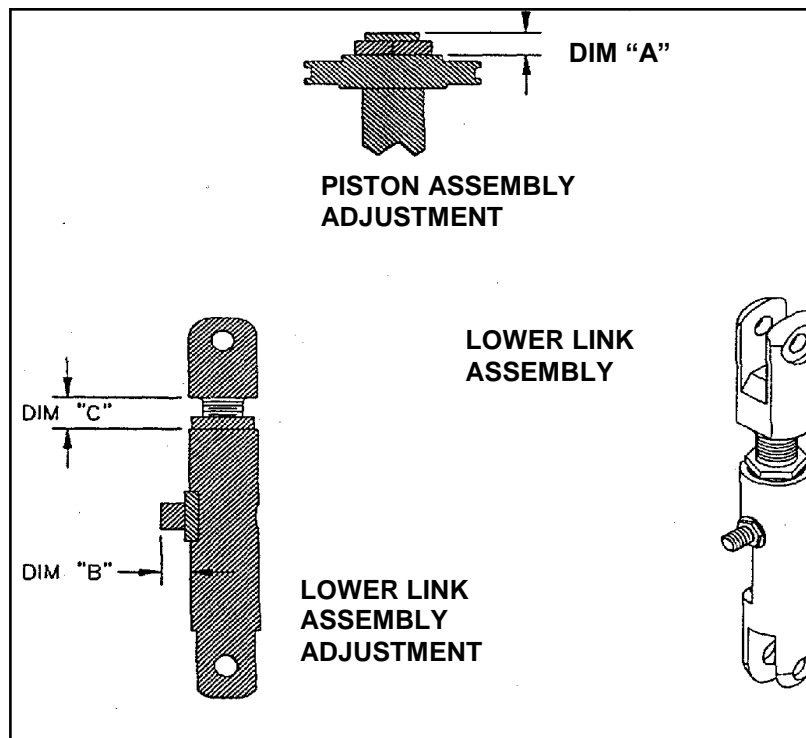
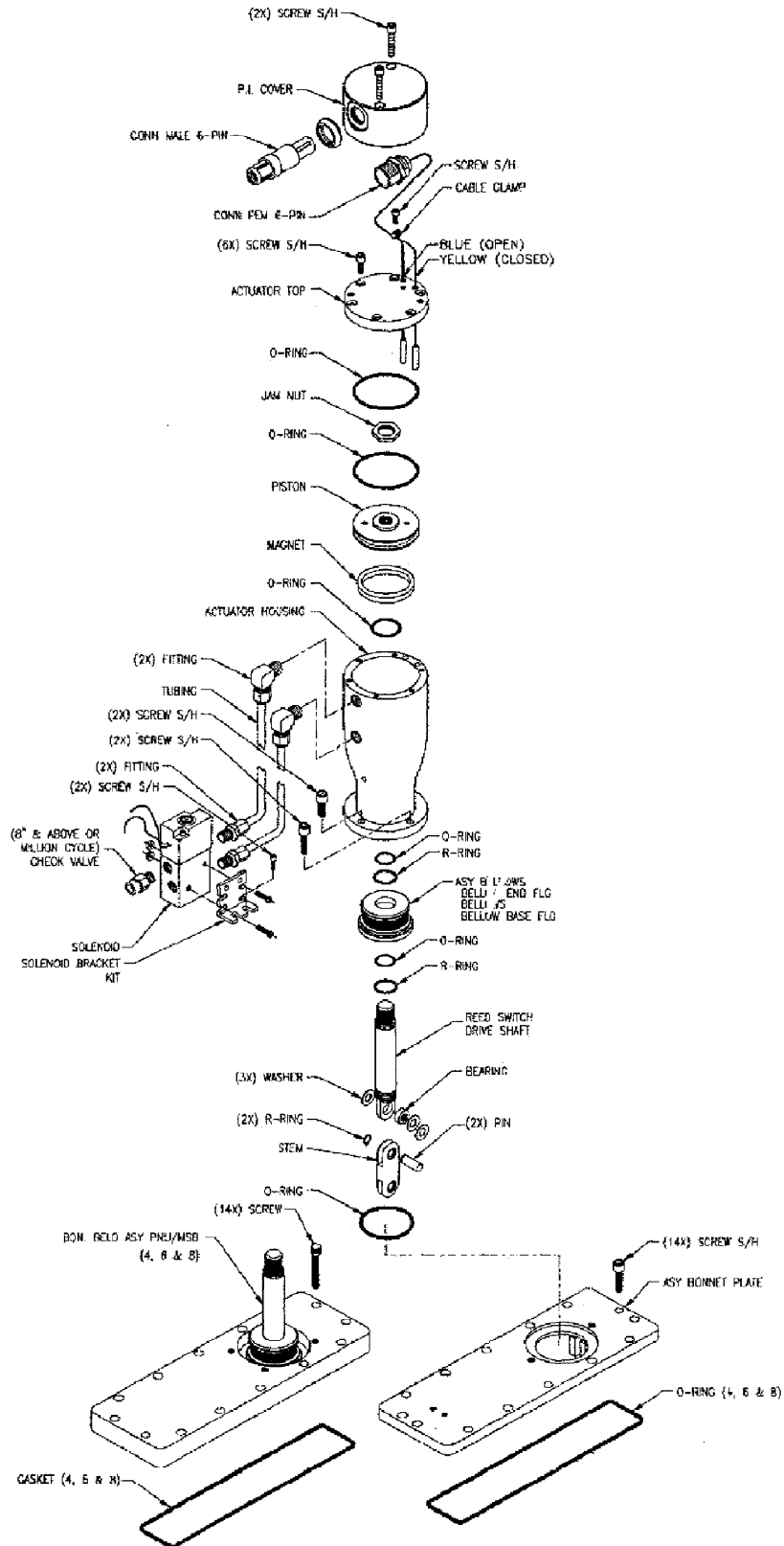


Figure 15 DIMENSIONS "A", "B", "C"

**GATE VALVE MAINTENANCE AND ADJUSTMENT PROCEDURE**



**Figure 16 PNEUMATIC ACTUATOR ASSY.**

GATE VALVE MAINTENANCE AND ADJUSTMENT PROCEDURE

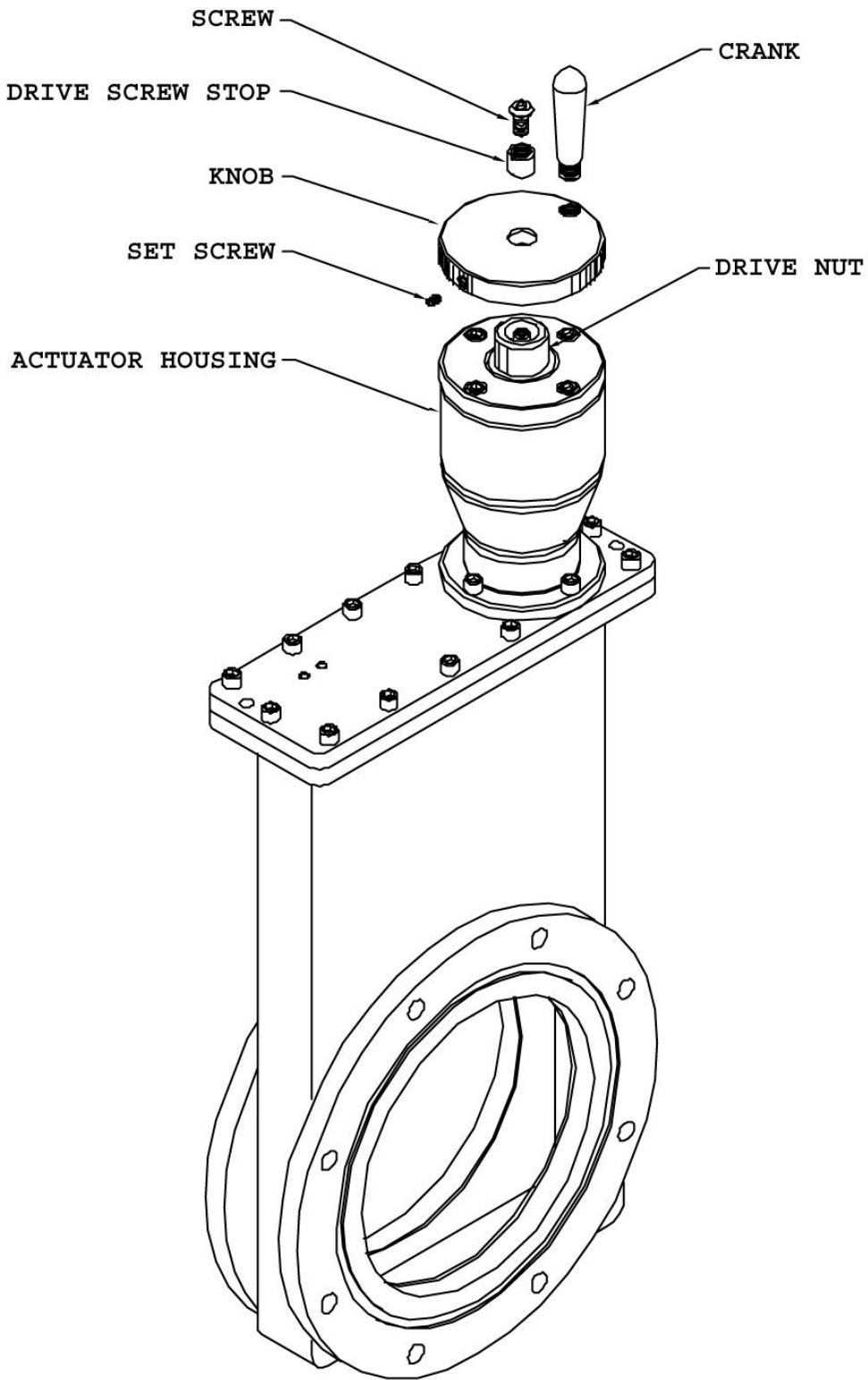
Notes:

## **REMOVAL OF ACTUATOR FOR BAKEOUT FOR MSB BONNET MANUALLY ACTUATED VALVES 1 ½" TO 12"**

Refer to the Manual actuator schematic (Figure 8 & 9) for part location.

1. Remove the left-hand threaded screw located on the top of the actuator. (See Assembly of Knob and Crank, Figure 9).  
\* This screw only has a left-handed thread and must be turned clockwise to loosen. This applies to valves built after 1995.
2. Remove the Drive Screw Stop.
3. Loosen the set screw located on the side of the knob. The set screw does not need to be completely removed.
4. Pull the knob off. Notice a flat on the drive nut. On reassembly, position the knob so the set screw matches the flat.
5. Remove the bearing block screws (4 each) located above the bearing block.
6. Remove the bearing block assembly by turning clockwise. The ACME thread on the actuator stem is lefthanded.
7. Loosen set screw on brass hex nut. The set screw does not have to be completely removed.
8. Remove nut on 4"-12" gate valves / Remove retaining ring on 1½"-3" gate valves.
9. Remove drive nut.
10. Remove the remaining screws on the actuator housing.
11. Slide the actuator housing off the drive shaft.
12. After bakeout, assemble the valve back together in the reverse order.

FIGURE 9  
ASSEMBLY OF KNOB & CRANK



**FIGURE 8**  
**ASSEMBLY OF BEARING**  
**BLOCK & DRIVE NUT**

