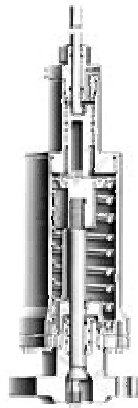




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11421-A Todd Road  
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# OPERATING AND SERVICE MANUAL FOR SAFOCO, INC. HYDRAULIC ACTUATORS



## 4000, 5000 AND 6500 SERIES





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## Operation

The SAFOCO Hydraulic Actuator is operated by application of adequate hydraulic pressure to the side port on the actuator head. Hydraulic pressure on the internal piston will in turn, force the bonnet stem to either open or close the valve, depending upon whether the valve is direct acting or reverse acting. The proper amount of hydraulic supply needed per operation is found on page 11.

In a closed reverse acting valve having a pressure differential across the gate, the initial opening or cracking action might be quite rapid as the pressure differential is reduced. This is normal and neither causes damage or hinders valve function. The remainder of the stroke can be expected to be normal.

Upon loss of pressure to actuator, the closing motion should be smooth, without any hesitation, until the valve comes to the end of its travel. This closing action should be smooth, whether or not the actuator is operating a pressured or non-pressured valve, regardless of orientation. This SAFOCO Hydraulic Actuator incorporates a larger compression spring for greater assist in closing. If the motion is not as described, refer to troubleshooting on page 5.

## Installation

The SSV Hydraulic Actuator should be the second valve in the wellhead flow stream. If two master valves are used, the SSV should be the top master valve; if a single master valve is used, the SSV should be the wing valve. Other installations are flow lines, header valves, gathering lines and pipelines. The SAFOCO Surface Safety valves are designed to provide automatic valve shut-in protection where needed. These SSV applications are ideal oil and gas installations where corrosive ( $H_2S$  or  $CO_2$ ), abrasive and/or paraffin-laden products are produced.



## Periodic Maintenance

The following maintenance schedule is recommended for normal operations.

<b>Maintenance</b>	<b>Interval</b>
<ol style="list-style-type: none"><li>1. Cycle open and close one time</li><li>2. Replace diaphragm and seals</li><li>3. Inspect top shaft and interior of diaphragm case</li><li>4. Replace safety valve</li><li>5. Clean debris from vent or breather holes, replace as needed.</li></ol>	<ol style="list-style-type: none"><li>1. Once a month</li><li>2. Every five years or when leakage occurs</li><li>3. When seals are replaced</li><li>4. Every five years or when leakage occurs</li><li>5. As required</li></ol>
<p>In order to maintain the traceability requirements, all certified replacement parts must be documented and referenced in writing to each individual SSV Actuator by its serial number. (NO EXCEPTIONS)</p> <p>Use the SSV Field Repair Report form for reporting.</p>	

## Troubleshooting

The following table of maintenance problems and corrective actions refer to the actuator connected to the bonnet and valve as a unit.

<b>Problem</b>	<b>Cause</b>	<b>Corrective Action</b>
Control pressure will not build	Damaged control line	Inspect control line for damage or leaking fittings.
	Insufficient pressure in control line	Install gauge at pressure source to verify desired pressure available.
	Faulty pressure gauge	Verify pressure gauge is correctly calibrated.
	Leaking around bolted flange and/or bottom of actuator	Replace and/or inspect seals on diaphragm retainer nut in accordance with assembly instructions.
Actuator will not stroke on a valve whether or not valve is pressurized	Insufficient pressure in control line	Verify pressure availability from source. Consult control pressure information from the information chart per size valve application on page 13.
	Bonnet to bonnet stem binding	Consult appropriate maintenance and operating instructions for bonnet.
	Valve and/or seals improperly installed	Remove actuator instructions per this manual. Remove bonnet per maintenance and operating instructions manual per bonnet manufacturer. Repair and/or replace valve components in accordance with valve manufacturer's instruction manual.
	Debris in valve and actuator vents	Remove actuator per instructions in this manual. Remove bonnet per instructions for bonnet manufacturer maintenance and operating manual. Clean debris from valve body.



Actuator will not attach to bonnet assembly	Debris in shaft or spring housing	Re-inspect lower housing and spring.
	Bonnet stem is not fully extended and backseated	Grasp stem in bonnet and pull to full extension properly backseating stem.
	Bad/or wrong thread on bonnet stem and downstop on bonnet/spring assembly	Check threads on bonnet stem and downstop plates for burrs, nicks, dings and debris. Check size and thread pattern for proper engagement.
	Spring cartridge too long because of bonnet	Check thread engagement of bonnet stem and downstop. Check for proper stroke distance between downstop and spacers on bonnet.
Actuator will not stroke to full closed or "Fail Safe" Position	Gate and seats are improperly installed causing excessive friction	Remove actuator per instructions in this manual. Manually push and/or pull bonnet stem to determine severity of binding. If severe, clean and inspect gate and seats for wear or abrasion. Replace if signs of galling are observed.
	Excessive seal friction due to loss of lubrication in bonnet/valve.	Remove actuator per instructions in this manual. Manually push and/or pull bonnet stem to determine severity of binding. Remove bonnet per instructions in appropriate maintenance and operating manual. Clean, inspect, and lubricate.
Actuator will not drift after assembly of bonnet to valve.	Wrong number of spacers installed.	Remove actuator per instructions in this manual. Check number of spacers.
	Wrong spacer ring per valve size.	Repeat actuator removal and check for proper spacer per bill of material.
	Improper gate to stem engagement.	Remove actuator per instructions in this manual. Remove bonnet and check engagement per valve



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		manufacturer's instructions. Reassemble.
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# Application Summary

The SAFOCO hydraulic actuator can be adapted to all valve manufacturers reverse-acting gate valves.

Gate Valve Size.....1 13/16” through 6-3/8”

Valve Working Pressure..... 0 PSI to 15,000 PSI

Fail Safe Operation .....Designed to close the reverse acting gate valve completely by spring force alone without flowline pressure in gate valve.

Actuator Operating Pressure.....As Specified

Temperature Range.....0° to 150°F (-18°C to 66°C)  
(Special – Low Temperature)                   -50°F to 150°F (-46°C to 66°C)

Typical Application.....Secondary Master Valve, Wing Valve, Flowline Valve, Gathering Lines, Headers and Pipeline Valves





## Ordering Information

The following information should be provided with any request for a quote or order placement for SAFOCO Hydraulic Actuators and Bonnets. If the valve is to be supplied by SAFOCO, see valve specifications below.

### **Actuator:**

Model of Actuator  
Series of Actuator  
Size of Actuator  
API 6A Requirements (PR – PSL)  
ISO Certification Requirements  
Control Fluid Power  
Well Fluid Power  
Temperature  
Location (Onshore/Offshore)  
Material (API 6A)  
Actuator Control Pressure Availability  
Special Test Requirements  
Special Material Requirements  
Other Specifications and/or Certifications  
Accessories

### **Valve:**

Model of Valve  
Size of Valve  
Pressure Rating (maximum)  
Manufacturer  
API 6A Requirements (PR- PSL)  
Temperature Rating (API 6A)  
Material (API 6A)  
Special Test Requirements  
Special Material Requirements  
Special Coating or  
Protection Requirements  
Other Specifications and/or  
Certifications

### **Bonnet:**

(Bonnet to be supplied by SAFOCO)  
Model of Bonnet  
Size of Bonnet  
Pressure Rating (maximum)  
Manufacturer (other than SAFOCO)  
API 6A Requirements (PR – PSL)  
Temperature (API 6A)  
Material (API 6A)  
Special Test Requirements  
Special Material Requirements  
Special Coating or Protection Requirements  
Other Specifications and/or Certifications



## Actuator Accessories

### **Clear Stem Protector:**

This device protects the rising shaft of the actuator from the adverse effects of the weather, sandblasting, contaminating operating environments and painting. The material is polycarbonate tubing.

### **Hand wheel Opener:**

This device is used to mechanically stroke the actuator. It is used on smaller valves or low-pressure valves while valve body is pressurized. It is typically used during installation and testing phases of well completions.

### **Hydraulic Opener:**

When high torque requirements make the use of hand wheel opener impractical, this device may be used to hydraulically stroke the actuator. Typically used for stroking large or high-pressure valves under well pressure and sometimes workover operations.

### **Heat-Sensitive Lock Open Cap:**

Mechanically holds open the actuator and valve during workover or when the safety systems are inoperative. This device locks the actuator in the down position, allowing it to rise only in the event of a fire.



## Actuator Accessories (Electrical)

### **Electrical Limit Switch:**

An electrical contact permits a remote indication of gate valve position (full open or full closed). Typically used on large production platforms or automated leases where there is remote monitoring and control of valves.

### **Continuous Position Indicators:**

Linear displacement transducers operate at low currents. The frequency of their output can be used to provide exact position throughout the range between the open and closed positions.

### **Proximity Switches:**

This magnetically operated switch senses the linear motion of the valve by magnetic action either with or without the need for physical contact.

### **Hydraulic Switches:**

Hydraulic limit switches are available for use when electrical supply is not present.

### **Magnetic Reed Switches:**

This magnetic reed switches device is activated by a magnetic field. It monitors linear travel of the gate valve. The switches are completely sealed against harsh environments.



## Actuator Selection

To simplify the process of selecting an actuator for a specific job, contact SAFOCO sales representative. It is important to note that higher control supply pressure makes possible the use of smaller size actuators.

Additional savings can result from anticipating the maximum flowline or S.I.T.H.P. conditions. If the maximum flowline pressure is much less than the pressure rating of the valve, then selection of the size of the actuator for this lower pressure rating will be less expensive.

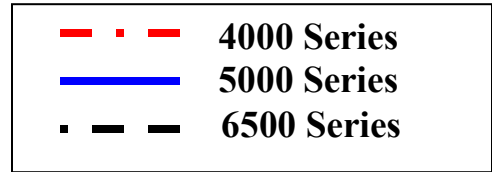
## Actuator Selection Procedure

Determine valve specifications such as size, maximum working pressure and expected shut-in pressure or maximum sales line delivery pressure. If maximum flowline pressure is less than half of the maximum working pressure of the valve consult SAFOCO for optimum sizing of actuator.

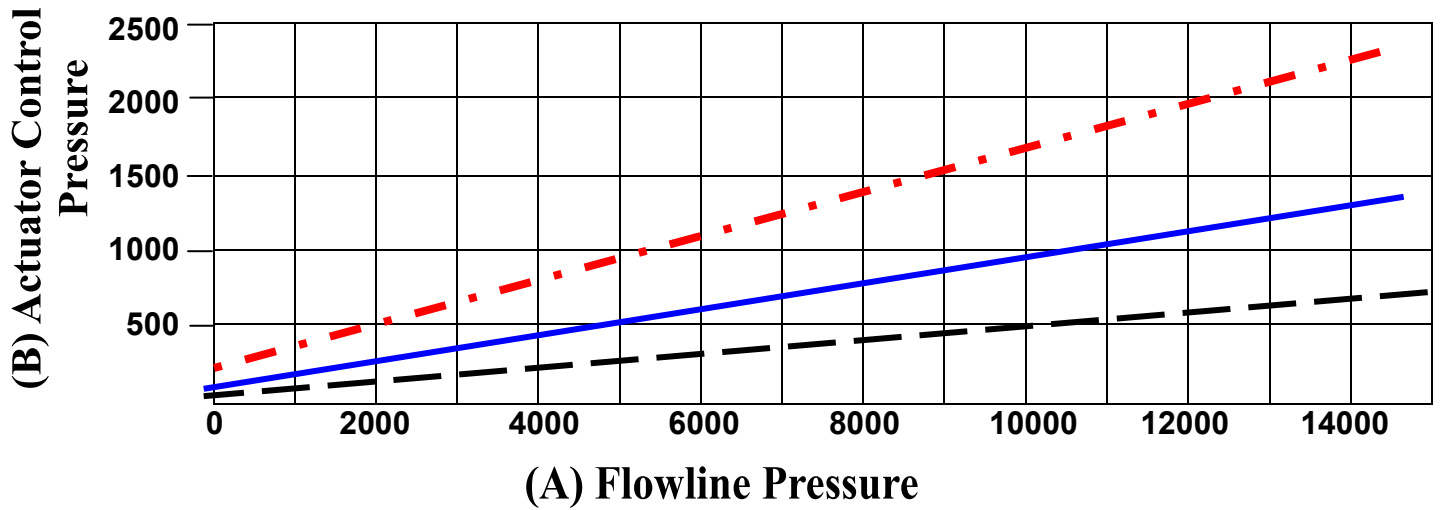
Determine the available control pressure supply at the wellsite. This is typically hydraulic pressure. This supply can be rated up to 4000 PSI.

Consult the graph on page 13 for normal valve size. Find the maximum control pressure supply on the vertical (left) axis (B). Next, find the flowline pressure on the lower horizontal axis (A). After locating flowline pressure and control pressure supply, locate their intersection point by drawing a line horizontally from the (B) axis and a vertical line from the (A) axis.

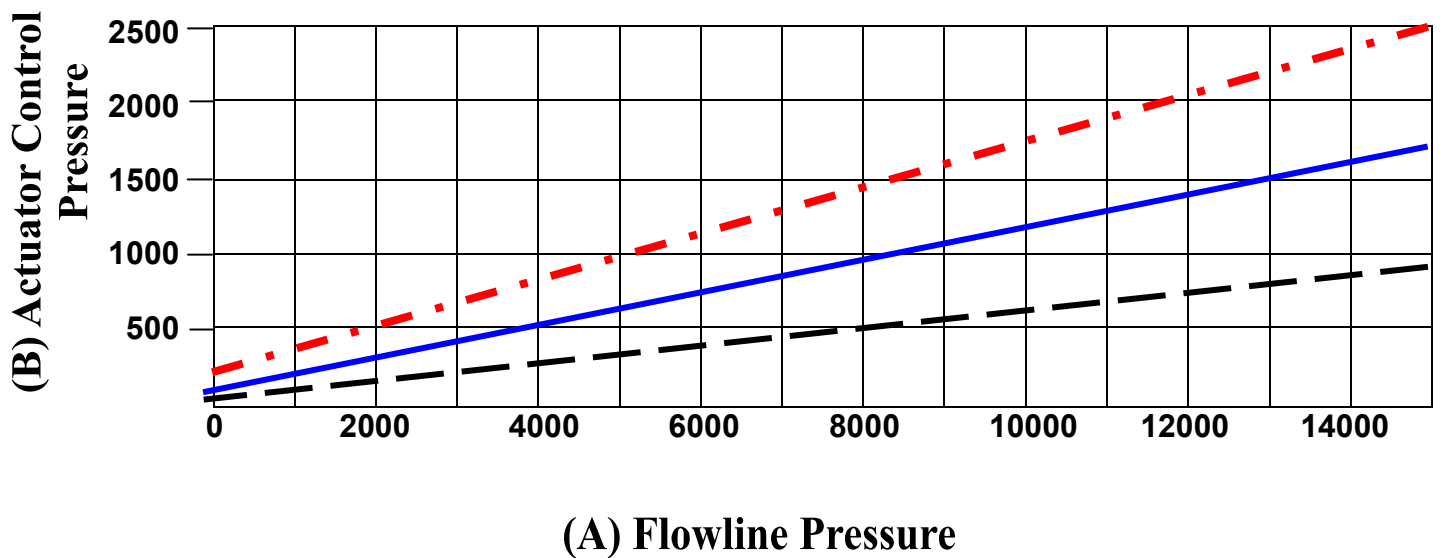
# Hydraulic Control

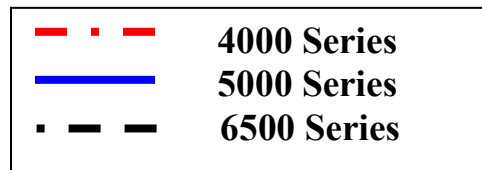


## 1 13/16 & 2" Valve Operating Pressures

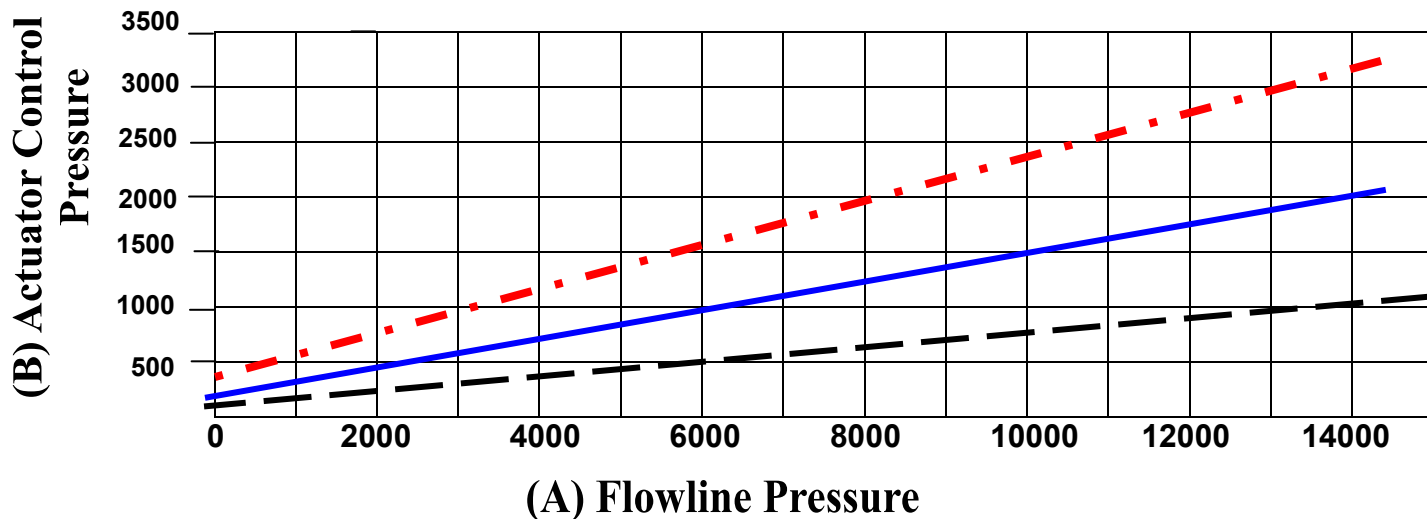


## 2 9/16" Valve Operating Pressures

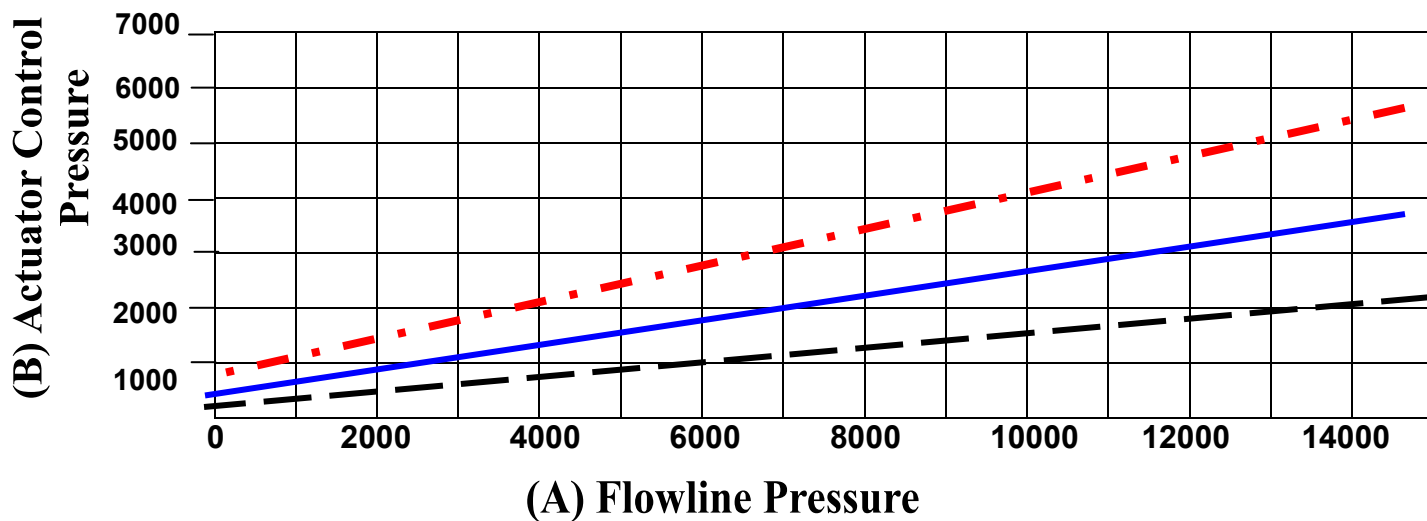




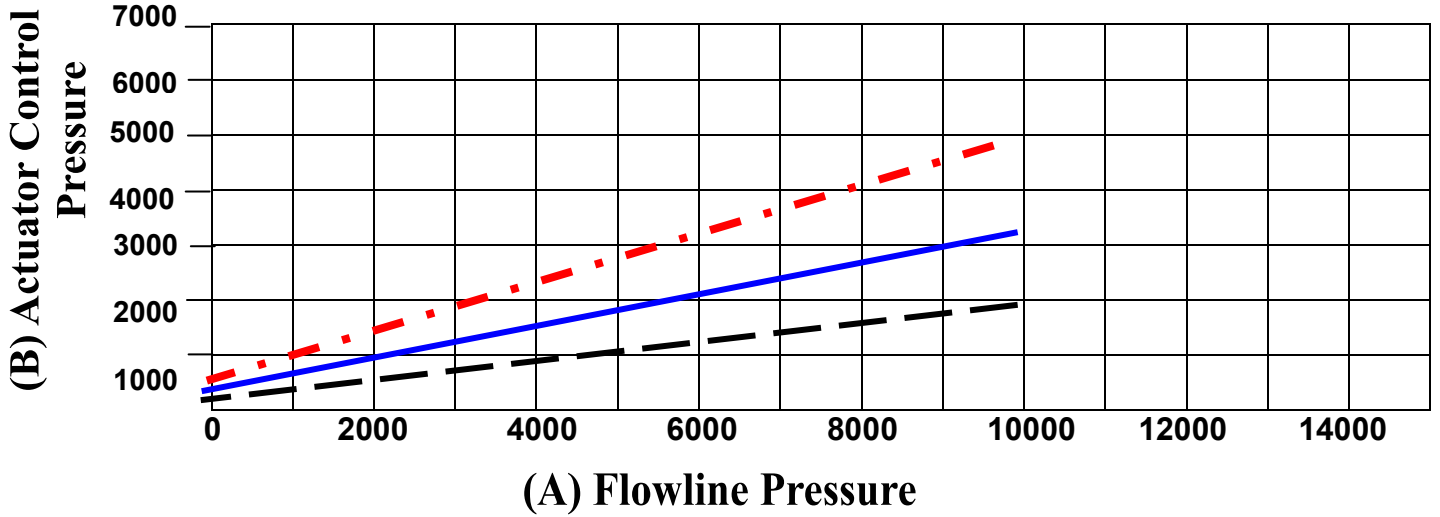
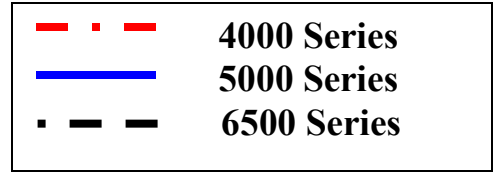
### 3" Valve Operating Pressures



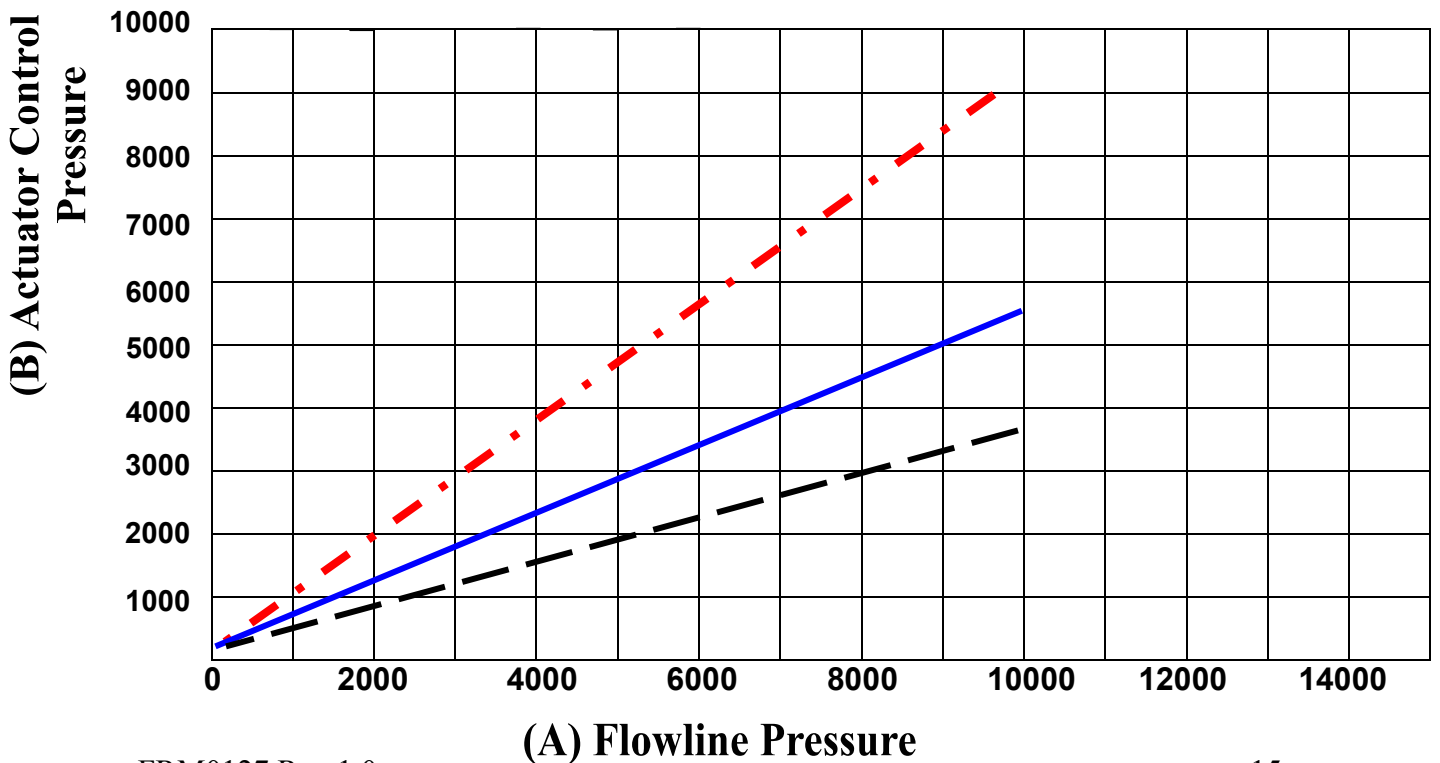
### 4" Valve Operating Pressures



### 5" Valve Operating Pressures



### 6" Valve Operating Pressures





## List of Service Tools Required

1. One Lifting Eye (5/8" – 11 UNC – 2A Thread)
2. One 12" or 14" Crescent Wrench
3. One Flat Blade Screw Driver 6" to 8"
4. Drift Mandrel (Required for Testing Procedures Only)
5. One Strap Wrench
6. One Torque Wrench Hammer
7. One Hammer Wrench Hammer for Bonnet Bolting or Socket Set with Torque Wrench



## Assembly of Hydraulic Actuator

1. Assembly work area must be clean and free of dirt, metallic shavings and wood particles.
2. Surface preparation of work area should be metallic or covered with a layer of corrugated cardboard.
3. All grease or lubricants used in assembly should be stored and clean. Any utensils such as brushes or applicators will be free of any foreign particles after use.
4. Clean all components (metallic) prior to assembly.
5. Keep all elastomer and plastic base materials in bags or boxes until needed for assembly.
7. Inspect all components for burrs, dings, marks, scrapes, nicks, and etc. prior to assembly.
8. Inspect internal surface finish of piston housing.
9. Check all non-metallic components for flash, nicks, cuts, abrasions and etc.
10. Inspect seal bore of threaded boss on top plug for surface imperfections. Make sure coating is smooth. No ripples or fish eyes or covered particles are present.
11. Inspect seal bore of threaded boss on top plug for surface imperfections. Make sure coating is smooth. No ripples or fish eyes or covered particles are present.
- 12 Grease entire bore with light application of white silicone grease.
13. Check all non-metallic components for flash, nicks, cuts, abrasions and etc.
14. Install polypak (5), wear ring (4) and rode wiper (3) in top plug (2). Caution: make sure lip of rod wiper is pointing toward grooved end of top plug. Install O-ring (8) on nose of top plug. Grease lightly.
15. Install wear ring (7) into groove and grease lightly.
16. The top plug is now assembled.
17. Grease outside diameter of piston lightly.

18. Install polypaks (10) and wear rings (9).

17. Place top shaft (1) in top of piston and install retainer ring (24). Caution: Make sure retainer ring snaps into groove completely.

18. Stand spring (17) on flat surface. Place upper spring retainer (15) on top of spring. Place downstop (16) in upper spring retainer.

19. Place spring housing (18) over spring pack assembly.

20. Apply never-seize or equivalent to inside diameter threads in spring housing and outside diameter threads of piston housing.

21. Screw piston housing into spring housing until piston housing bottoms. Install set screws (12) into spring housing. Install retainer ring (14) into piston housing.

22. Lightly grease piston bore and install piston assembly.

23. Apply never-seize or equivalent to inside diameter threads of piston housing and outside diameter threads of top plug.

24. Screw top plug into the piston housing until the top plug bottoms. Install set screws (2) into piston housing.

25. Insert one .625 – 11 UNC – 2A X 1.750 long bolt (23) through hole in lock open cap (22).

26. With one hand holding top shaft (1) from moving, place the lock open cap (22) over and onto top of shaft (1). With other hand, rotate screw into threaded hole in top shaft (1); make up threads by hand.

27. Lift entire actuator assembly up and over compression spring. At this time, the weight of the components will move downward. The lock open cap (22) will stop this movement.

28. Rotate the lock open cap (22) in a clockwise direction until lock open cap stops on shoulder of top plug case (2). This action suspends the internal components from moving in any direction.



29. The SAFOCO Hydraulic Actuator is now assembled and ready for testing.

30. Before the completed hydraulic actuator can be tested, it must be thoroughly inspected.

31. If this is a new actuator assembly, it must be adapted to a bonnet assembly and stroked several times, making sure that operating is smooth and complete by using an adequate hydraulic pressure.

32. Once this new actuator assembly is mounted to the bonnet assembly, make sure that the lower housing to base plate (21) and bolts (20) are in place, tightened and secure.

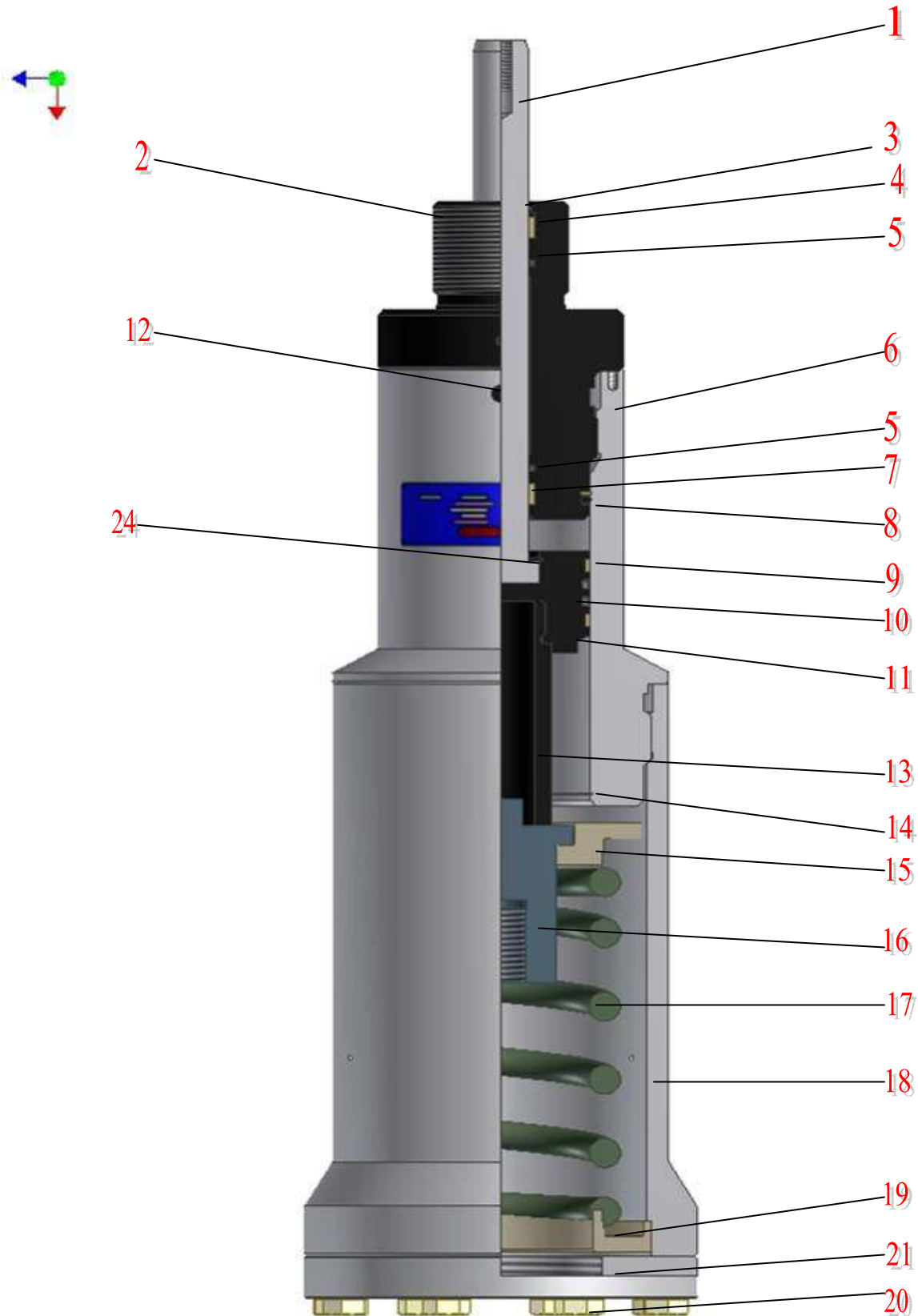
33. If this is a new actuator assembly, or if the bonnet, actuator, or valve have been repaired, testing must be performed by procedures outlined in API 14D or API 6A whichever is applicable for the valve and service. (This testing excludes Hydrostatic testing of the actuator).

34. A certified individual should perform all assembly and testing.

**Disassembly:**

To disassemble the actuator, reverse the steps above, starting with step 28 and moving backwards towards step 1.

# ASSEMBLY DRAWING OF HYDRAULIC ACTUATOR





## Bill of Material for Model A

Item Number	Description	Quantity Required	Material
1	TOP SHAFT	1	17-4PH NACE
2	TOP PLUG	1	4130, 75K
3	WIPER RING	1	MOLYTHANE 90
4	WEAR RING	1	MOLYGARD
5	POLYPAK	1	TEFLON
6	PISTON HOUSING	1	4130, 75K
7	WEAR RING	1	MOLYGARD
8	O-RING	1	BUNA – N 90
9	WEAR RING	2	MOLYGARD
10	POLYPAK	2	TEFLON
11	PISTON	1	4130, 75K
12	SET SCREW	*	SAE J429 GRADE 8 ALLOY STEEL
13	PISTON EXTENSION	1	4130, 75K
14	RETAINER RING	1	316SS
15	UPPER SPRING RETAINER	1	ASTM A36 STEEL
16	DOWNSTOP	1	4130, 75K
17	SPRING	1	ASTM A689, 5160 RC48 MAX
18	SPRING HOUSING	1	4130, 75K
19	LOWER SPRING RETAINER	1	ASTM A36 STEEL
20	HEX HEAD BOLT	*	SAE J429 GRADE 8 ALLOY STEEL
21	BASE PLATE	1	ASTM A36 CARBON STEEL
22	LOCK OPEN CAP	1	AISI 1018 – 1026 C.S.
23	HEX HEAD BOLT	1	SAE J429 GRADE 8 ALLOY STEEL
24	RETAINER RING	1	316 SS

ALL NON-STAINLESS PARTS ARE COATED. SPRING IS COATED WITH EPOXY.

\*AS REQUIRED BY ASSEMBLY BILL OF MATERIAL



# Clearance Removal Dimensions for Actuator (SEE NEXT PAGE FOR DIAGRAM)

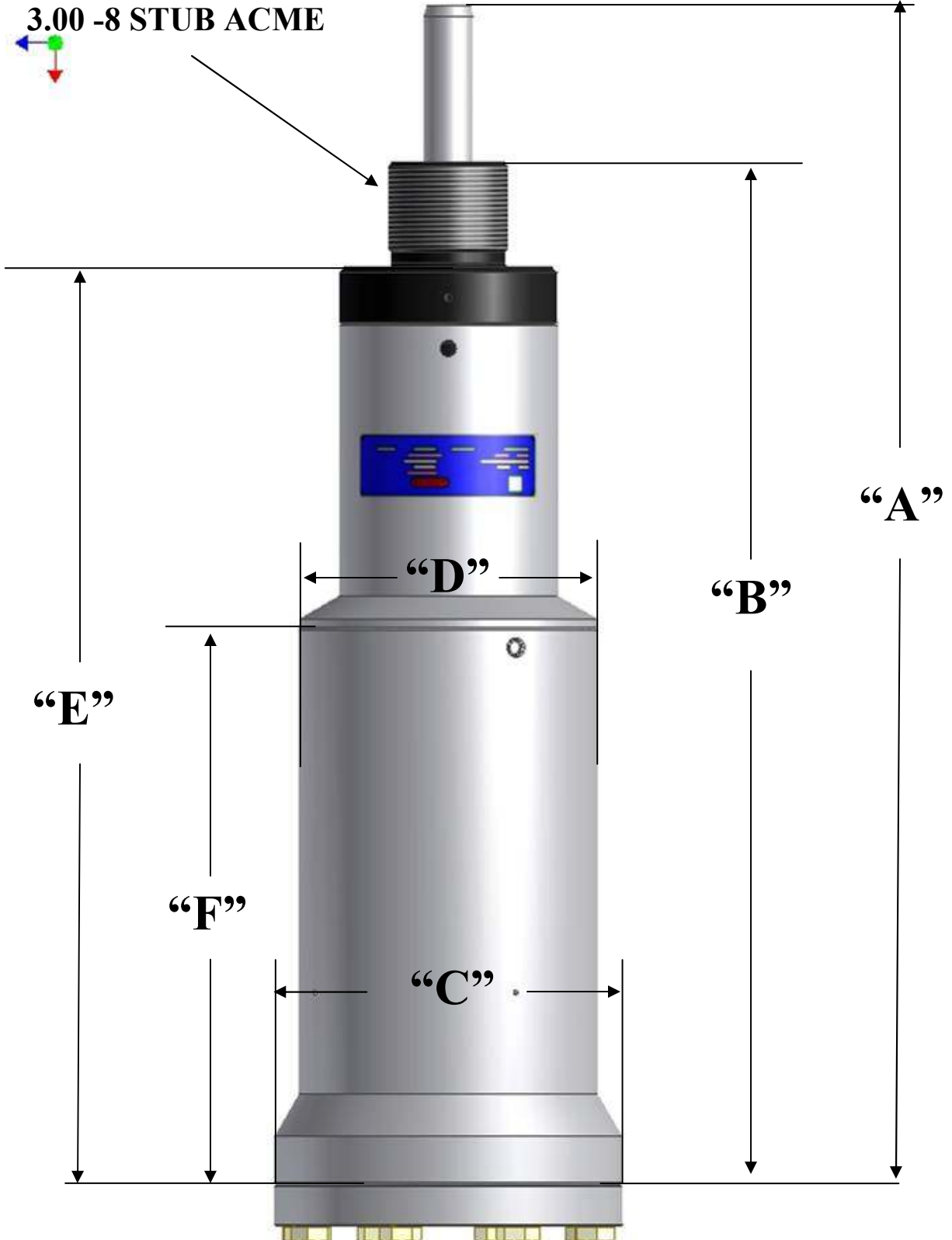
## Physical Dimensions

Valve Size (Inches)	Pressure (PSI)	A (Inches)	B (Inches)	C (Inches)	D (Inches)	E (Inches)	F (Inches)
1 13/16	10,000	29.4	25.7	8.75	7.50	13.85	23.0
2 1/16	5,000	29.4	25.7	8.75	7.50	13.85	23.0
2 1/16	10,000	29.4	25.7	8.75	7.50	13.85	23.0
2 9/16	5,000	29.4	25.7	8.75	7.50	13.85	24.0
2 9/16	10,000	29.9	26.2	8.75	7.50	14.35	24.5
3 1/8	5,000	30.4	26.7	8.75	7.50	14.85	25.0
3 1/16	10,000	31.2	27.2	8.75	7.50	15.35	25.5
4 1/16	5,000	33.0	29.0	8.75	7.50	16.55	26.0
4 1/16	10,000	36.8	27.7	10.50	9.50	27.7	27.7
6 3/8	5,000	36.8	29.7	10.50	9.50	29.7	29.7
7 1/16	5,000	36.8	29.7	10.50	9.50	29.7	29.7

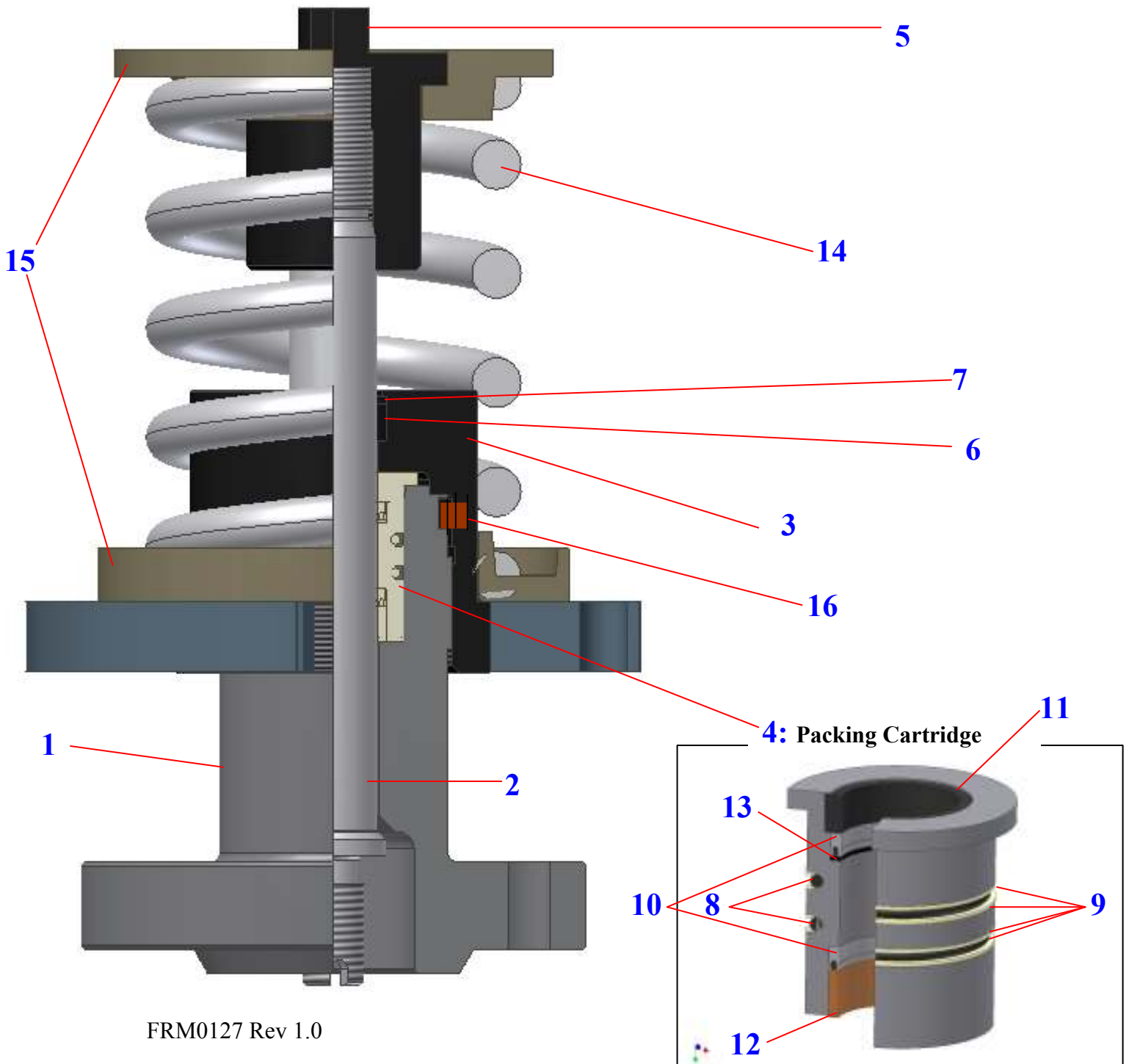
## Temperature Ratings

Temperature Classification	Operating Range		Operating Range	
	Degrees Fahrenheit (°F)		Degrees Celsius (°C)	
	Min.	Max.	Min.	Max.
K	-75	to 180	-59	to 82
L	-50	to 180	-46	to 82
P	-20	to 180	-29	to 82
R	Room Temperature		Room Temperature	
S	0	to 150	-18	to 66
T	0	to 180	-18	to 82
U	0	to 250	-18	to 121

NOTE: For special applications involving other sizes and pressure ratings, temperatures, materials, etc., please contact SAFOCO.



# SAFOCO MODEL "A" BONNET







## Bill of Material for Bonnet

Item	Description	QTY	Material
1	Bonnet	1	ALLOY OR 410 NACE
2	Stem	1	4130-75K, 17-4 PH, or other CRA
3	Bonnet Ring	1	AISI 4130 ALLOY STEEL-RC22 MAX
4	Packing Cartridge	1	17-4 PH HH1150
5	Downstop	1	AISI 4130 ALLOY STEEL-RC22 MAX
6	Bearing	1	MOLYGARD
7	Rod Wiper	1	MOLYTHANE 90
8	O-ring	2	HSN 90
9	Back up F/O-ring	4	Teflon or PEEK
10	Poly Pak Seal	2	HSN 90
11	Upper Wear Bearing	1	Nylatron or PEEK
12	Lower Wear Bearing	1	Nylatron or PEEK
13	Back up for Polypak	1	Nylatron or PEEK
14	Spring	1	Alloy
15	Spring Retainers	1	A-36 Plate
16	Set Screw	1	Grade 8
17	Drift Spacers	4	300 Series Stainless

ALL NON-STAINLESS STEEL PARTS ARE COATED INTERNALLY AND EXTERNALLY WITH EPOXY.

## Assembly of SAFOCO Bonnet (Typical)

The Bonnet is the part of the Actuator that connects the actuator to the valve. SAFOCO can manufacture the bonnet to adapt to each manufacturer or use the Adapter Bonnet Kit, when bonnet is to be supplied by the valve manufacturer. This adaptation component is designed for each manufacturer and each model of valve.

1. Assembly work area must be clean and free of dirt, metallic shavings, wood particles and etc.
2. All grease or lubricants used in assembly should be stored and clean. Any utensils should be stored and cleaned after use. All utensils such as brushes and applicators will be free of any foreign particles after use. No residue is to be left in grease or lubrication containers.
3. All tools used in assembly must be clean and in good working order.
4. All seal rings used in testing of bonnets are wrapped and delivered to testing area only at time of testing.
5. Clean and prepare all components prior to assembly.
6. Keep all elastomers and plastic base materials in bags or boxes until needed for assembly.
7. Inspect all individual components for burrs, pings, marks, scars, nicks and etc. prior to assembly.
8. Inspect the bonnet in the following critical areas:
  - A. Bonnet gasket seal face
  - B. Fire seal area
  - C. Retaining threads for lower bonnet flange
  - D. Proper identification after testing with proper marking technique on flange outer diameter or nameplate identification. This includes all additional porting such as bleeder holes, etc. Porting will differ with each valve manufacturer.
9. Grease and install the backup ring (for polypak) on the lower gland of the packing cartridge



10. Install the polypak seal into the packing bore of the cartridge. Lightly grease.
11. Install the lower wear bearing, spliced, to the lower gland of the cartridge. Lightly grease.
12. Install the polypak seal into the upper gland of the polypak, with the "O-ring" in the polypak facing down. Then install the upper wear bearing to gland, position it on top of the polypak seal. Lightly grease
13. Install the two O-rings on the outside of the packing cartridge.
14. Install the spliced "O-ring back-up rings", quantity 4, to the cartridge.
15. Lightly grease and install one rod wiper into bore of bonnet ring.
16. Install wear bearing into bore or bonnet ring. Set bonnet ring aside.
17. Lightly coat entire length of stem (2) and slide stem into bonnet (1). Be careful to center stem as it slides through the packing seals. (The stem should travel its full length to backseat by hand). Wipe off excess grease after achieving full up position.
18. Rotate bonnet ring (3) onto bonnet (1). Be careful to center stem as it slides through lower bearing, polypak seals, and upper bearing. Push down by hand until thread engagement is made. Rotate bonnet ring (3) clockwise until it stops on bonnet (1) shoulder.
19. Apply Never Seize on the dog point set screw (16) into circular groove on bonnet by rotating clockwise in tapped hole, the screw must stop below the outer diameter of the bonnet ring (3).
20. Place spacers over bonnet stem (2) and down onto face of bonnet ring (3) 2-4 spacers will be installed depending on stroke of the valve. Note: if setting drift, if gate valve see page 33 for proper drift.
21. The bonnet is now complete and ready to be assembled and tested. See page 28 for assembly to gate valve.
22. The valve and bonnet assembly must be tested in accordance with API 6A as applicable to the valve usage and service.
23. All assembly and testing must be performed by a certified assembler and tester.
24. To DISASSEMBLE the bonnet assembly, reverse the steps above, starting at step 20.

# Assembly of SAFOCO Bonnet to Valve (Typical)

## Summary

When installed on an unbalanced gate valve, the SAFOCO Bonnet assembly is the interface between the actuator and the gate valve. The bonnet will provide leak-free sealing when the valve is being operated or in the static condition. Before adaption of the actuator, the stem should stroke freely in both directions. When the valve is pressure in the full closed position the stern will be urged outward because of valve pressure acting upon the bonnet stem diameter.

The SAFOCO bonnet is used as an up and downstop for the valve. This design prevents damage to the valve or to the bonnet stem in the event of accidental over pressuring of the actuator.

The SAFOCO bonnet provides positive stroke reliability by use of spacers. Once proper stroke has been set a constant stroke distance will be maintained throughout normal service life.

All the SAFOCO bonnet assemblies are shipped ready for installation on the valve.





## Installation

During installation, pay special attention to removal of any devices in the valve such as stem balancing components, internal gate downstop devices and any adjustments to gate travel. Installation must be carefully done. Prior to installation of bonnet, check all sealing surfaces and parts for shipping and/or handling damage. The bonnet interface surface is most important. Check to be sure that the correct seal ring is present and in excellent condition.

1. Remove the downstop from bonnet subassembly by rotating it in a counterclockwise direction from the bonnet stem. Hold or secure gate end of stem to prevent rotation of bonnet stem. Note: As the downstop Unscrews from the bonnet stem, the preload is gradually released from the compression spring returning the spring to a free length position.
2. Remove spring from bonnet assembly and set aside.
3. Remove protection plastic netting from bonnet stem.
4. Remove lower spring retainer and set aside.
5. Rotate base plate ring from bonnet ring by rotating in a counter-clockwise direction and set aside.
6. Do not remove the bonnet.
7. Using your hand shove or push the top of the bonnet stem (2) toward the bonnet ring. Caution: Do not push the threaded end of the bonnet stem past the nose of the bonnet ring. The gate end of the bonnet stem is now exposed for adaption of gate.
8. Note: Each gate valve manufacturer generally has a unique “adapted for” mechanism that then adapts to a bonnet. The use of a threaded gate nut on the “tee” style gate is most common. To this purpose, the procedure will only exhibit a threaded style for assembly. However, in each case the gate valve manufacturer will supply proper assembly instructions for their design. The gate valve manufacturers “adapted for” valve components are generally body, gate, lifting nuts, studs, nuts, seat rings, seats, and miscellaneous items used in the closing mechanism. The body and closure mechanism are pressure tested to check the valve before shipment.
9. Thread the gate onto the exposed portion of the bonnet stem (2) in a closing direction. Look to the installation specifications for the correct amount of engagement.
10. Rotate the gate slightly in either direction to bring the slot in the bonnet stem into alignment with the corresponding hole in the gate.
11. Drive the pin (supplied with valve) through the gate pinhole and the stem slot. Note: Be sure the bonnet seal ring is installed in the body. Carefully insert the gate into the valve body between the seats and slide bonnet assembly down over the valve body studs.

**(Continued)**

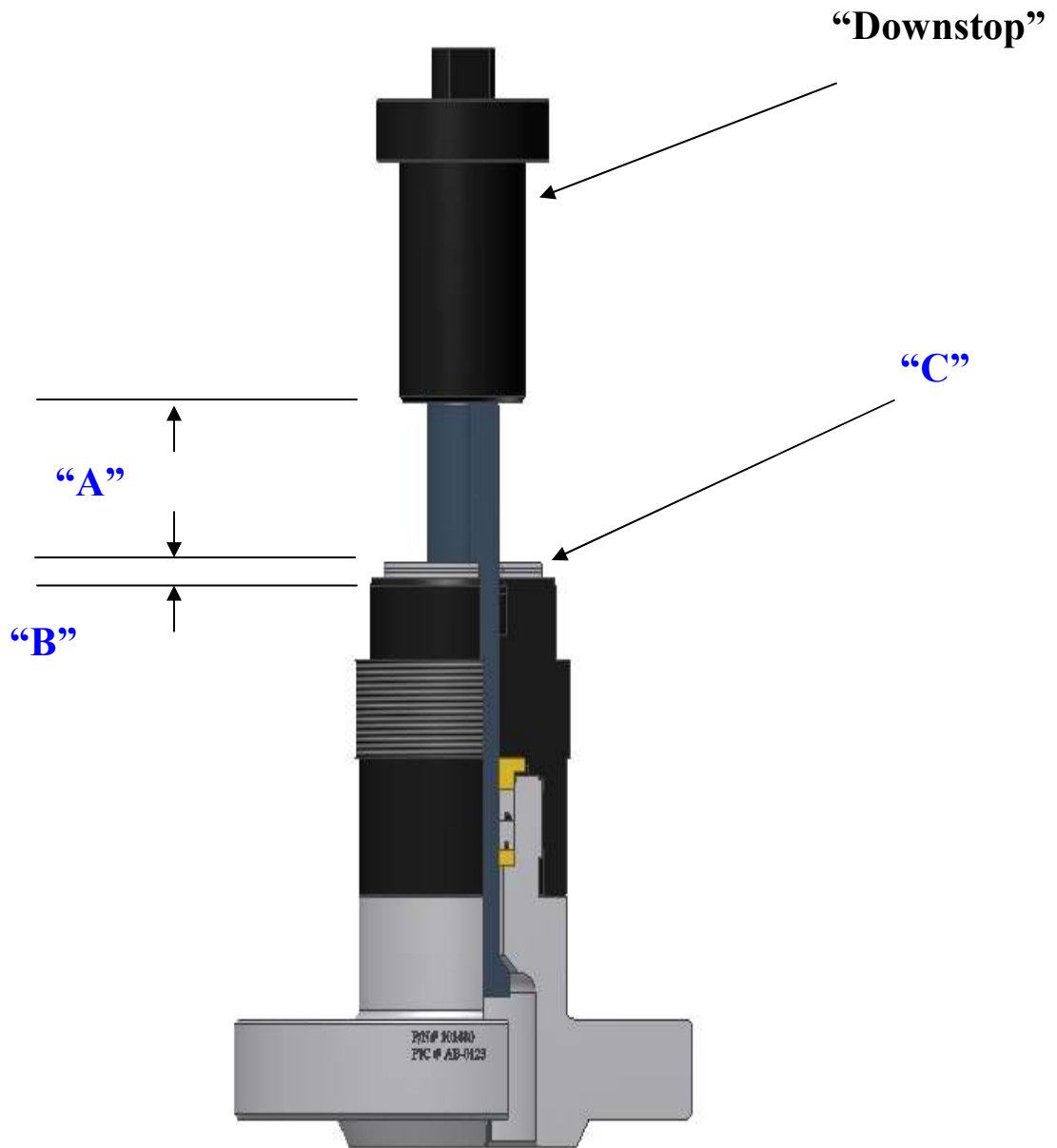
12. Install and torque nuts on valve body studs in accordance with instructions from valve manufacturer.
13. The bonnet stem valve should slide easily upward by pulling the gate up to the full closed position with your hands if necessary. The downstop can be threaded onto the bonnet stem for better leverage. Do not use any other device or tool to lift the bonnet stem to the full closed position other than previously mentioned.
14. Note: After drift setting has been completed, remove downstop and set aside. See page 31 for drift setting.
15. Place base plate ring down and over bonnet ring and engage threads by rotating ring in a clockwise direction. Rotate the plate one or two turns past top shoulder of the bonnet adapter ring.
16. Place the lower spring retainer over and down on the nose of the bonnet ring with the groove side up. Lower spring retainer should be centered and resting on the shoulder of the bonnet ring. Note: A gap of 1/16 to 1/8 should be present between the lower spring retainer and base plate ring.
17. Install compression spring into the groove of the lower spring retainer. The spring should sit in the groove.
18. Place upper spring retainer on compression spring. The spring retainer should center itself properly.
19. Insert the downstop through the bore of the upper spring retainer.
20. Depress the spring slightly with one hand. Rotate the downstop in a clockwise direction with other hand until engagement with crescent wrench and the downstop bottoms out on the nose of the bonnet stem.  
Note: With the bonnet stem connected to the gate, the stem does not require restraint from rotation.
21. The SAFOCO bonnet assembly is now complete and ready to be assembled to the actuator.
22. Once the bonnet has been installed on a valve, it may be hydrostatically tested along with the valve and the actuator.
23. The testing and assembling must be a qualified assembler and tester.
24. The valve, bonnet and actuator assembly must be tested in accordance with API 6A as applicable to the valve usage and service.
25. To DISASSEMBLE the bonnet assembly from the valve, reverse the steps above, starting at step 20.

## Setting Drift of Valve

This section explains how to set the drift of the gate valve after assembly of the bonnet to the valve has been completed.

1. After bonnet stem (2) has been extended outward to the full closed position, place spacers, two each, over the bonnet stem (2) and down onto the face of the bonnet ring (3). Remove the threaded downstop if used to pull bonnet stem (2) out to the full closed position.
2. Thread the downstop in the end of the threaded bonnet stem (2) by rotating in a clockwise direction until the downstop bottoms out on the end of the bonnet stem (2).
3. Using both hands, push the downstop downward until the downstop stops on top of spacers.
4. Check the drift alignment by running the appropriate drift tool through the valve. If the gate is not aligned with the valve bore, pull the bonnet stem upward to the full closed position of the valve. Remove the downstop and add or subtract spacers as necessary to compensate for drift error.
5. After successful completion of previous step, continue assembly of actuator adaptor kit to bonnet.

## Drift Setting of Valve







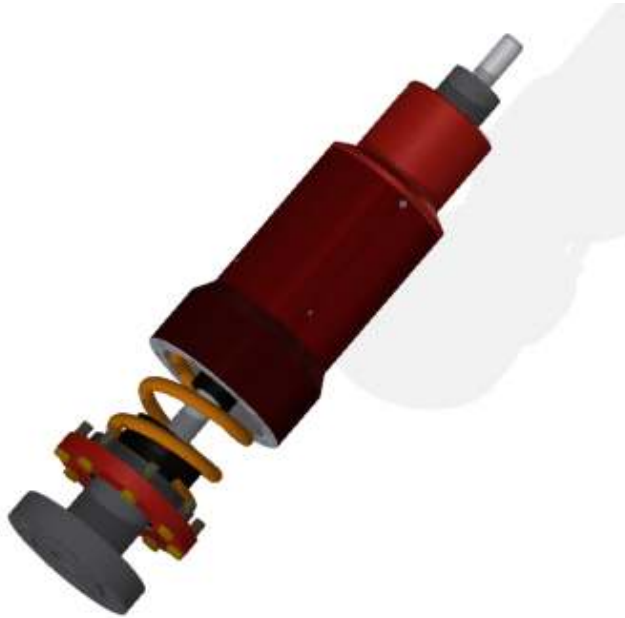
## Drift Setting of Valve

Valve Size (INCHES)	Pressure (PSI)	A (INCHES)	B (INCHES)	C (QUANTITY)
<b>1 13/16</b>	<b>10,000</b>	<b>2.70</b>	<b>0.13</b>	<b>2</b>
<b>2 1/16</b>	<b>5,000</b>	<b>2.60</b>	<b>0.13</b>	<b>2</b>
<b>2 1/16</b>	<b>10,000</b>	<b>3.00</b>	<b>0.13</b>	<b>2</b>
<b>2 9/16</b>	<b>5,000</b>	<b>3.10</b>	<b>0.13</b>	<b>2</b>
<b>2 9/16</b>	<b>10,000</b>	<b>3.60</b>	<b>0.13</b>	<b>2</b>
<b>3 1/8</b>	<b>5,000</b>	<b>3.70</b>	<b>0.19</b>	<b>3</b>
<b>3 1/16</b>	<b>10,000</b>	<b>4.30</b>	<b>0.19</b>	<b>3</b>
<b>4 1/16</b>	<b>5,000</b>	<b>4.70</b>	<b>0.19</b>	<b>3</b>

**NOTE: DRIFT SETTING WILL VARY WITH VALVE MANUFACTURER**

## Assembly of Actuator to Bonnet

The assembly of the actuator to the bonnet is the final procedure in the SSV assembly.



1. Do not remove the plastic plug from the threaded nipple on the actuator housing. This will prevent the actuator top shaft from dropping downward.
2. Remove bolt and lock open cap from actuator top plug.
3. Lower the actuator body over and down onto the bonnet assembly. Align and center the actuator lower housing shoulder to the spring retainer shoulder. Note: If the actuator is being mounted in a horizontal position, support the weight of the actuator until it is fully installed.
4. Remove the plastic plug from the pressure inlet and align tapped holes in the lower housing of the actuator body to correctly position the pressure inlet nipple for proper tubing location. Note: When installation of the actuator is at the well site, the pressure inlet can be rotated 360° for exact plumbing location.



5. Rotate the base plate ring in a counter clockwise direction toward the actuator body. Note: Base plate ring must stand off from the actuator body a minimum of 1/32 of an inch. Once the alignment of holes in the base plate ring is exact with the actuator body, install 8 bolts and tighten to 75 to 90 pound-feet of torque. A cross type-tightening pattern is required.
6. Install proper inlet fitting into pressure inlet.
7. Connect a suitable hydraulic supply to the pressure inlet of the actuator and apply enough hydraulic pressure to stroke the actuator all the way down.
8. Remove the hydraulic pressure supply allowing the actuator to return to the full closed position.
9. Install the thread protector.
10. Before testing of the newly assembled actuator to the bonnet, check all actuator bolts, relief device and base plate ring bolts.
11. All testing to the new actuator assembly must be performed by procedures outlined in API 6A; whichever is applicable to the new actuator assembly.
12. To DISASSEMBLE the actuator from the bonnet assembly, follow steps below:
  - a. Drain all hydraulic fluid from the actuator, returning the topshaft to the up position.
  - b. Disconnect hydraulic supply and place a plug into the 1/2" NPT hydraulic inlet port of the actuator.
  - c. Remove the bolts that hold the actuator to the baseplate and lift the actuator off of the bonnet assembly.



## Disassembly of SSV

When disassembling the SSV, reverse each section of assembly procedure in the following order:

1. Remove actuator from bonnet assembly (see Assembly of Actuator to Bonnet, step 12).
2. Remove bonnet assembly from valve (see Assembly of Safoco Bonnet to Valve – Installation, Step 25).
3. To disassemble actuator, see Assembly of Hydraulic Actuator – Disassembly.
4. To disassemble bonnet assembly, see Assembly of Safoco Bonnet, Step 24.



## Material Requirements

<b>Material Class</b>	<b>Minimum Material Requirements for: <i>Body, Bonnet and Flange</i></b>	<b>Minimum Material Requirements for: <i>Pressure Controlling Parts and Stems</i></b>
AA – General Service	Carbon or low alloy steel	Carbon or low alloy steel
BB – General Service	Carbon or low alloy steel	Stainless steel
CC – General Service	Stainless steel	Stainless steel
DD – Sour Service*	Carbon or low alloy steel**	Carbon or low alloy steel**
EE – Sour Service*	Carbon or low alloy steel**	Stainless steel**
FF – Sour Service*	Stainless steel**	Stainless steel**
HH – Sour Service*	CRA's**	CRA's**

### s- Material Requirements

\*As defined by NACE Standard MR-01-75

\*\*In compliance with NACE Standard MR-01-75

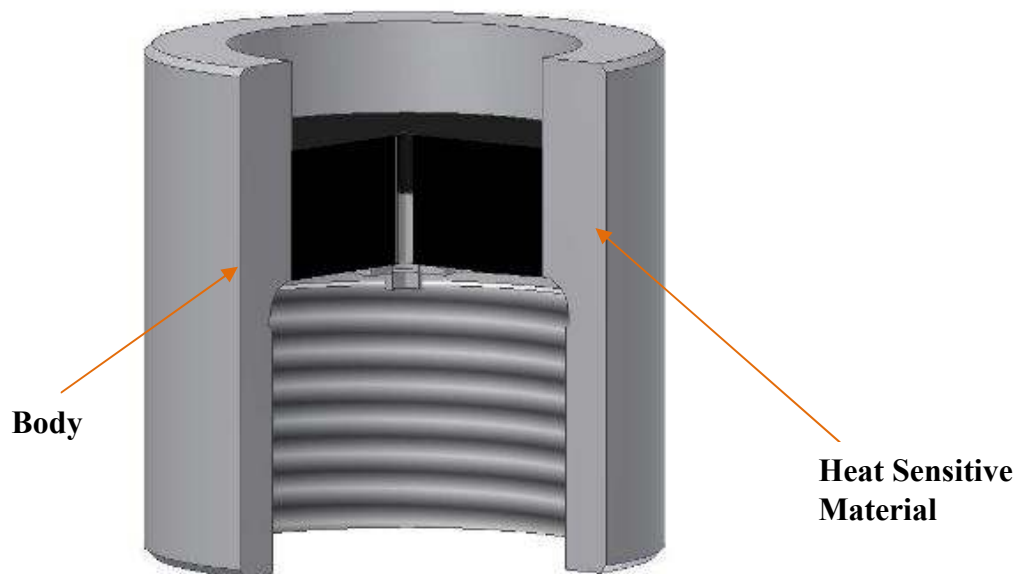
## Heat Sensitive Lock Open Device

The heat sensitive lock open cap device is designed to melt out and permit the valve to close when the actuator is subjected to high temperatures, such as a fire.

The heat sensitive insert is placed into the body of the cap. A retainer ring is installed to keep the insert from falling out.

**CAUTION:** The body of the heat sensitive lockopen device is intentionally made from thin cross-section stainless material, for maximum sensitivity to heat. This body is intended to be threaded on the top case **by hand only**.

**WARNING:** This fusible lockopen device is **not** to be used when shell testing the rated working pressure of the valve. Use steel lock open caps supplied with the actuator.



**Figure 15 - Heat Sensitive Lock Open Device**



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