



Worcester Controls

19406-H

Factory Mutual Approved Series 51 and 52 Fire-Safe Valves *Installation, Operation and Maintenance Instructions*

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CAUTION: Flowserve recommends that all product which must be stored prior to installation be stored indoors, in an environment suitable for human occupancy. Do not store product in areas where exposure to relative humidity above 85%, acid or alkali fumes, radiation above normal background, ultraviolet light, or temperatures above 120°F or below 40°F may occur. Do not store within 50 feet of any source of ozone.

I. VALVE

A. Installation

1. Valves may be installed for flow in either direction. Use care to exclude pipe sealants from the valve cavity. Note that the maximum pressure rating for these valves is 125 psig.
2. When installing, certain line flange bolts and gaskets are specifically required in order to be in conformance with FM requirements.
 - a. Flange bolts shall be: ASTM A193, Gr. B7; Nuts: ASTM A194, Gr. 2H.
 - b. Flange gaskets shall be Spirotaulic, or equivalent.
3. Install valve into pipe line and secure all flange bolts evenly. Tighten the bolts to the following recommended torque values:

Bolt Size	Torque
½-13	87 Ft.-Lbs.
⅝-11	178 Ft.-Lbs.
¾-10	253 Ft.-Lbs.

B. Operation

1. The operation of the FM fire valve depends upon the attachments and options included with the valve.
 - a. For actuated fire valve with Series 39 actuator only, refer to Section II of this manual.
 - b. For actuated fire valve with Series 39 actuator and end mounted limit switches, refer to instruction sheet that comes with the switches.
 - c. For control valve, refer to PM15 instruction manual.
 - d. For manual operated valves with handles, refer to the next paragraph.
2. The operation of the manually operated valve consists of turning the handle ¼ turn clockwise to close and ¼ turn counter-clockwise to open. When the valve is closed, the handle points across the line, providing position indication.
3. These valves will provide bubble-tight shutoff when used in accordance with the Worcester pressure/temperature chart.
4. It is not good practice to leave ball valve partially open (throttling operation) without knowledge of the pressure drop and flow at that position.

5. As shipped from the factory, valves contain a silicone based lubricant. This is for break-in and may be removed (by disassembling and solvent washing) if it is objectionable for a particular application. Lacquer thinner will remove the lubricant.
6. Media which can solidify, crystallize, or polymerize should not be allowed to stand in ball valve cavities.

CAUTIONS:

7. **The fluoropolymer body seal makes an excellent seal. However, some points of caution in its use need emphasizing.**
 - a. **No fluoropolymer part (except seals) is reusable. Upon disassembly of the valve, they should be discarded and replaced with new parts.**
 - b. **Care must be taken to avoid scratching the fluoropolymer during installation. Light lubrication can help to prevent damage.**

C. Maintenance

It is possible that, under certain circumstances, there could be some seepage past the stem seals. If this should occur, simply tighten the retaining nut, for 3" -4" valves only, ¼ of a turn at a time, until the seepage stops. (Do not overtighten. This can cause higher torque and adversely affect the stem seal life.) For ½"-2" valves only, adjust as follows:

For Valves with two stem nuts and a lockwasher (with or without handle):

1. Tighten retaining nut (lower nut) until Belleville washers are flat, the nut will "bottom".
2. Back off retaining nut ¼ turn.
3. Tighten handle nut securely to lock retaining nut in place.

For valves with self-locking stem nut (and four Belleville washers):

4. Tighten self-locking stem nut until Belleville washers are flat, the nut will "bottom".
5. Back off nut ¼ turn.

CAUTION: The self-locking stem nut is difficult to tighten, and must fully flatten Belleville washers before backing off.

D. Rebuilding

WARNING: BALL VALVES CAN TRAP PRESSURIZED FLUIDS IN BALL CAVITY WHEN CLOSED

If the valve has been used to control hazardous media, it must be decontaminated before disassembly. It is recommended that the following steps are taken for safe removal and disassembly.

- Relieve the line pressure. Operate the valve prior to attempting removal from line.
- Place valve in half-open position and flush the line to remove any hazardous material from valve.
- All persons involved in the removal and disassembly of the valve should wear the proper protective clothing such as face shield, gloves, apron, etc.

A standard repair kit can be ordered which contains all necessary seats and seals to rebuild the valve. To order the repair kit (RK), specify the valve size and the R (Revision) number of valve, or the "P", "T", "C" or similar number, as found on the valve nameplate. If valve body is stainless steel, place a "6" after valve size in repair kit ordering code. Use the following format to order:

Valve Size MRK 51 Revision, P, T, C, etc. #

The seats and seals included in this kit are the only ones approved for the Factory Mutual fire-safe valve. Please do not use any others for rebuilding this valve. Doing so will void the Factory Mutual approval.

If spare parts are necessary, include the complete valve code as given on the valve nameplate and then the part(s) that is (are) being ordered.

For part description and valve assembly, refer to the appropriate parts list and exploded views.

CAUTION: Exercise caution that sealing and ball surfaces are not damaged during disassembly, cleaning or reassembly.

1/2"-2" 51/52 Valves:

1. Disassembly Of Valve

- a. Place valve in open position, unscrew all flange bolts and remove valve from line.
- b. Place valve with end plug up on a clean surface. Secure by clamping or bolting.
- c. Unscrew end plug. Set aside. If the body seal was not removed with the end plug, remove it from the valve and discard. Remove and discard near seat.

NOTE: If required, end plug assembly/disassembly tools are available from Flowserve.

- d. Place valve in the closed position and remove the ball.

2. Removing Stem Assembly

- a. Remove top nut, lockwasher and one-piece handle/stop, if you have a manual valve. NOTE: This step is not applicable to valves with self-locking stem nut.
- b. Remove retaining or self-locking stem nut. Use a wrench to prevent stem from turning.

- c. Remove and discard Belleville washers. Push stem into ball cavity and remove. On the 1/2" size, the far seat must be removed before pushing stem into cavity.
- d. Remove and discard stem seal, stem seal protector and thrust bearings, which may be on the stem or in body stem cavity, and far seat. Retain the follower.

3"-4" 51/52 Valves:

3. Disassembly of Valve:

- a. Place valve in open position, unscrew all flange bolts and remove valve from line.
- b. With valve in closed position, remove end plug retaining screws.
- c. Remove end plug. If necessary, drive end plug from valve, using wooden drift applied to ball.
- d. Remove body seal, ball and seats. Discard seats and body seal.

4. Removing Stem Assembly:

- a. Remove handle assembly (if any) by loosening handle screw.
- b. Remove retaining nut. Prevent stem from rotating by holding stem with wrench.
- c. Remove stop or valve stem spacer (actuated valves). Remove and discard Belleville washer(s), if any. Remove and retain the follower.
- d. Push stem into body cavity and remove. Remove and discard stem seal and thrust bearing. Remove and retain stem centering washer.

5. Visual Inspection

Important areas for visual inspection are:

- a. The ball and the surfaces against which the seats and seals are installed should be undamaged, clean and free of pit marks and scratches. Light marring from the action of the ball against the seats is normal and will not affect the operation of the valve. Flaws which can be seen but barely detected with fingertips are acceptable.
- b. The stem and body surfaces that the thrust bearing(s) and stem seal(s) contact must be undamaged, clean, and should be free of pit marks and scratches.

6. Reassembly (Refer to exploded views on pages 6 and 7)

CAUTION: Care must be used when handling graphite stem seals and body seals. These parts can be easily damaged by squeezing the O.D. of the seal. Parts are to be handled on the flat surfaces rather than the O.D. These parts will not work if they are cracked or broken. Light flaking of the material is acceptable. If resistance is encountered when installing stem seals over the stem, use follower to gently push the stem seal down.

1/2"-2" 51/52 Valves

- a. Lightly lubricate the ball, seats, seals, seal protector (if used) and thrust bearing(s) with a lubricant compatible with the media being handled. White petroleum jelly is a good general purpose lubricant.
- b. On all but the 1/2" size, the far seat can now be installed.
- c. Place new PEEK thrust bearing protector (tan in color) and new thrust bearing (carbon-filled, black in color or graphite, metallic silver gray) on stem and insert assembly through body cavity. The carbon-filled or graphite thrust bearing must be used for proper grounding of stem to body.
- d. Install new stem seal, which is a metallic silver gray color, new stem seal protector (tan in color) and the old follower. PEEK thrust bearing and stem seal protectors are placed outside of seals and bearings. The seals/bearings must contact the body. Thrust bearing and stem seal protectors are the same size, tan in color and generally interchangeable. Install two new Belleville washers with outer edges touching.

For actuated valves, which use a single self-locking stem nut, place four new Belleville washers in position (two pairs of washers with larger diameter sides touching each other).

Place retaining or self-locking stem nut on stem and using handle or a wrench to prevent rotation, tighten nut to make snug and firm. Follow Section C - Maintenance - for proper stem adjustment.

- e. Install far seat on 1/2" sizes only.
- f. Install one-piece handle and stop, lockwasher and handle nut, if manual valve. Tighten handle nut securely to lock retaining nut in place. (This step is not applicable to valve with self-locking stem nut.)
- g. Install ball, body seal, second seat and end plug. When end plug and body are metal-to-metal, end plug face may project up to .009" beyond surrounding serrated surface. End plug must be fully tightened against machined step in body. If in doubt, assemble end plug without seat and seal, make a witness mark, and reassemble the full assembly.
- h. If practical, check leak tightness before reinstalling valve in line.

3"-4" 51/52 Valves

- i. Lightly lubricate the ball, seats, body seal, stem seal and thrust bearing with a lubricant compatible with media being handles. White petroleum jelly is a good general purpose lubricant.
- j. To reassemble stem, disassembly procedure should be followed in reverse order. Fire-rated valves use a graphite stem seal, which is metallic silver gray and larger than the black, carbon-filled fluoropolymer thrust bearing. This thrust bearing must be used for proper grounding of stem to body. A belleville washer is also added, concave side up, over follower.

NOTE: FOR 3" and 4" ACTUATED VALVES HAVING A GRPAHITE STEM SEAL AND BELLEVILLE WASHER, A SECOND BELLEVILLE WASHER IS USED. THE BELLEVILLES ARE INSTALLED WITH THE LARGER DIAMETER SIDES TOUCHING EACH OTHER. THE STEM SPACER IS DELETED AND NOT USED.

- k. When stem assembly is complete, retaining nut should be tightened to fully flatten Belleville(s), then backed of 1/8 turn. Excessive tightening causes higher torque and shorter stem seal life.
- l. Insert new far seat in body. Make sure seat rests firmly on back surface of recess.
- m. With valve in closed position, insert ball into body so that stem slot engages tang on stem.
- n. Install and make sure body seal rests squarely on seal surface of body.

CAUTION: If the body seal is installed in the end plug, it will be damaged.

Insert new seat in cavity of end plug, and slide the end plug into the body as far as it will go.

- o. Secure end plug in place by threading in the end plug retaining screws and tightening each one firmly. Proper installation will allow no more than .010" protrusion of the end plug beyond the valve body.
- p. Replace handle assembly (wrench block and extension) and tighten hex head screw (manual valves only).
- q. If practical, check leak tightness before installing valve in line.
- r. Upon reinstallation of the valve in the line, retighten the end plug retaining screws after the flange bolts are fully torqued up.

Special Note: In order to maintain FM certification, it is essential when reinstalling the valve into the pipeline that new spirataulic flange gaskets and grade B-7 flange bolts be used.

II. 39S ACTUATOR

WARNING: Series 39 actuators are electro-mechanical devices subject to normal wear and tear. Actuator life is dependent upon application and environmental conditions. If applied in hazardous services such as, but not limited to, media temperature extremes, toxins, flammables, or other services where improper or incomplete operation could produce a safety hazard, it is incumbent upon the system designer and the user to provide proper warning devices such as temperature sensors, oxygen sensors and flow sensors. Flowserve also recommends that the optional auxiliary limit switches be used for monitoring and/or electrical interlock.

CAUTION: Do not install 39S (spring return) models with air connection in end cap or with integral solenoid vertical, if water spray or rainfall can occur in area. End cap or solenoid vent port will allow water to accumulate in spring chambers.

A. INSTALLATION:

NOTE: Sizes 10 - 35. Rev. R6 actuators may come with an ISO locating ring (used for optional ISO mounting) shipped taped to bottom of actuator.

The Series 39 Pneumatic Spring Return Actuator is factory lubricated. For optimum operation, filtered and lubricated air is recommended. Requirements are as follows:

1. Pressure: 60 psig minimum to 120 psig maximum.
2. Air Connection: 1/8 NPT (Sizes 10-20), 1/4 NPT (Sizes 25-35), 1/4 NPT Port on integral solenoid block
3. Electrical Supply (On Solenoid Models Only): The solenoid coil wattage and required amperage are as follows:

VOLTAGE	HOLDING CURRENT	INRUSH CURRENT	WATTS
24 VAC, 50/60 Hz	71 amps	1.18 amps	11
120 VAC, 50/60 Hz	14 amps	.23 amps	10
240 VAC, 50/60 Hz	.07 amps	.11 amps	10
12 VDC	.81 amps	—	10
24 VDC	.41 amps	—	10

B. OPERATION

The actuated fire-safe valve is operated by energizing the solenoid with the proper electrical supply, or by pressurizing the air inlet with the required supply pressure. This opens the valve a full 90°. To completely close the valve, de-energize the solenoid, or remove the supply pressure. Loss of electrical power, or air pressure, or both, will result in the actuator closing the valve.

For solenoid operated actuators, only the speed of the spring (closing) stroke is adjustable. This is accomplished by turning the set screw contained in the exhaust nut (shipped separately in envelope) which mounts directly to the end of the solenoid.

If the valve is subjected to a fire or high ambient temperature, there is a fusible plug attached to the actuator which will melt out and cause the valve to close automatically.

C. MAINTENANCE:

Check all fasteners periodically for proper tightness.

D. REBUILDING

NOTE: When rebuilding the actuator, please note that there are only three (3) springs for each end cap on Rev. R2 and later actuators, and eight (8) springs for each end cap on Rev. R1. This is done as a benefit to the customer. When supply pressure drops due to peak consumption levels, the actuator will still operate normally down to an absolute minimum supply pressure of 50 psi.

For identification of all numbered parts discussed below, consult exploded view of actuator.

INCLUDED IN ALL 39 ACTUATOR REPAIR KITS IS A REBUILD/ACCESSORY ADDITION LABEL, WHICH IS TO BE MARKED WITH A PERMANENT MARKER AND THEN APPLIED TO THE ACTUATOR AFTER ACTUTOR HAS BEEN REPAIRED.

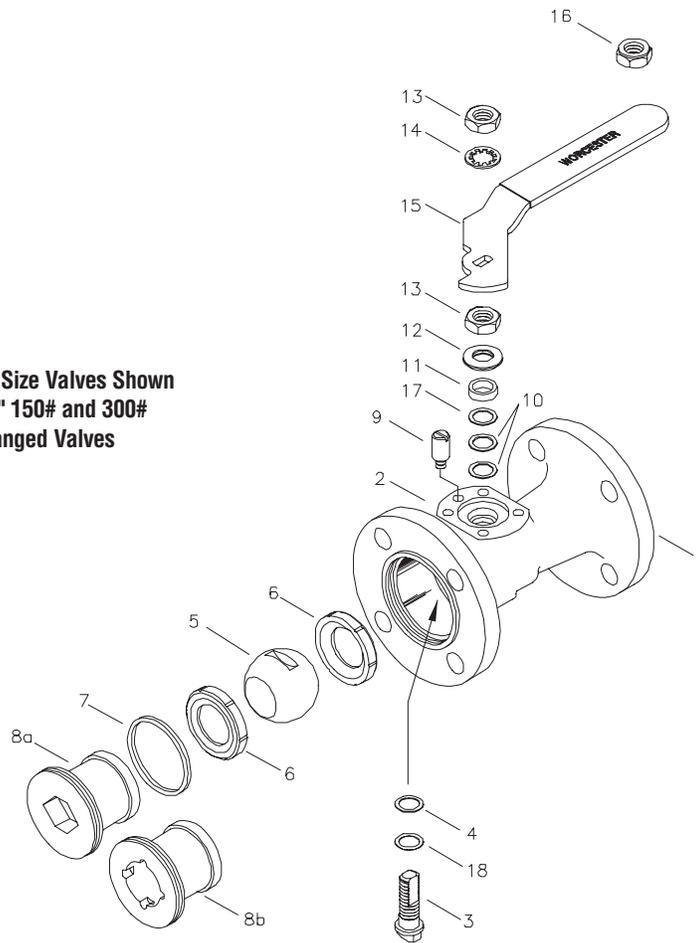
1. Actuator Disassembly

- a. Disconnect the air supply and electrical service to actuator.
- b. Remove the actuator and its mounting bracket from valve. If the actuator uses a positioner, loosen the set screws in the coupling between the valve and actuator. (See Caution note below.)

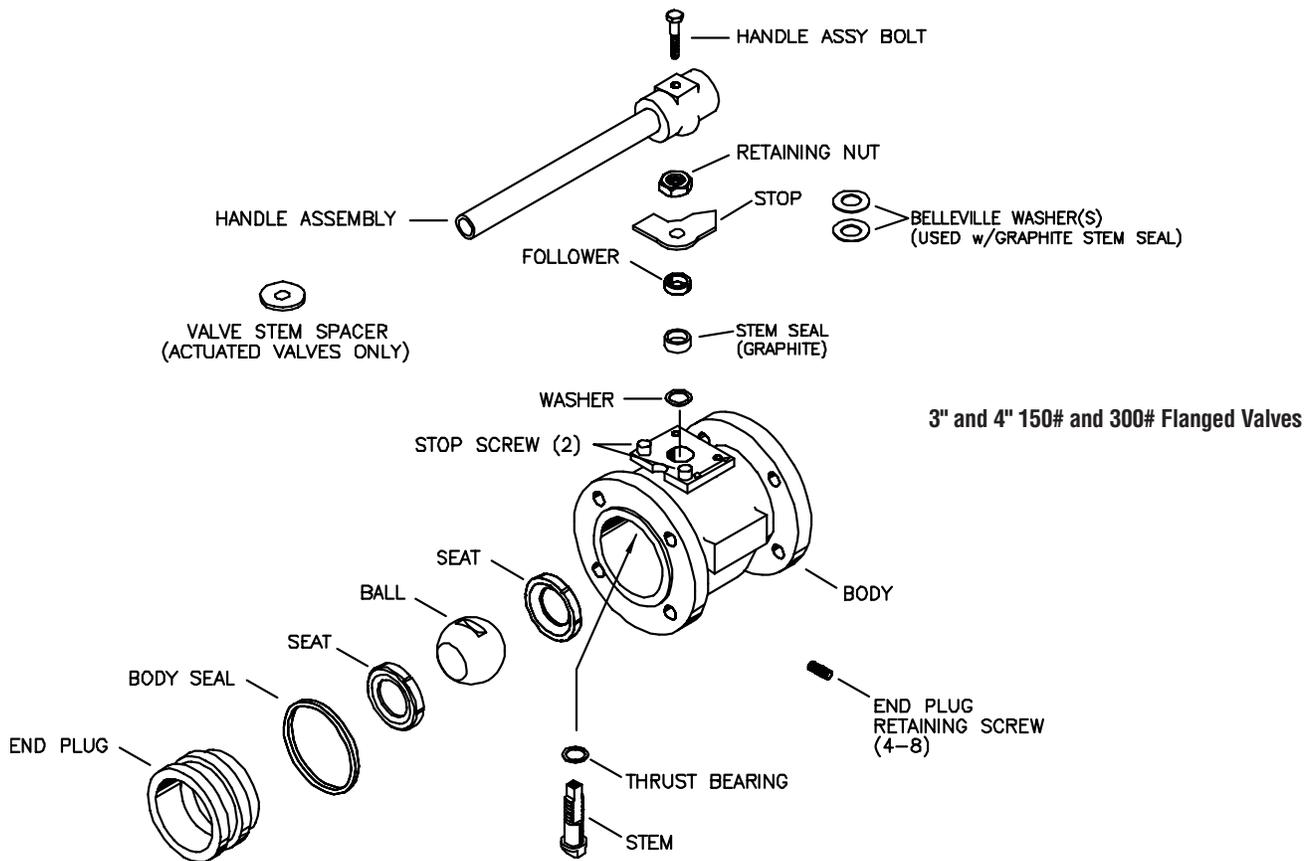
CAUTION: Ball valves can trap pressurized media in the cavity. Isolate the piping system in which the actuator/valve assembly is mounted and relieve any pressure on the valve. Note orientation of actuator to valve. It is important that the actuator be remounted in the same position to assure fail-safe operation.

- c. Remove the actuator bracket from the actuator to begin repair. Remove positioner (if used) by loosening positioner coupling set screws, removing positioner bracket screws and hose connections.
- d. It is not necessary to remove solenoid control block (7) if any, to rebuild actuator. However, if it becomes necessary to remove the block, begin by removing the solenoid block bolts (8E). Use care to retain the solenoid block gasket (9).
- e. Each end cap (5A, 5B) is aligned onto the body (1) over a "foolproof pin". This ensures that the end caps can only be assembled to their respective end of the actuator. Remove all four metric screws (5C) from and remove both end caps. For Rev. R1 and R3 thru R6 actuators, remove the two bearings (6A) and O-rings (15A and 15B) from each end cap. Note that for Rev. 2 models with top-hat style bearings (6C), the bearings and particularly the retaining washers (16) in each end cap should not be disturbed during O-ring seal replacement, as they are not included in the rebuilding kit.

1 1/2" - 2" Size Valves Shown
1/2" - 2" 150# and 300#
Flanged Valves



ITEM	QTY	DESCRIPTION
1	1	Body
2	1	Nameplate
3	1	Stem
4	1	Thrust Bearing
5	1	Ball
6	2	Seat
7	1	Body Seal
8a	1	End Plug (1/2" - 1")
8b	1	End Plug (1 1/2" - 2")
9	1 or 2	Stop Pin (Manual valve only)
10	1	Stem Seal
11	1	Follower
12	2 or 4	Belleville Washer (See Part D.6.d.)
13	2	Retaining Nut
14	1	Lockwasher
15	1	Handle (Manual Valve Only)
16	1	Self-Locking Stem Nut (Actuated Valve Only)
17	1	Stem Seal Protector
18	1	Thrust Bearing Protector



CAUTION: The actuator is a “spring return” model. First remove two end cap screws diagonally opposite each other, then lubricate the threads and under the head. Replace the screws and repeat the procedure for the other two screws. Do this for each end cap as this will aid reassembly. Now uniformly loosen all four end cap screws on each end cap two to three turns at a time, in sequence, to relieve pre-load of the springs. End cap screws are long enough to allow springs to relieve before disengaging. Note position of springs, gently pry off each end cap and use caution when removing end caps.

the shaft clip (15F) (not reusable part!) (see note below) and the S.S. washer from the top of shaft. Then remove the shaft thru the larger opening in the bottom of the body. The top bearing (15G) and the O-ring (15D) can now be removed. Remove the two S.S. washers and thrust bearing (10) from the top of the shaft and the O-ring (15E) and bearing (15H) from the bottom end.

NOTE: Some actuators may be using a spiral ring type shaft clip as shown at right.

To remove this clip, engage the lower end of the ring with a flat blade screwdriver. Using another flat blade screwdriver push the top end of the clip in the opposite direction. As the clip I.D. expands lift the clip from the shaft. the installation of a new clip would be the above steps in reverse and ensuring that the edges of the clip are properly seated in the shaft groove.

The Rev. R1 model, all sizes, and the Rev. R3 thru R6 models, sizes 25 through 35, have an anti-ejection ring (15J), which is a one-piece spiral wound ring. This ring does not have to be removed and may or may not be included in repair kits.

- f. The two-piston guide rod assemblies (4) can now be removed from each end of the body and disassembled by removing the piston set screws (12). Do not interchange piston guide rods and their respective piston. For sizes 10-20 Rev. R6, each guide rod and piston may be press fitted together (do not use set screws) and cannot be disassembled. (To assist reassembly, mark the body with a line on the side from which the guide rod using the thru hole is removed.) Remove all O-rings (15B and 15C) and bearings (6B) from pistons.
- g. The shaft on Rev. R2 and sizes 10-20 Rev. R3 thru R6 models can only be removed after the piston assemblies are taken out. Remove the position indicator (17) (if any),

For Rev. R1 models, remove shaft clip (15F) (not reusable part!) (see note above) and the S.S. washer from the shaft. Then remove the top pinion bearing (15G) and the bottom pinion bearing (15H) by carefully prying them away from the body.

CAUTION: Both of these bearings may have a projecting “nib” which locates the bearings to the actuator body. Be careful not to break off these nibs inside the body when removing the top and bottom bearings. NOTE: Top bearing is marked “Top”. Bottom bearing has a larger ID than the top bearing.

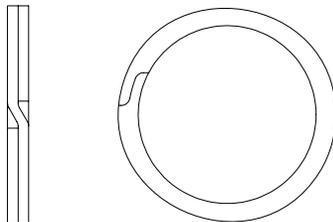
Next, slide the shaft out through the bottom of the body and remove the top O-ring (15D) and the bottom O-ring (15E) from the body.

- h. All rebuilding kit O-rings and bearings may now be installed if all the actuator surfaces are clean and free of grit and scratches. If the inside walls of the body are scored, or the guide rod surfaces are scratched, the actuator will leak after rebuilding. New “unscored” parts should be obtained from the factory. Light tracking, barely detectable to touch, is acceptable.
- i. Lubricate the actuator thoroughly with a #1 grease. Apply a light film of grease to all O-rings.

2. ACTUATOR REASSEMBLY

- a. Some Rev. R2 actuators, sizes 10-35, use different bearings in the end caps. They resemble a “top hat”, and are installed with the brim of the hat facing out.

These bearings are retained by “star washers” (16). These bearings and star washers should not be removed for O-ring seal replacement. On sizes 10 & 15 only, there is one star washer, or retainer, per bearing. On sizes 20-35, there are two star washers per bearing. They are installed one on top of the other, with the “points” of the “star” overlapping each other (as opposed to being on top of each other). All the washers must be pressed in firmly and straight. The points of star are bent slightly. When installed, they bear back, away from the hole.



For sizes 10-35 Rev. R1 thru R6 actuators, replace the two split-ring style bearings (6A) and one guide rod O-ring (15B) in each end cap.

Replace the split-ring style bearing (6B) and guide rod O-ring(s) (15B) into I.D. groove(s) in each piston. Install O-Rings (15C) onto pistons.

Replace O-ring (15E) and bearing (15H) on the bottom of shaft. On the top of the shaft add the two S.S. washers with the thrust bearing (10) between them. Locate the top bearing (15G) and O-ring (15D) into the body.

NOTE: For Rev. R6 actuators, the top bearing (15G) is flat, the same as and interchangeable with thrustbearing (10). Replace the shaft thru the larger opening in the bottom of the body.

For Rev R3 thru R6, sizes 25 through 35 actuators, replace anti-ejection right (15J) in its groove on the shaft (2B), if removed.

For Rev. 1 models:

Locate the shaft O-rings into the actuator body. O-ring (15D) is the top O-ring while (15E) is the bottom O-ring.

Replace the top bearing (15G) and bottom bearing (15H).

Replace the shaft in the body through the bottom of the actuator body.

Replace the anti-ejection ring (15J) in its groove on the shaft (2B), if removed. Check that the ring is properly seated in its groove.

- b. Very carefully align the piston guide rod assemblies inside the body. Keep the pistons square to the body. (This is very important in the 30 39 actuator where steel set screws can cause internal body damage if the piston assemblies “cock” inside the actuator body.)

IMPORTANT: One piston guide rod assembly has a thru hole drilled in it. It can be easily located by looking down the ends of both guide rods. This piston assembly must be reassembled, with its respective guide rod opposite the nameplate on the body, as it was removed.

- c. Align the shaft so that the teeth on the shaft will “pick up” the piston assembly’s rack teeth when turning the top extension of the shaft clockwise (CW). (See Figure 1.)

IMPORTANT: Proper 90° rotation can only be ensured if the shaft teeth begin to mesh with the piston assembly’s teeth at the “proper tooth” between these meshing gear pairs. (See Figure 1.)

- d. To ensure proper meshing of teeth, move the shaft 15-20 degrees counter-clockwise (CCW) from its normal position when the piston assemblies are located at the body ends. (See Figure 2).

NOTE: The “normal position” of the shaft on the 10-20 sizes is when the top flats are parallel to the main axis of the actuator body. On the 25-35 sizes the teeth of the shaft will be on the left side of the actuator when viewed from the ends of actuator (see Figure 1).

- e. With the piston assemblies in the body, gently push each piston into the body. Turn the top shaft extension clockwise (CW). Do not allow the pistons to “cock”.

At the proper point of engagement between the shaft and piston assemblies, both piston assemblies will move toward the center of the body when turning the top shaft extension of the actuator clockwise (CW).

- f. Once the center gear and pistons are properly engaged, ensure that smooth movement and 90° operation can

occur without moving the pistons out of the actuator body. This is important!

- g. Install O-rings (15A) into and replace the actuator end caps, (5A & 5B), noting that the “foolproof” pin between the body and end cap mates properly. See steps “j” through “o” below for spring installation, before replacing end caps.

NOTE: When installing the end cap O-rings, use a small amount of a general purpose lubricant, such as petroleum jelly, to hold them in place for ease of assembly and to avoid having them fall and get pinched.

On Rev. R1 and earlier actuators, be sure O-ring is installed in groove on end cap.

- h. Replace the S.S. washer over the top shaft extension.
- i. VERY IMPORTANT: Install the NEW shaft clip (15F) into its mating groove on the top shaft extension. (The removed shaft clip is not to be reused.)

Place the numbered side up on the shaft clip and be certain the clip is fully seated in its groove. See note on bottom of page 8 for installation of spiral ring shaft clip, which newer rebuilding kits will contain.
- j. Replace springs in end cap. Ensure that the springs are replaced in their identical position in the end cap from which they were removed. For Rev. R2 and later actuators use three (3) springs on a diagonal. For Rev. R1 use eight (8) springs around the outside pockets.
- k. If the actuator is being repaired due to a failed spring, REPLACE all the springs in this actuator, as well as any other parts which may have been damaged.
- l. When replacing the springs, place the springs in the end cap pocket after thoroughly lubricating each spring. Be generous!

- m. With the springs pointing up and the end cap on a solid surface, place the actuator body over the springs and the proper end cap. (Each end cap can only be mounted to just one end of the actuator body.)
- n. Force the body down and begin by engaging two end cap screws (SC) by hand through the end cap. Take each end cap screw up in SMALL and EQUAL turns. Once the end cap is temporarily secured to the body, turn the actuator over to its normal position and uniformly take up the four end cap screws.

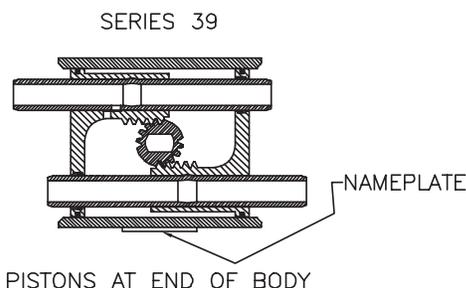
Uniformly load all springs to prevent any spring from buckling.

IMPORTANT: Locating nibs are permanently cast into the Rev. R1 (all sizes) and the Rev. R3 thru R6 (sizes 25-35) actuator piston face. The actuator springs must fit over these locating nibs on the piston face. Care in following the above instructions will ensure the proper alignment of the spring in the actuator body and proper contact with the piston face and end cap.

- o. In a similar manner, as written in the previous steps, replace the springs in the other end of the actuator body.
- p. If solenoid block was removed:

Place gasket (9) on solenoid control block (7) and attach block securely to end cap to obtain a seal at gasket.
NOTE: If fiber gasket is used, work a generous amount of assembly grease or vaseline into the gasket prior to assembly (wipe off excess grease). If a rubber gasket is used, do not apply any grease, it must be installed dry.
- q. Replace the position indicator (17) of the positioner (if used). Locate position indicator on center gear (shaft) flats. Press firmly until location nibs snap into recess on pinion.

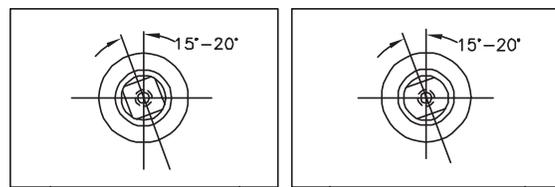
NOTE: Check that indicator, when located on center gear (shaft), will show correct indication. Indicator is set up to show valve closed on in-line mounting, i.e., pistons together on actuators.



IMPORTANT: NOTE THE RELATIVE LOCATION OF THE SHAFT TEETH & THE PISTON ASSEMBLY’S RACK TEETH. THE ABOVE FIGURE IS VIEWED WHEN LOOKING AT THE TOP OF THE ACTUATOR.

Figure 1

ALIGNMENT OF SHAFT AT REASSEMBLY (PISTONS AT END OF BODY)



25-35 39 ACTUATOR 10-20 39 ACTUATOR

IMPORTANT: ALIGN GEAR TEETH ON THE SHAFT PER FIG. 1.

Figure 2

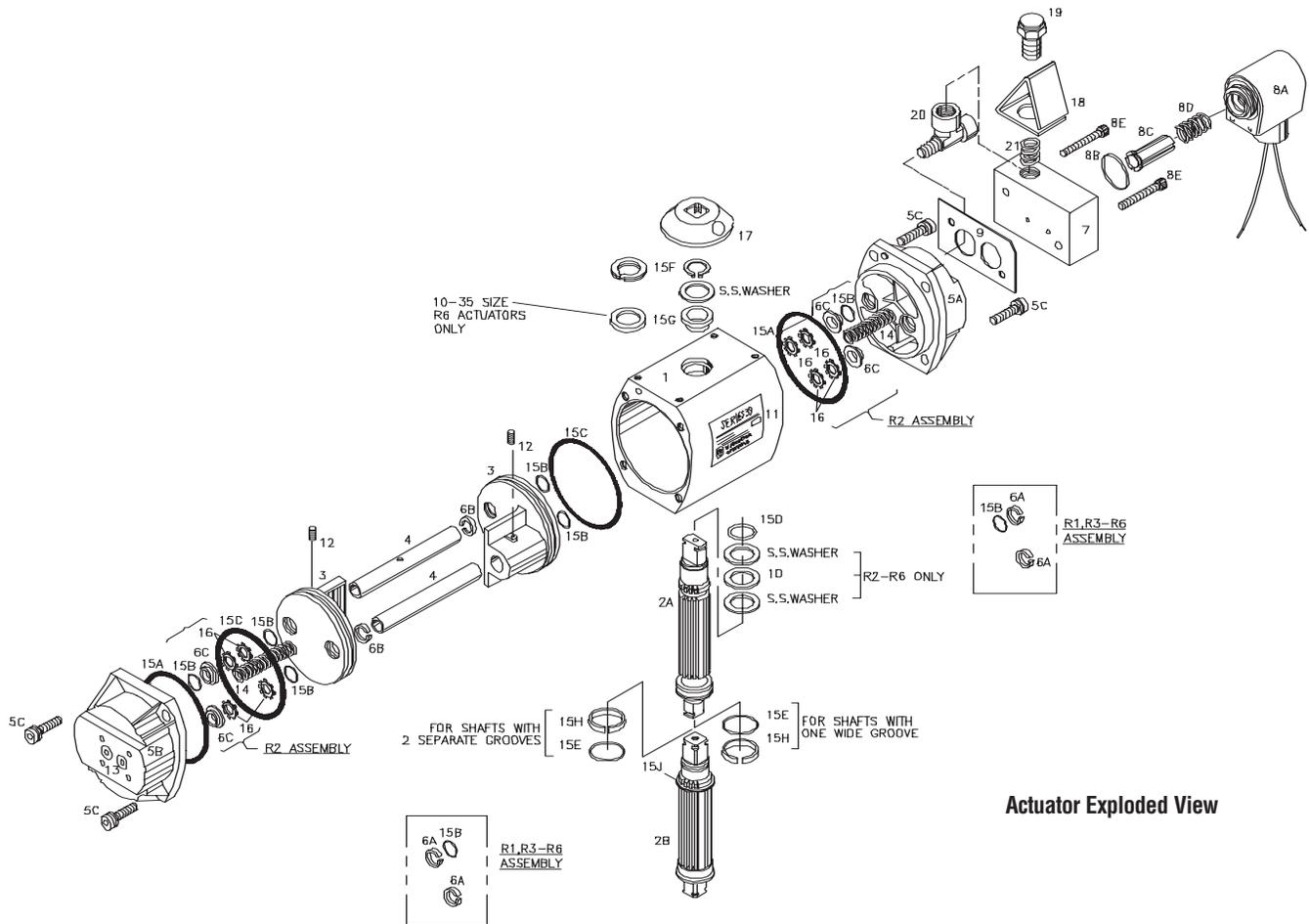
CAUTION: Be sure that the fusible plug is reinstalled before returning the actuator to service.

- r. Mark Rebuild/Accessory Addition Label, if included in repair kit, and apply to actuator.

TROUBLESHOOTING

1. If actuator does not function, check to ascertain:
 - a. That correct voltage is supplied to solenoid, if so equipped.
 - b. That sufficient air supply is available at inlet to actuator or solenoid block. When checking supply pressure, place gage in line at actuator or solenoid block inlet and monitor gage for unexpected pressure drops.
 - c. That valve is free to rotate.
 - d. That speed control screw is loose (solenoid operated actuators only). If screw is tightened all the way, actuator will not operate.
2. If proper voltage and air pressure have been verified and valve is free, proceed as follows:
 - a. Turn on signal voltage. Check the solenoid for clicking sound.
 - b. If no sound is detected:
 - 1) Remove air pressure.
 - 2) Carefully unscrew solenoid and solenoid stem from block.
 - 3) Reapply signal voltage and observe solenoid plunger. If it does not retract, replace solenoid.
 - c. If solenoid functions, remove solenoid valve block and place on bench. Connect to reduced air supply (50 psig) and correct voltage. Switch signal voltage and check air flow. Air should flow out output port to actuator when solenoid is energized.
 - d. If block and solenoid are operating correctly, remove the actuator from the line.
 - e. Cycle actuator shaft with wrench to ascertain the actuator shaft and/or pistons are not bound.
 - f. If actuator does not cycle properly, disassemble (per Rebuilding Instructions) to ascertain:
 - 1) That internal porting is clear of obstructions.
 - 2) That piston guide rod with hole is on side opposite nameplate (see Step b. on Page 9).
 - 3) That unit is well lubricated and that there is no solidified grease between the pinion and the piston racks.
 - a) If actuator has no lubrication, apply generous amount of a #1 grease. If actuator is prepared for high or low temperature operation, consult Flowserve for proper lubricants.
 - b) If solidified grease between the pinion and the piston racks is present, clean, dry, regrease and reassemble.
3. If actuator is free, valve is free, and solenoid block (if used) is shifting air properly, reassemble and remount the actuator to valve and retest. If Sections 1 and 2 have been verified, the actuator will function. If unit still fails to operate, consult Flowserve.
4. If the actuator functions but exhibits leakage, or power loss accompanied by leakage, proceed as follows:
 - a. Check voltage as in Section 1 above. Voltage must be within 10% of the specified voltage (low voltage will cause leakage out of the back of the solenoid and burn out the coil).
 - b. Check air supply as in Section 2. Be certain that no sharp pressure drops occur as unit is cycled due to insufficient flow at required pressure.
 - c. If air supply and voltage are adequate, proceed as follows:
 - 1) If leak is at solenoid exhaust port, replace the solenoid.
 - 2) On spring return piston seal, leakage will show at the breather port of the end cap. However, care should be taken not to mistake intake and exhaust of ambient air during cycling for leakage. If there is leakage at piston seal, replace seals to prevent leakage.
- 4) Verify that actuator pinion shaft and/or pistons are not bound. If bound, reassemble per Rebuilding Instructions.
- 5) If unit exhibits excessive amounts of backlash, check teeth on piston racks for wear. If worn, replace piston assemblies.
- 6) Check for misplaced or broken springs. If springs are broken, check body bore for scoring.
 - a) If springs are broken, replace springs. **SPRINGS SHOULD ALWAYS BE REPLACED IN COMPLETE SETS.**
 - b) If body bore is scored, replace it. Also, replace piston O-rings (contained in repair kit).

NOTE: The most common problem encountered on the 39S actuator is the improper replacement of the piston guide rod assembly with the hole in it relative to the nameplate on the body.



Actuator Exploded View

ITEM	QTY	DESCRIPTION	ITEM	QTY	DESCRIPTION
1	1	Body	12	2	Piston Set Screws
2A	1	Shaft (10-2039)	13	2	Pipe Plugs
2B	1	Shaft (25-3539)	14	6	Springs (R2-R6)
3	2	Pistons	14	16	Springs (R1)
4	2	Guide Rods	15		REBUILDING KIT (Includes the following)
5A	1	Solenoid Block (Inlet) End Cap	15A	2	End Cap O-Rings
5B	1	Limit Switch End Cap	15B	6 or 12	Guide Rod O-Rings (See Note)
5C	8	End Cap Screws (Metric)	15C	2	Piston O-Rings
*6		Bearings (Guide Rod)	15D	1	Top Shaft O-Ring
6A	4	End Cap Bearing (Split Ring Style)	15E	1	Bottom Shaft O-Ring
6B	2	Piston Bearing (Split Ring Style)	15F	1	Shaft Clip
6C	4	End Cap Bearing (Top Hat Style)	15G	1	Top Pinion Bearing
7	1	Solenoid Block (Spring Return)	15H	1	Bottom Pinion Bearing
8A	1	Solenoid	15J	1	Anti-Ejection Ring (R1 & Sizes 25-35 R3-R6)
8B	1	Solenoid O-Ring	16	4 or 8	Bearing Retainer (R2 Only)
8C	1	Solenoid Plunger	17	1	Position Indicator
8D	1	Solenoid Spring	18	1	Splash Guard
8E	2	Solenoid Block Bolts	19	1	Fusible Plug
9	1	Solenoid Block Gasket	20	1	Tee Fitting
10	1	Thrust bearing (Available in R6 RK only)	21	1	Guard Spring
11	1	Nameplate			

FACTORY MUTUAL APPROVED FIRE-SAFE VALVE SPECIFICATIONS

VALVE		ACCESSORIES	
SIZE:	½" - 4"	ACTUATOR:	10-3039S for ½"-2" Valves 3039S For 3" Valves 3539S For 4" Valves
STYLE:	ANSI 150# Flange (51 Series) ANSI 300# Flange (52 Series)	PRESSURE RATING:	60 psig min. to 120 psig maximum.
PRESSURE RATING:	125 psig maximum (Pressure rating is dependent on temperature. Refer to published pressure/temperature curves for approximate rating.)	TEMPERATURE:	0° TO +100°F
MATERIALS:	Body: Carbon Steel or 316 Stainless Steel Ball and Stem: Carbon Steel, 316 Stainless Steel or Hastelloy C	VOLTAGE (SOLENOID):	24, 120 or 240 VAC - 12 or 24 VDC
SEATS:	Polyfill	NEMA RATING (SOLENOID):	TYPE 4X, 7, 9 (Watertight and Hazardous Locations, Class I, Groups A, B, C and D; Class II, Groups E, F and G)
BODY SEAL:	Virgin fluoropolymer (½"-2") Graph-Lock (3"-4")	MOUNTING:	All actuators are factory mounted inline, fail-close.
STEM SEAL:	Grafoil	SWITCHES:	End-mounted, Enclosure TYPE 4, 7, 9 (Watertight and Hazardous Locations, Class I, Groups C & D; Class II, Groups E, F & G)
THRUST BEARING:	Carbon-Filled fluoropolymer		Switch Options: Z-SPDT, ZD-DPDT, Z1-AC Proximity, Z3-DC Proximity
		POSITIONERS:	PM-15
		SIGNAL:	3-15 psig
		SUPPLY:	60-120 psig

To order proper parts, please specify the actuator size, model and revision number. Use the standard nomenclature listed above.

The rebuilding kits include Items 15A-15H, 6A & 6B, 10 and S.S. washers. Color of some replacement parts, such as bearings, may vary from the parts removed. Item 15J may or may not be included in repair kits.

Rebuilding kit labeled R6 is for Rev. R2 thru R6 actuators.

*End Cap Bearings (6C) illustrated are for Rev. R2 actuators only. All other revision end caps use split ring style (6A), same as piston bearing (6B). Only split-ring style bearings are included in R2/R3

rebuilding kits, and normally all styles of bearings do not need replacement during a rebuild.

NOTE: Size 15 Rev. R6 rebuilding kits include 12 guide rod O-rings. The six larger diameter O-rings are for Rev. R3 thru R6 actuators.

NO OTHER OPTIONS, ACCESSORIES OR VARIATIONS ARE APPROVED. ALL FACTORY MUTUAL APPROVED FIRE-SAFE VALVES, OR VALVE ASSEMBLIES, MUST BE ORDERED COMPLETE FROM FLOWSERVE IN ACCORDANCE WITH FM'S PUBLISHED ORDERING CODES.

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