

***Factory Mutual Approved Oil or Gas
 Safety Shutoff Valves***
Installation, Operation and Maintenance Instructions

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CAUTION: Flowserve recommends that all products 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. INSTALLATION

A. ¼"-2" 44 Series Reduced-Port and ¼"-4" 59 Series Full-Port Valves, Three-Piece Construction:

1. Standard valves may be installed for flow in either direction. Use care to exclude pipe sealants from the valve cavity.

2. For weld-end valves:

NOTE: Prior to welding or brazing, **THOROUGHLY CLEAN ALL JOINT SURFACES** to prevent contamination.

- a. Tack weld valve in place.
- b. Rotate valve stem 90° to open valve.
- c. Remove actuator, bracket and coupling, if necessary.
- d. For ¼"-2" valves, remove three body bolts and loosen fourth. Swing valve body away from pipe ends. For 3" and 4" 59 valves, remove all of the body bolts or studs and remove center section from valve.
- e. Close valve, then remove seats, body seals and ball.
- f. Swing or return body back in-line and secure with two body bolts or studs diagonally opposite each other.
- g. Weld valve in place (when gas welding or brazing, do not play flame on valve body).
- h. Allow valve to cool, then reassemble. Take care that interior of valve is free of dirt particles. Do not scratch any sealing surfaces (ball, seats, body seals or pipe end faces).
- i. Reassemble ball, seats and seals into body. Install new body seals, if they were shipped separately from the valve. Temporary Buna body seals, found in the valve as received, are not to be reused. Open valve. Swing body back in-line. Close valve.
- j. Install body bolts or studs.
- k. Remount actuator to valve, if removed. (Insert coupling between valve and actuator.)
- l. The body bolts of the valve should be tightened evenly. Tighten diagonally opposite each other alternating in a criss-cross pattern. Use torque figures listed:

For Carbon Steel Bolts

Bolt Diameter	In.-Lbs.	Ft.-Lbs.
¼"	96-120	8-10
⅕"	156-204	13-17
⅜"	216-264	18-22
7/16"	480-540	40-45
½"	720-780	60-65
⅝"	1080-1140	90-95
⅞"	1370-1420	114-119
¾"	1800-1860	150-155

For Stainless Steel Bolts

Bolt Diameter	In.-Lbs.	Ft.-Lbs.
¼"	72-94	6-8
⅕"	120-144	10-12
⅜"	192-216	16-18
7/16"	336-384	28-32
½"	504-552	42-46
⅝"	682-730	57-61
⅞"	972-1020	81-85
¾"	1402-1450	117-121

CAUTION: In ¼"-2" 44 and ¼"-1½" 59 valves, TFE seals are not reusable. Upon disassembly of the valve, they should be discarded and replaced with new parts. New valves are shipped with Buna seals installed and TFE seals packaged. Care should be taken to avoid scratching the TFE seals during installation. Light lubrication of these seals can help to prevent damage.

B. 2"-8" 51/52 Flanged Valves and 3" and 4" 4 (151) Flangeless Valves:

1. Standard valves may be installed for flow in either direction. Use care to exclude pipe sealants from the valve cavity.
2. When installing, use standard gaskets suitable for the specific service. Tighten flange bolts or studs evenly.
3. On 4 (151) flangeless valves, it is recommended to leave the ball in the open position while installing, to eliminate possibility of damaging ball finish.

C. 39S Actuator:

▲ WARNING: Series 39 actuators are electromechanical 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.

General Purpose Solenoid				Watertight And Hazardous Location Solenoid			
Voltage Amps	Holding Amps	Inrush Amps	Watts	Voltage Amps	Holding Amps	Inrush Amps	Watts
24 VAC, 50/60 HZ	.80	1.20	11	24 VAC, 50/60 HZ	.71	1.13	11
120 VAC, 50/60 HZ	.15	.30	11	120 VAC, 50/60 HZ	.14	.23	10
240 VAC, 50/60 HZ	.08	.12	11	240 VAC, 50/60 HZ	.07	.11	10
12 VDC	.70	—	11	12 VDC	.17	—	10
24 VDC	.35	—	11	24 VDC	.41	—	10

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.

NOTE: Sizes 10–35 Rev. R6 actuators may come with an ISO locating ring, used for optimal ISO mounting.

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 for all size actuators.
2. Air Connection:
¼" NPT on the bottom of the solenoid block.
3. Electrical Supply:
The solenoid coil/wattage and required amperage are as indicated in the table above.

II. OPERATION

- A. The safety shutoff valve is operated by energizing the solenoid to open the valve. To close the valve, the solenoid is de-energized. Loss of electrical power, or air pressure, or both, will result in the actuator closing the valve.

Only the speed of the spring (closing) stroke is adjustable. This is accomplished by tightening the set screw contained in the exhaust nut (shipped separately in envelope) which mounts directly to the end of the solenoid. **IMPORTANT:** It is the responsibility of the user to ensure that, when the spring stroke speed is adjusted, closure time does not exceed five seconds.

- B. The valve is a quarter-turn ball valve. Turning the valve 90° counterclockwise opens the valve, and 90° clockwise closes the valve. When used in accordance with the published pressure/temperature chart, the valve will provide bubble-tight shutoff.

III. MAINTENANCE

- A. Valve: For all valves, except as noted below, tighten retaining nut one-sixth turn at a time if seepage is noted at stem.

For ¼"–2" 44, ¼"–1½" 59 and 2" 51/52 valves with self-locking stem nut and four Belleville washers:

1. Tighten self-locking stem nut until Belleville washers are flat, the nut will bottom.
2. Back off nut ⅓ turn.

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

Excessive tightening causes higher torque and shorter seal life.

- B. Actuator: Periodic checks are recommended to be certain all fasteners remain tight.

IV. 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 be 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. 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 seat and body seal material, the valve size and style, and the R (revision) number of valve or the "P", "T", "C", or similar number, as found on the valve nameplate or on the actuator bracket nameplate. If valve body is stainless steel, place a "6" after valve size in repair kit ordering code.

The seats will be either virgin TFE (T) or reinforced TFE (R). The body seals are standard virgin TFE (T) or Buna (B).

NOTE: These are the only materials approved by F.M. and the use of any other materials may void the F.M. approval.

The valve styles will be as follows:

- ¼"–2" Three-Piece Reduced Port (Series 44)
- ¼"–4" Three-Piece Full Port (Series 59)
- 2"–8" Flanged Reduced Port (Series 51 and 52)
- 3"–4" Flangeless Reduced Port (Series 4, Type 151)

To order the proper repair kit, use the following format. **NOTE:** For valve styles 4 (151) and 52, repair kits can be ordered as RK51:

	Valve Size	Valve Style	Seat Material	Seal Material	Revision, P, T, C, etc. No. (If Any)
Examples:	3"	RK 51	R	T	R5
	2"	RK44	T	T	P1845

CAUTION: If the seats and seals installed differ from those removed, the valve nameplate must be replaced or remarked to indicate the altered materials and ratings, or valve tagged to so indicate.

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

The terminology shown in the exploded views and Part Listings on following pages is standard.

B. Disassembly

1. Disassemble ¼"–2" 44 three-piece and ¼"–1½" 59 valves as follows:
 - a. Place valve in open position, remove three body nuts and bolts, loosen fourth, swing out center section from between pipe ends with valve open.
 - b. With valve in closed position, remove old seats, body seals and ball.
 - c. Using a wrench to prevent stem from turning, remove self-locking stem nut, Belleville washers, and stem seal follower from stem. Remove stem through body cavity.
 - d. Remove thrust bearings from body or stem; stem seals and stem seal protector from recess in top of body.
 - e. Discard all seats, seals and Belleville washers removed from the valve.
2. Disassemble 2"–4" 59 three-piece valves as follows:
 - a. Place valve in open position. Remove all body nuts and bolts or studs and lift out center section from between pipe ends.
 - b. With valve in closed position, remove old seats, seat retainer (if present), body seals and ball.
 - c. Prevent stem from turning by holding inside body. (The ball can be inserted and prevented from rotating with a non-metallic rod such as a screwdriver handle.) This will hold the stem stationary without damaging the ball.

- d. Remove retaining nut and spacer from stem.
 - e. Push stem into body cavity and remove. Retain follower and centering washer(s). There are no washers on 2" valves.
 - f. Remove and discard stem seals and thrust bearing, which may be stuck on the stem or in the body cavity.
3. Disassemble 2" 51/52 Flanged Valve as Follows:
 - 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 your supplier or Flowserve.
 - d. Place valve in the closed position and remove the ball.
 - e. Remove self-locking stem nut. Use a wrench to prevent stem from turning.
 - f. Remove and discard Belleville washers. Push stem into ball cavity and remove.
 - g. Remove and discard stem seals, stem seal protector and thrust bearings, which may be on the stem or in body stem cavity, and far seat. Retain the follower.
 4. Disassemble 3"–8" 51/52 flanged and 3"–4" 4 (151) flangeless valves as follows:
 - a. Place valve in open position. Unscrew all flange bolts or studs and nuts and remove valve from line.
 - b. Place 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.
 - e. Using a wrench to prevent stem from turning, remove retaining nut, spacer, and follower.
 - f. Push stem into body cavity and remove. Remove and discard stem seals and thrust bearing. Remove and retain any existing washers.
 5. Visually inspect all valves as follows:
 - 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 not 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 free of pit marks and scratches.

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

1. Reassemble ¼"-2" 44 and ¼"-1½" 59 three-piece valves as follows:

- a. Lightly lubricate the ball, seats, body seals, stem seals and thrust bearings with a lubricant compatible with the media being handled. White petroleum jelly is a good general-purpose lubricant.
- b. Place new PEEK thrust bearing protector (Tan) and new thrust bearing (black) on stem and insert assembly through body cavity. Thrust bearing, stem seals, thrust bearing and stem seal protectors that are the same size and color are generally interchangeable.
- c. Install new stem seals (black), stem seal protector (tan) 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. Install new Belleville washers (two pairs of washers with outer edges touching). Install self-locking nut. Holding the stem with a wrench, tighten nut until Belleville washers are compressed flat (nut will bottom); then back off nut ⅓ of turn. Do not overtighten as a reduction in seal life will result.
- d. With stem in closed position, replace ball and install new seats. With valve in open position, carefully insert new body seals and place center section between pipe ends.

CAUTION: Do not scratch body seals when replacing valve body.

- e. Replace and tighten body bolts and nuts per torque figures and method found in Section I.A.2.1.

2. Reassemble 2"-4" 59 three-piece valves as follows:

- a. Lightly lubricate the ball, seats, body seals, stem seals and thrust bearing with a lubricant compatible with the media being handled. White petroleum jelly is a good general-purpose lubricant.
- b. On 3" and 4" valves, reinstall stem centering washer(s) into the recesses in the body. When only one washer is used, it goes inside recess at top of the body and under the stem seals(s).
- c. Place new thrust bearing on stem and insert through body cavity. The thrust bearing can be distinguished from the stem seals by the darker color of the 25% filled fluoropolymer used in the thrust bearing. Thrust bearings and stem seals are the same color and size, and are interchangeable on 2" size valves only.
- d. Install new stem seals over the top of the stem and down into the recess in the top of the body. The follower is installed on top of the stem seals. Place spacer onto the valve stem.

- e. Replace retaining nut onto stem. Using wrench to prevent stem rotation, tighten the retaining nut to fully compress packing, then back off ¼ turn. Excessive tightening causes high torque and shorter seal life.

- f. With the stem in the closed position, install ball, new seats, and seat retainer (if used). Open the valve and install new body seals.

- g. Place center section between pipe ends and replace bolts or studs and torque to figures in Paragraph I.A.2.1.

After the valve is assembled, it should be cycled a few times to ensure that the valve operates smoothly with no chattering of the ball. The normal operation is an initial high torque to "break" from the closed position to a smooth running lower torque mid-cycle, to a high torque at the end of the 90° cycle or open position. The torque is similar when closing.

3. Reassemble 2" 51/52 flanged valves as follows:

- a. Lightly lubricate the ball, seats, body seals, stem seals and thrust bearings with a lubricant compatible with the media being handled. White petroleum jelly is a good general-purpose lubricant.
- b. Install new far seat in the body cavity.
- c. Place new PEEK thrust bearing protector (tan) and new thrust bearing (black) on stem and insert assembly through body cavity. The thrust bearing, stem seals, thrust bearing and stem seal protectors that are the same size and color are generally interchangeable.

- d. Install new stem seals (black), new stem seal protector (tan) and the old follower. PEEK thrust bearing and stem seal protector are placed outside of seals and bearings. The seals/bearings must contact the body. Install new Belleville washers (two pairs of washers with outer edges touching). Install self-locking stem nut. Holding the stem with a wrench, tighten nut until Belleville washers are compressed flat (nut will bottom); then back off nut ⅓ of turn. Do not overtighten as a reduction in seal life will result.

- e. Install ball, new body seal, new 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.

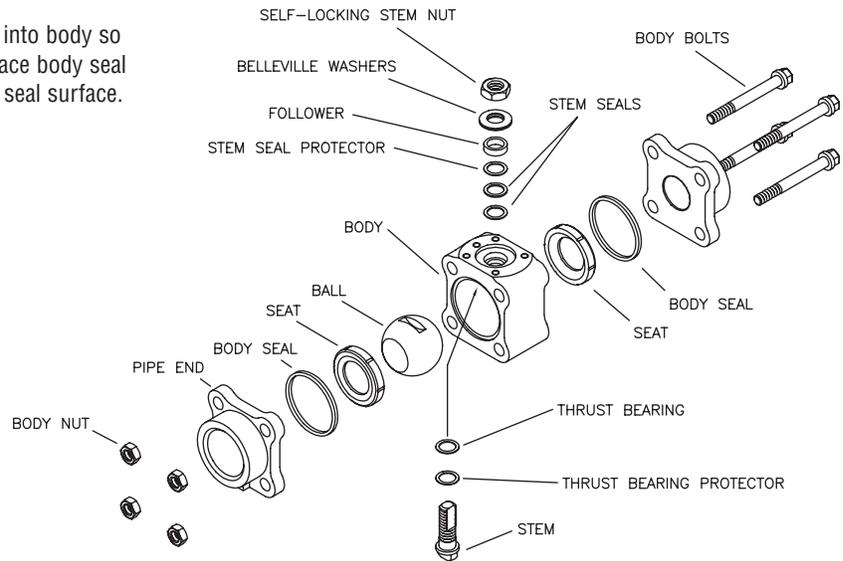
4. Reassemble 3"-8" 51/52 flanged and 3"-4" 4 (151) flangeless valves as follows:

- a. To reassemble, stem disassembly procedure should be followed in reverse order. The thrust bearing can be distinguished from the stem seals by the darker color of the 25% filled fluoropolymer, used in the thrust bearing. Be sure to replace any washers removed from the body.

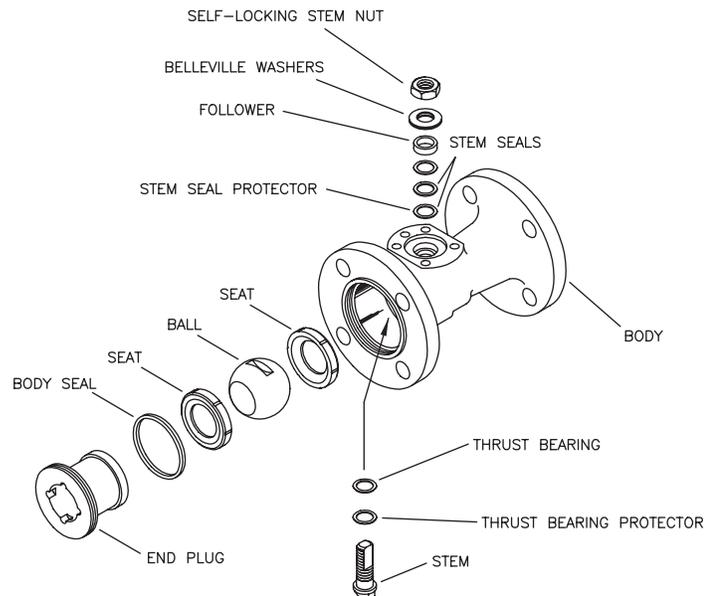
- When only one washer is used, it goes inside recess on top of the body and under the stem seals.
- b. Lightly lubricate the ball, seats, body seal, stem seals and thrust bearing with a lubricant compatible with media being handled. White petroleum jelly is a good general-purpose lubricant.
- c. When stem assembly is complete, retaining nut should be tightened to fully compress packing, then backed off 1/4 turn. Excessive tightening causes higher torque and shorter seal life.
- d. Insert seat in body. Make sure seat rests firmly on back surface of recess.
- e. With stem in "closed" position, insert ball into body so that stem slot engages "tang" on stem. Place body seal into body so it rests squarely on the body seal surface.

- f. Insert seat in cavity of end plug. Assemble end plug into body and secure with end plug retaining screws. Proper installation will allow no more than .010" protrusion of the end plug beyond the valve body.
 - g. Upon reinstallation of the valve in the line, retighten the end plug retaining screws after the flange bolts are fully torqued.
- If practical, pressurize valve to check for leakage.

**1/4"-2" 44 and 1/4"-1 1/2" 59
(1 1/2" and 2" Size 44 Valves Shown)**



2" 51/52



Item	Qty	Description
1	1	Body
2	2	Body Seal
3	1	Ball
4	1	Retaining Nut
5	2	Seat
6	1	Follower
7	3	Stem Seal
8a	1	Centering Washer (3" and 4" Only)
8b*	1	Centering Washer (3" and 4" Only)
9	1	Thrust Bearing
10	1	Stem
11	1	Seat Retainer (3" and 4" Only)
12	2	Pipe End (BW, SE, SW)
13	4	Body Bolt (2" 59 Four-Bolt Design)
	8	Body Bolt (3" 59)
	8	Body Studs (4" 59)
14	4	Body Nut (2" 59 Four-Bolt Design)
	8	Body Nut (3" 59)
	16	Body Nut (4" 59)
15	1	Spacer

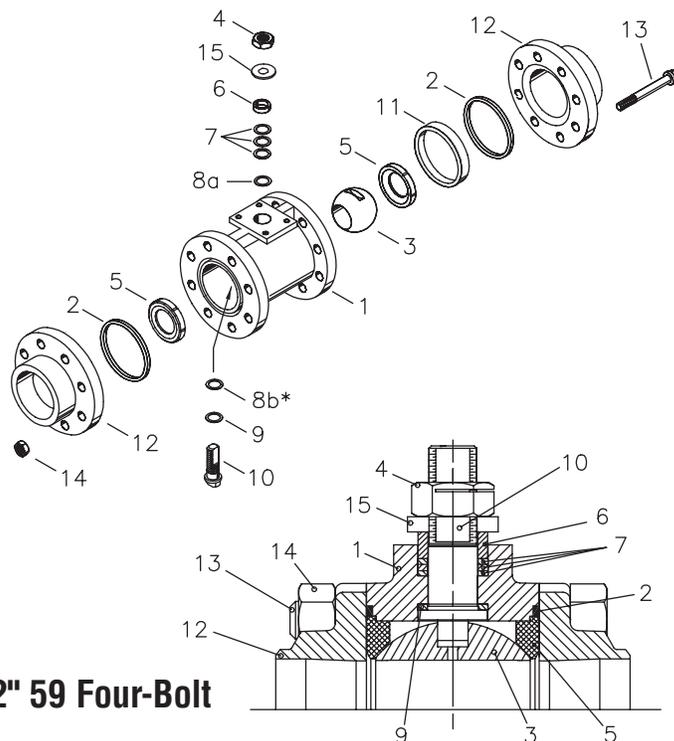
* This washer is not used on all 3" and 4" valves. Reuse existing washer when present.

Item	Qty	Description
1	1	Body
2	1	Body Seal
3	1	Ball
4	1	Retaining Nut
5	2	Seats
6	1	Follower
7	3	Stem Seals
8a	1	Centering Washer
8b*	1	Centering Washer
9	1	Thrust Bearing
10	1	Stem
11	1	End Plug
12	2-12	End Plug Retaining Screws
13	1	Spacer

NOTE: Flanged valve is shown. For Flangeless valve, disassembly is exactly the same.

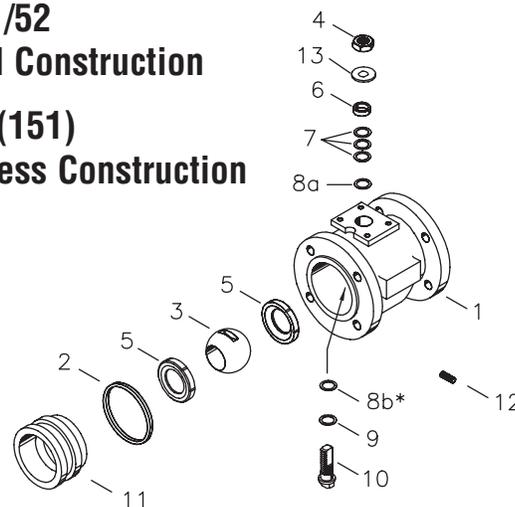
* This washer is not used on all valves. Reuse existing washer when present.

3" and 4" 59 Valves



2" 59 Four-Bolt

3"-8" 51/52 Flanged Construction 3"-4" 4 (151) Flangeless Construction



D. 39S Actuator

NOTE: 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 ACTUATOR HAS BEEN REPAIRED.

1. Actuator Disassembly

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

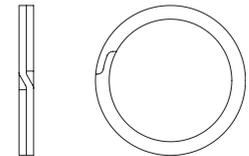
CAUTION: Ball valves can trap pressurized media in the cavity. Isolate the piping system in which the actuator/valve assembly is mounted and relieve any pressure on the valve. Note orientation of actuator to valve. It is important that the actuator be remounted in the same position to assure fail-safe 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) 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 through R6 actuators, remove the two bearings (6A) and O-rings (15A and 15B) from each end cap. Note that for Rev. R2 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.

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.

- 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 through-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 through Rev. R6 models can only be removed after the piston assemblies are taken out. Remove the position indicator (17) (if any), shaft clip (15F) (not a reusable part) and the stainless steel washer from the top of shaft. Then remove the shaft through 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 stainless steel washers (10–35 sizes only) and thrust bearing (10) from the top of the shaft and the O-ring (15E) and bearing (15H) from the bottom end. **NOTE:** For sizes 40 and 42 Rev. R3 through R6 models, only a single stainless steel washer is used and the thrust bearing (10) is not used.

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 through R6 models, sizes 25 through 42 have an anti-ejection ring (15J) that 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.

For Rev. R1 models, remove shaft clip (15F) (not a reusable part!) (see note on bottom of page 10) and the stainless steel 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 and 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 the star are bent slightly. When installed, they bear back, away from the hole.

For sizes 10–40 Rev. R1 and 10–42 Rev. R3 through 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) (10–42 sizes only) on the bottom of shaft. On the top of the shaft add the two stainless steel washers (10–35 sizes only) with the thrust bearing (10) between them.

NOTE: For sizes 40 and 42 Rev. R3 through R6, only a single stainless steel washer is used and the thrust bearing (10) is not used. Locate the top bearing (15G) and O-ring (15D) into the body. Replace the shaft through the larger opening in the bottom of the body.

For sizes 10–35 Rev. R6 actuators, top bearing (15G) is flat, the same as and interchangeable with thrust bearing (10).

For Rev. 3 through R6, sizes 25–42 actuators, replace anti-ejection ring (15J) in its groove on the shaft (2B), if removed.

For Rev. R1 models, locate the shaft O-rings into the actuator body. O-ring (15D) is the top O-ring while (15-E) 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 in the shaft (2B), if removed. Check that the ring is properly seated in its groove.

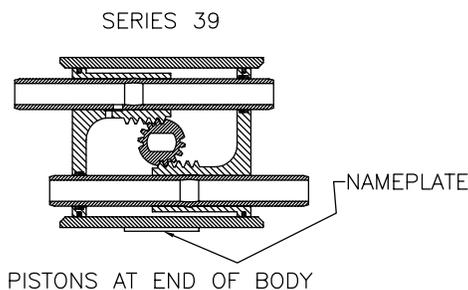
- b. Very carefully align the piston guide rod assemblies inside the body. Keep the pistons square to the body. (This is very important in the 30 39 actuator where steel set screws can cause internal body damage if the piston assemblies “cock” inside the actuator body.)

IMPORTANT: One piston guide rod assembly has a through 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.)

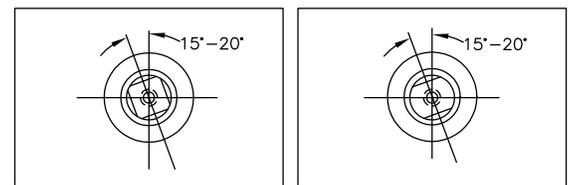
Figure 1



IMPORTANT: Note the relative location of the shaft teeth and the piston assembly’s rack teeth. The above figure is viewed when looking at the top of the actuator.

Figure 2

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



25-42 39 ACTUATOR 10-20 39 ACTUATOR

IMPORTANT: Align gear teeth on the shaft per Figure 1.

- d. To ensure proper meshing of teeth, move the shaft 15 to 20 degrees counterclockwise (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 25–42 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-ring (15A) into and replace the actuator end caps, (5A and 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 general-purpose lubricant, such as Vaseline, 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 stainless steel washer over the top shaft extension.
- i. **VERY IMPORATNT:** 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 page 8 for installation of spring ring shaft clip (which new 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 where they were removed.

IMPORTANT: When less than the standard number of springs is used in each end cap, these springs should be positioned according to the air supply figures listed below.

Sizes 10–35 Rev. R2 through R6 and Sizes 40 and 42 Rev. R3 through R6

60 psi – 8 springs – 4 per end cap.
Remove center spring.

Sizes 10–40 Rev. R1

60 psi – 18 springs – 9 per end cap. Remove the required

number of springs starting in the center. Remaining springs should be as evenly spaced as possible.

- k. If the actuator is being repaired due to a failed spring, replace all the springs in the actuator, as well as any other parts that 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 one end of the actuator body.)
- n. Force the body down and begin by engaging two end cap screws (5C) by hand through the end cap. Take each end cap screw 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 the springs to prevent any spring from buckling.

IMPORTANT: Locating nibs are permanently cast into the Rev. R1 (all sizes) and the Rev. R3 through R6 (sizes 25–42) actuator piston face. The actuator springs must fit over these locating nibs on the piston face. Care in following these instructions will ensure 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 control 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) (if any) by locating on center gear flats. Press firmly until locating 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 actuator.
- 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.
 - b. That sufficient air supply is available at inlet to solenoid block. When checking supply pressure, place gage in line at solenoid block inlet and monitor gage for unexpected pressure drops.
 - c. That valve is free to rotate.
 - d. That speed control screw is loose. (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 airflow. 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 #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 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.

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.

Factory Mutual Approved Oil and Gas Safety Shutoff Valve Specifications

Valve Size:

- ¼"-2" Reduced Port, Three-Piece (44)
- ¼"-4" Full Port, Three-Piece (59)
- 2"-8" Reduced Port, Flanged (51/52)
- 3"-4" Reduced Port, Flangeless (4-151)

Materials:

- All Carbon Steel
- All Stainless Steel
- Carbon Steel with Stainless Steel or Hastelloy C Ball and Stem

Valve End Configurations:

- ¼"-2" Reduced Port (44) and ¼"-4" Full Port (59):
Screwed End, Butt Weld and Socket Weld
- 2"-8" Reduced Port:
150# Flanged (51)
300# Flanged (52)
- 3"-4" Reduced Port:
150# Flangeless (4-151)

Seats:

- TFE or Reinforced TFE

Body Seals:

- TFE or Buna

Stem Seals:

- Polyfill with PEEK Protector or Reinforced TFE

Pressure Ratings:

- Unheated No. 4 and Lighter Oil, Natural or LP Gas Service @ 100°F Max:
 - 950 PSI: ¼"-2" (44/59), Fluoropolymer Seats
 - 1,450 PSI: ¼"-2" (44-59), Reinforced Fluoropolymer Seats
 - 285 PSI: C.S. 3"-4" (4-151), 2"-8" (51)
 - 275 PSI: S.S. 3"-4" (4-151), 2"-8" (51)
 - 740 PSI: C.S. 2"-8" (52), 3"-4" (59)
 - 720 PSI: S.S. 2"-8" (52), 3"-4" (59)

Heated No. 5 or 6 Oil, 300°F Maximum:

- 400 PSI: ¼"-2" (44/59), Fluoropolymer Seats
- 600 PSI: ¼"-2" (44/59), Reinforced Fluoropolymer Seats
- 225 PSI: C.S. 3"-4" (4-151), 2"-8" (51)
- 210 PSI: S.S. 3"-4" (4-151), 2"-8" (51)
- 425 PSI: 2"-8" (52), 3"-4" (59) Fluoropolymer Seats
- 640 PSI: C.S. 2"-8" (52), 3"-4" (59) Reinforced Fluoropolymer Seats
- 560 PSI: S.S. 2"-8" (52), 3"-4" (59) Reinforced Fluoropolymer Seats

Pressure rating is dependent upon temperature. Refer to published pressure/temperature curves for appropriate rating.

Actuator:

- 10-3539S For ¼"-2" (44/59/51/52)
- 30-4039S For 3"-4" (4-151)
- 30-4239S For 3"-8" (51/52) and 3"-4" (59)

Actuator Pressure Ratings:

- ¼"-6" Valve Sizes: 60-120 PSI
- (Actuator time to be 5 seconds or less to close valves)

Ambient Temperatures:

- +50°F To +150°F, Valves with 3039S Actuators
- 0°F To +150°F, For all Valves with Other Actuator Sizes

Voltages (Solenoid):

- 24, 120, 240 VAC / 12, 24 VDC

Nema Rating (Solenoid):

- Type 1 – General Purpose
- Type 4X, 7, 9 – Watertight and Hazardous Locations, Class I, Groups A, B, C and D; Class II, Groups E, F and G

Mounting:

- All actuators are factory mounted in-line, fail-close.

End-Mounted Limit Switch (Elk) Option:

- Switch Options: Z-SPDT, ZD – DPDT, Z1 – AC Proximity, Z3 – DC Proximity

Enclosure:

- Type 4, 7, 9 – Watertight and Hazardous Locations, Class I, Groups C and D; Class II, Groups E, F and G

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