



Worcester Controls

WCAIM2027  
(Part 15462)

# 10, 15, 20 ACCESS I 39 Actuators

## Installation, Operation and Maintenance Instructions

### DESCRIPTION

Worcester Controls/McCANNNA Access I Series 39 actuators are pneumatic quarter-turn valve actuators with solenoid and limit switches integral to the actuator end cap. The design utilizes a double-rack, single-pinion concept, with each rack integrally cast to a piston. Both pistons are supported and centered by large, stainless steel guide rods. In double-acting units, both pistons are pressurized on both strokes of the actuator. Ambient temperature range of the Access unit is 0°F minimum to 160°F maximum.

Standard units feature an extended top shaft for manual override capabilities and a completely modular design that allows simple attachment of a variety of accessories. The units feature a control block (with spool valve) that properly directs supply air to the actuator. The control block provides independently adjustable speed control for both opening and closing strokes of the actuator on double-acting units, and for the closing stroke on spring-return units (standard mounting configuration). The units can also be supplied with an air connection block (in place of control block) for when there is no solenoid valve integral with unit.

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**▲ 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 integral limit switches be used for monitoring and/or electrical interlock.**

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**CAUTIONS: When actuator is installed in outdoor conditions, water can enter the exhaust hole(s) of the control block or air connection block, and then freeze. Flowserve suggests a cover be used, or mount the actuator such that the block exhaust hole(s) will not fill with water.**

Flowserve recommends that all products that 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.

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**IMPORTANT:** Included in all 39 actuator accessory and repair kits is a rebuild/accessory addition label, which is to be marked with a permanent marker and then applied to the actuator after an accessory kit has been installed or an actuator has been repaired.

### INSTALLATION

**NOTE:** The Series 39 actuator is normally installed with its major axis parallel to the pipe line. This is mandatory when mounting actuator to 90° V1 diverter/Three-Way (D44 and T44) valves and CPT valves. The actuator can be oriented above, beside or beneath the valve without affecting its operation.

Rev. R6 actuators may come with an ISO locating ring used for optional ISO mounting.

- A. Determine mode of operation desired (normally open or normally closed) of the valve.
- B. Determine desired quadrant for bracket attachment and direction of mounting of actuator (in-line or cross-line).
- C. Attach mounting bracket to actuator using four (4) cap screws and lockwashers provided in mounting kit. To avoid any damage to the Series 39 actuator body, **ONLY** the proper length screws supplied with the mounting kit should be used. For ¼" - 2" top mount style valves, attach bracket such that bracket nameplate will be to side of valve.

For mounting to 818/828 Series valves, insert ISO locating ring into groove on bottom of actuator before attaching to bracket.

**NOTE:** Ring can be permanently held in groove by applying Loctite to ring before inserting in groove.

D. Attach bracket/actuator assembly to valve as follows:

**CAUTION: Ball valves can trap pressurized media in the cavity. If it is necessary to remove any valve body bolts, stem nuts, or remove valve from the line, and if the valve is or has been in operation, make sure there is NO pressure to or in the valve and operate valve one full cycle. However, the valves listed below do not require the removal of any valve body bolts or removal of valve from line in order to mount actuator.**

1. Rotate valve ball and stem to position necessary to achieve desired operation. If any valve information is marked on stop plate or handle, it will be necessary to transfer this information to the bracket nameplate.
2. For ¼" - 2" 44, ½" - 2" WK70/WK74, ¼" - 1½" 59, and ½" - 1½" H71 Series top-mount style valves and ½" - 2" 51/52, ½" - 1½" 82/83 Series valves with high-cycle stem packing as standard, remove handle nut, lockwasher, handle, separate stop plate, if any, retaining nut and stop pin(s). Add the two additional Belleville washers with their larger diameter sides touching each other. Add the self-locking nut to the stem and tighten while holding the stem flats with wrench. Tighten until Belleville washers are flat, the nut will "bottom", and then back nut off ⅓ of a turn. The two additional Belleville washers and the self-locking nut are included in the mounting kit.

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

For 2" 59, H71, 82/83, and 2½" 45, 82/83 valves, and valves 3" and larger with square stem, remove handle assembly, retaining nut, stop and stop screws. Replace with valve stem spacer or, if valve has graphite stem packing, with two Belleville washers, and replace retaining nut. **NOTE:** Belleville washers are installed with their larger diameter sides touching each other. Do not use stem spacer when Belleville washers are used. Using a wrench to prevent stem from turning, tighten retaining nut until stem packing is fully compressed or Bellevilles, if used, are fully flattened, then back off nut ⅓ turn. Excessive tightening causes higher torque and shorter seal life.

**NOTE:** Large valves with V51 high-cycle stem packing option installed, identified by two Belleville washers installed and handle assembly, stop, and stop screws removed, and 818/828 Series valves do not require stem area disassembly.

For 2" and larger 818/828 valves, remove handle assembly, locking plates and hardware, and stop screw, if any. Do not remove stop plate or spacer.

For ½"-2" 94 valves, remove handle, if any. Do not remove gland plate or gland bolts.

For 3" and larger 94 and 2" and larger E818/828 valves, remove handle assembly, stop, and spacer, if any. Do not remove gland plate or gland bolts.

3. Center coupling on valve stem.
4. Lower mounting bracket/actuator assembly over coupling and onto valve, making sure that male actuator shaft engages slot in coupling.
5. Secure bracket to valve using cap screws and lockwashers, or bolts and nuts provided in mounting kit. Tighten securely. For ½" - 2" top-mount style valves, bracket nameplate will be to side of valve.
6. Install set screws, if any, in the coupling and tighten securely.
7. Determine if mode of operation is as desired; if not:
  - a. **Double-Acting Actuators** - Mount the actuator 90° from normal mounting, or the actuator can be inverted, yielding the opposite mode.
  - b. **Spring-Return Actuators** - The normal method of mounting is to have the actuator in-line with the pipeline and the valve and actuator in the "FAIL-CLOSED" position. For "FAIL-CLOSED" cross-line operation, invert actuator and cross-line mount actuator to pipeline. For "FAIL-OPEN" in-line operation, invert actuator. Note: If in-line coupling is used, actuator does not need to be inverted. Rotate the valve ball and stem 90°, so coupling lines up with actuator shaft. Mount actuator in line with the pipeline. See Electrical Connection Section for proper wiring information. For "FAIL-OPEN" cross-line operation, rotate the valve ball and stem 90°, so coupling lines up with actuator shaft. Mount actuator cross-line to pipeline. See Electrical Connection Section for proper wiring information.
8. Determine position indication. Buttons on position indicator are set up to show valve closed on in-line mounting, i.e., pistons together in actuator. If different indication is required:
  - a. Check which visual indication is required.
  - b. Check that indicator, when located on actuator shaft, will show correct indication.
  - c. To change indication, push out/remove red and white buttons and reassemble in opposite positions.
  - d. Locate indicator on actuator shaft flats. Press firmly until location nibs snap into recess on actuator shaft.

#### AIR SUPPLY AND ELECTRICAL INSTALLATION

A. 1. Air Supply:

The Series 39 Actuator is factory lubricated. For optimum operation, the use of filtered and lubricated air is recommended.

2. Air Supply Pressure:

Standard double-acting actuators require 40-120 psig supply air. Spring-return actuators require 80-120 psig supply air. Spring-return actuators can also be set up to operate on supply air pressures ranging from 40-80 psig by using fewer springs. See "Rebuilding Instructions", Spring-Return Actuator, paragraph 1 on page 12 for proper number and location of springs for reduced supply air pressures.

3. Air Supply Connection:

Connect air supply to 1/4" NPT connection on control block. For units with no integral solenoid valve, air connection block has two 1/4" NPT connections for inlet air (only one used for spring-return units).

4. Recommended Tubing Sizes:

In order to provide sufficient flow of supply air to the Series 39 actuator, the following tubing sizes are recommended:

Actuator Size	Runs Up To 4 Feet Long	Runs Over 4 Feet long
10, 15, 20	1/8"	1/4"

5. Air Consumption:

The following chart shows the amount of pressurized (80 psig) air consumed per stroke in cubic feet. To determine the total amount of air consumed per complete cycle for double-acting actuators, simply add the volumes for both the opening and closing strokes together; for spring-return units, the total volume of air consumed is the volume shown for the opening stroke.

Stroke	Actuator Size		
	1039	1539	2039
Open	0.04	0.08	0.16
Close	0.05	0.09	0.17

6. Electrical Supply:

Make electrical connections in accordance with the wiring diagram on the inside of cover or appropriate wiring diagram in Section B.4.

The power supply to the solenoid coil is three watts. Required amperage is as follows:

Voltage	Holding Amps*	Voltage	Holding Amps
24 VAC 50/60 Hz	0.13	12 VDC	0.25
120 VAC 50/60 Hz	0.025	24 VDC	0.13
240 VAC 50/60 Hz	0.013		

\*Inrush is 80% greater than holding values on AC solenoids.

7. Switch (Sensor) Ratings:

**Mechanical Switch** – 15.1 amps at 125/250 VAC; 5 amps at 125 VDC.

**Proximity Sensor** – 5-200 mA, 20-140 VAC, 10-140 VDC, current leakage < .8 mA, sensor frequency 25 Hz. Not sensitive to polarity.

**ELECTRICAL CONNECTION**

**NOTE:** Wiring diagrams for units with a PC board as found in this IOM are for the new PC board. The solenoid (power) and the limit switch circuits of the new PC board are now separate. The new board is rated for 10 amps maximum and can be identified by the board part number label. See table on page 8 for identification of color-coded part number label.

The old circuit board in the original unit was designed for a single voltage and current for the solenoid (power) and limit switches, and was rated for 6 amps maximum. If used on a dual voltage installation, damage will occur in the control device.

- B. 1. The "standard" mounting configuration of the 39 actuator to the valve is in-line, fail-closed. In this configuration, SW-2, as described in part 3 below and in the wiring diagram, will give indication when the actuator is in the closed position, or CW (clockwise) limit of rotation and the red LED will be on. SW-1 gives indication of the open position, or CCW (counter-clockwise) limit of rotation and green LED will be on (refer to appropriate wiring diagram in Section B.4.).

**NOTE:** The CW or CCW rotation of the actuator shaft is determined when viewing the actuator from the nameplate side of the actuator while being able to read the nameplate from left to right.

2. Fail-open mounting configuration may be obtained by either inverting the actuator, using in-line coupling or mounting the actuator cross-line. In these cases, SW-1 and SW-2 indication will be reversed from the above but actuator shaft rotation will vary depending on which fail-open mounting is used. The fail-open wiring diagrams in Section B.4 and adjustments in Section 3 below are for cross-line mountings only. For wiring and adjustments of other fail-closed or fail-open configurations consult Flowserve.
3. Switches (sensors) have been factory adjusted, but should be rechecked after installation. Adjustment is as follows:
  - a. Switch adjustment for "standard" mounting (24 VDC; 24, 120 VAC PC Boards using LEDs):  
 With actuator mounted in "standard" mounting configuration (see step 1) and wired per appropriate wiring diagram, set actuator in the closed position. With the adjustment screw near its loose limit, adjust closed position switch SW-2 by tightening the adjustment screw until red LED turns on. Then tighten the adjustment screw one additional turn. With air supply to actuator, energize the solenoid and cycle valve to full open position. The red LED will shut off and the yellow and orange LEDs will be lit indicating the valve is no longer in the fully closed

position, power to the coil and coil continuity, respectively. With the adjustment screw near its loose limit, adjust the open switch SW-1 by tightening the adjustment screw until the green LED turns on. Then tighten the adjustment screw one additional turn.

When power to the solenoid is off, the actuator will cycle to its original configuration. The green, yellow and orange LEDs will turn off indicating the valve is no longer fully open and the solenoid is de-energized. At the end of the stroke the red LED will turn on indicating closed position and solenoid de-energized.

- b. Switch adjustment for “standard” mounting (240 VAC Dual Voltage PC Board or 24 VDC; 24, 120 VAC units without a solenoid using Switch Indication LEDs only):

With actuator mounted in “standard” mounting configuration (see step 1) and wired per appropriate wiring diagram, set actuator in the closed position. With the adjustment screw near its loose limit, adjust closed position switch SW-2 by tightening the adjustment screw until red LED turns on. Then tighten the adjustment screw one additional turn. With air supply to actuator, energize the solenoid, if applicable, and cycle valve to full open position. The red LED will turn off. With the adjustment screw near its loose limit, adjust the open switch SW-1 by tightening the adjustment screw until the green LED turns on. Then tighten the adjustment screw one additional turn.

When power to the solenoid or air supply is off, the actuator will cycle to its original configuration. The green LED will turn off indicating the valve is no longer fully open and the solenoid is de-energized or air supply is off. At the end of the stroke the red LED will turn on indicating closed position and solenoid de-energized or air supply off.

- c. Switch adjustment for “standard” mounting (Units not using PC Board and/or not using LEDs):

With actuator mounted in “standard” mounting configuration (see Step 1) set actuator in full closed position with the adjustment screw near its loose limit. Adjust closed position switch SW-2 (see Wiring Diagram) by tightening the adjustment screw until switch contacts click. Then tighten adjustment screw one additional turn. With air supply to actuator, energize solenoid, if applicable, cycle to the full open position and adjust open position switch SW-1 in the same manner.

- d. Switch adjustment for “fail-open” mounting (24 VDC; 24, 120 VAC PC Boards using LEDs):

With actuator mounted in fail-open mounting configuration (see step 2) and wired per appropriate wiring diagram, set actuator in the open position with the adjustment screw near its loose limit. Adjust open

position switch SW-2 by tightening the adjustment screw until the green LED turns on. Then tighten the adjustment screw one additional turn. With air supply to actuator, energize the solenoid and cycle to the full closed position. The green LED will turn off and the yellow and orange LEDs will be lit indicating the valve is no longer fully open, power to the coil, and coil continuity, respectively.

With the switch adjustment screw near its loose limit, adjust the closed position switch SW-1 by tightening the adjustment screw until red LED turns on. Then tighten the adjustment screw one additional turn.

When power to the solenoid is off, the actuator will cycle to its original configuration. The red, yellow and orange LEDs will turn off indicating the valve is no longer fully closed and the solenoid is de-energized. At the end of the stroke the green LED will turn on indicating full open position.

- e. Switch adjustment for “fail-open” mounting (240 VAC Dual Voltage PC Board or 24 VDC; 24, 120 VAC units without a solenoid using Switch Indication LEDs only):

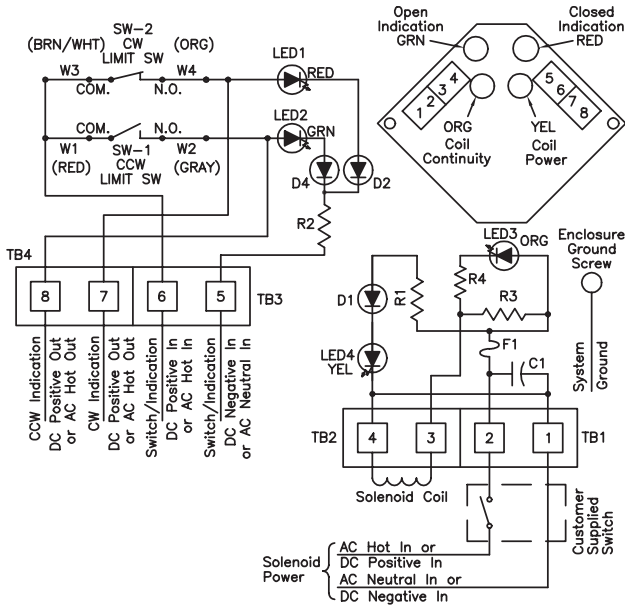
With actuator mounted in fail-open mounting configuration (see step 2) and wired per appropriate wiring diagram, set actuator in the open position with the adjustment screw near its loose limit. Adjust open position switch SW-2 by tightening the adjustment screw until the green LED turns on. Then tighten the adjustment screw one additional turn. With air supply to actuator, energize the solenoid, if applicable, and cycle to the full closed position. The green LED will turn off.

With the switch adjustment screw near its loose limit, adjust the closed position switch SW-1 by tightening the adjustment screw until red LED turns on. Then tighten the adjustment screw one additional turn.

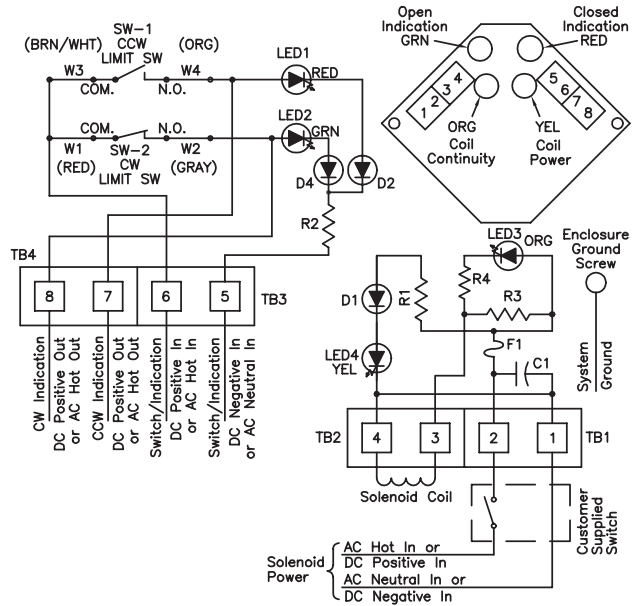
When power to the solenoid or air supply is off, the actuator will cycle to its original configuration. The red LED will turn off indicating the valve is no longer fully closed, and the solenoid is de-energized or the air supply is off. At the end of the stroke the green LED will turn on indicating full open position.

- f. Switch adjustment for “fail-open” mounting (Units not using PC Board and/or not using LEDs):

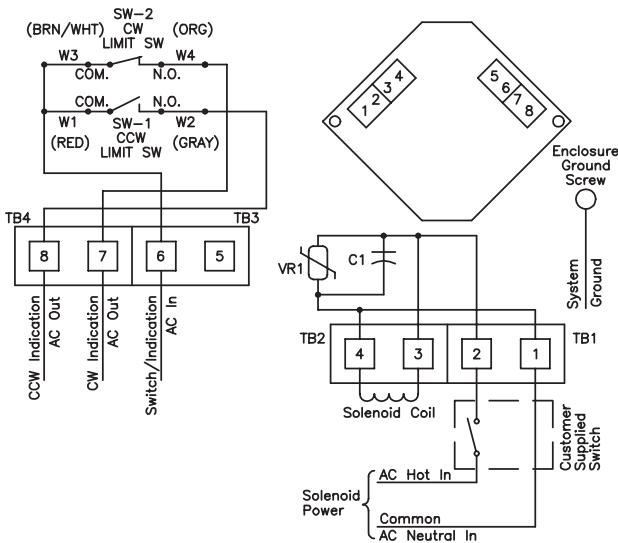
With actuator mounted in fail-open mounting configuration (see Step 2) set actuator in full open position with the adjustment screw near its loose limit. Adjust open position switch SW-2 (see Wiring Diagram) by tightening the adjustment screw until contacts click. Then tighten adjustment screw one additional turn. With air supply to actuator, energize solenoid, if applicable, cycle to the full closed position and adjust closed position switch SW-1 in the same manner as SW-2.



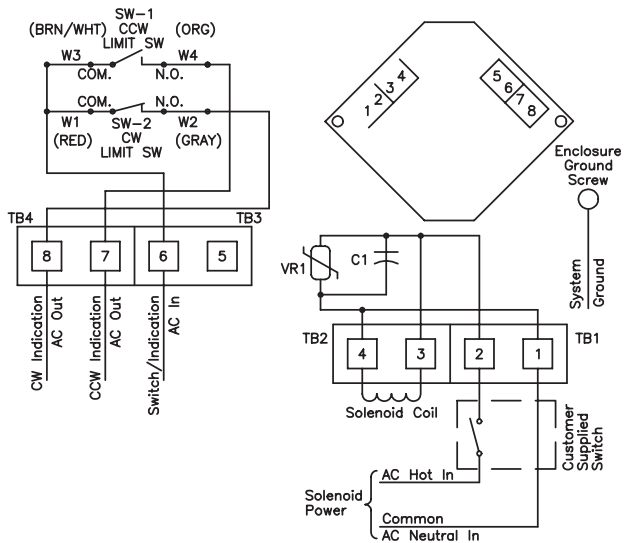
**24 VDC; 24, 120 VAC — SINGLE VOLTAGE ONLY  
(SOLENOID (POWER) AND SWITCH VOLTAGES IDENTICAL)  
(FAIL-CLOSED)**



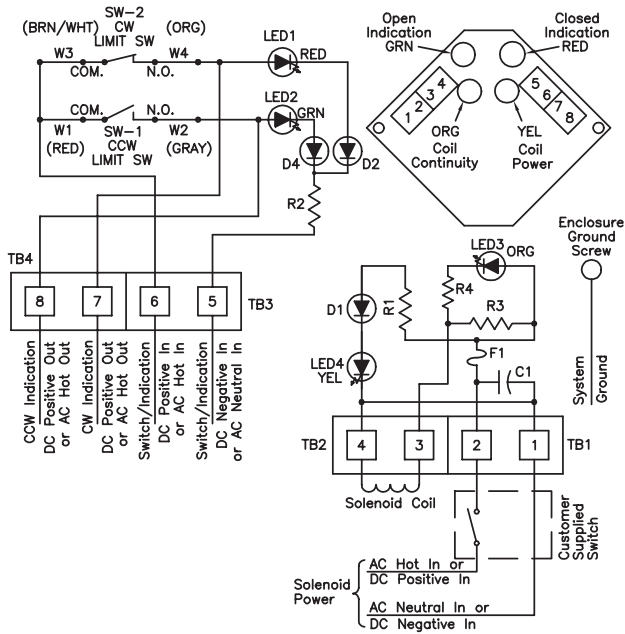
**24 VDC; 24, 120 VAC — SINGLE VOLTAGE ONLY  
(SOLENOID (POWER) AND SWITCH VOLTAGES IDENTICAL)  
(FAIL-OPEN)**



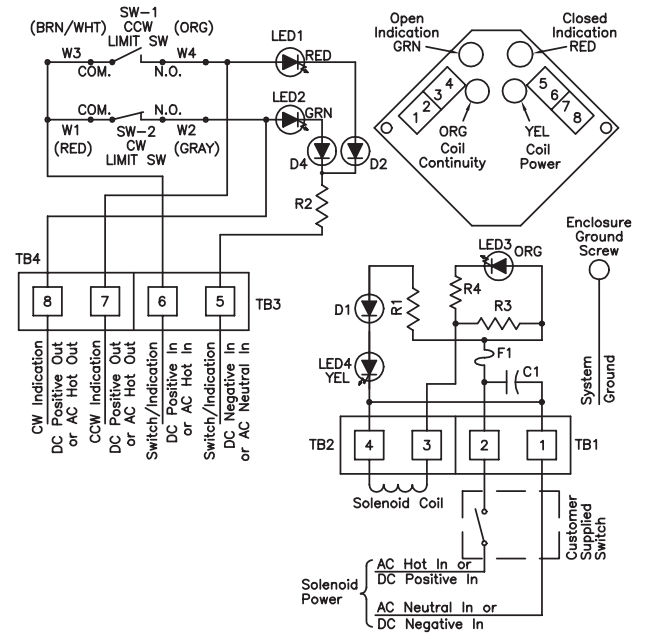
**240 VAC  
SOLENOID (POWER) AND SWITCH VOLTAGE ONLY  
(FAIL-CLOSED)**



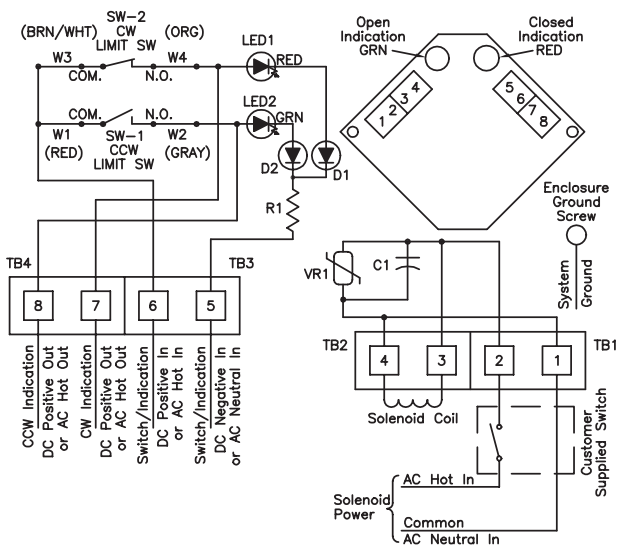
**240 VAC  
SOLENOID (POWER) AND SWITCH VOLTAGE ONLY  
(FAIL-OPEN)**



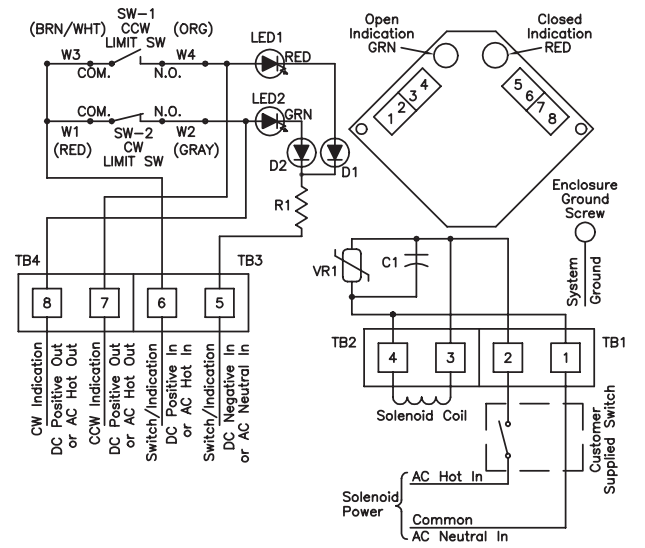
**24 VDC; 24, 120 VAC — DUAL VOLTAGE ONLY  
(SOLENOID (POWER) AND SWITCH VOLTAGES ARE DIFFERENT)  
(FAIL-CLOSED)**



**24 VDC; 24, 120 VAC — DUAL VOLTAGE ONLY  
(SOLENOID (POWER) AND SWITCH VOLTAGES ARE DIFFERENT)  
(FAIL-OPEN)**



**240 VAC — DUAL VOLTAGE ONLY  
(240 VAC SOLENOID (POWER) VOLTAGE)  
(24 VAC OR 24 VDC SWITCH VOLTAGE)  
(FAIL-CLOSED)**



**240 VAC — DUAL VOLTAGE ONLY  
(240 VAC SOLENOID (POWER) VOLTAGE)  
(24 VAC OR 24 VDC SWITCH VOLTAGE)  
(FAIL-OPEN)**



- g. Proximity Sensor adjustment for “standard” mounting (no PC Board):

Sensors have to be wired (and powered) per appropriate wiring diagram. With actuator mounted in “standard” mounting configuration (see Step 1) and the adjustment screw near its loose limit, set actuator in closed position and adjust closed position sensor SW-2 (see Wiring Diagram) by tightening the adjustment screw until sensor energizes its load. Then tighten the adjustment screw one additional turn. Supply power to solenoid, if applicable, and change actuator to full open position. Adjust the open position sensor SW-1 in the same manner as the closed position sensor. When solenoid is de-energized (if applicable) the actuator will return to the full closed position. The closed position sensor SW-2 will energize its load indicating the actuator is in the full closed position. NOTE: Whenever actuator is in either the closed or open position, the LED on SW-2 or SW-1 respectively, will turn on.

- h. Proximity Sensor adjustment for “fail-open” mounting (no PC Board):

With actuator mounted in fail-open mounting configuration (see step 2) and wired per appropriate wiring diagram, set actuator in full open position, with adjustment screw at its loose limit. Adjust open position sensor SW-2, by tightening the adjustment screw until sensor energizes its load. Then tighten the adjustment screw one additional turn. Supply power to solenoid, if applicable, and change actuator to its full closed position. Adjust the closed position sensor SW-1, in the same manner as the open position sensor. When solenoid is de-energized, if applicable, the actuator will return to its full open position. The open position sensor, SW-2, will energize its load indicating the actuator is in the full open

position. NOTE: Whenever actuator is in either the open or closed position, the LED on SW-2 or SW-1 respectively, will turn on.

- 4. Wiring instructions for solenoid and/or limit switches (proximity sensors).

Make electrical connections in accordance with the appropriate wiring diagram on inside of cover or on the following pages.

**▲ WARNING: A load must be used when power is applied to proximity sensors. Wiring without a load will cause sensor failure. The load must draw a maximum of 200 mA at working voltage.**

Circuit Board Color-Coded Part No. Label Identification	
Color	Voltage
Black	120 VAC
Yellow	240 VAC
Green	24 VAC / 24 VDC
Blue	120 VAC (dual voltage)
Red	240 VAC (dual voltage)

- 5. Place the lubricated O-ring down over the threaded section of the housing onto the machined shoulder. The cover must be threaded onto housing tightly for proper performance. The assembly is now complete.

**NOTE:** For units with a metal cover, a light coat of grease (such as a #1 grease) shall be applied to the cover threads. A minimum of 1/3 the circumference of the threads to be lubricated.

Figure 1

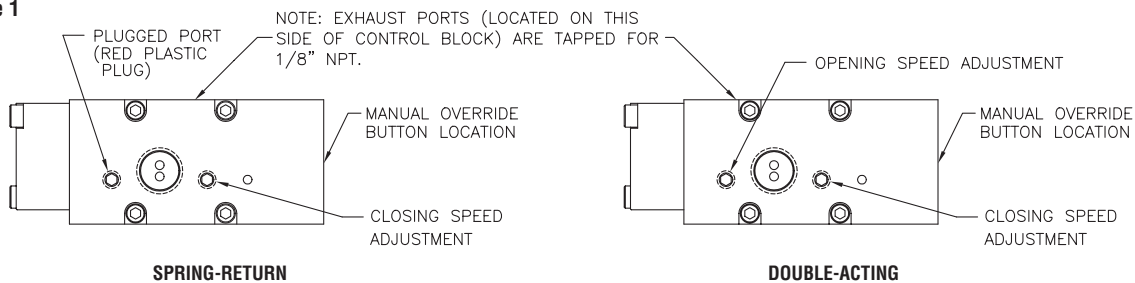
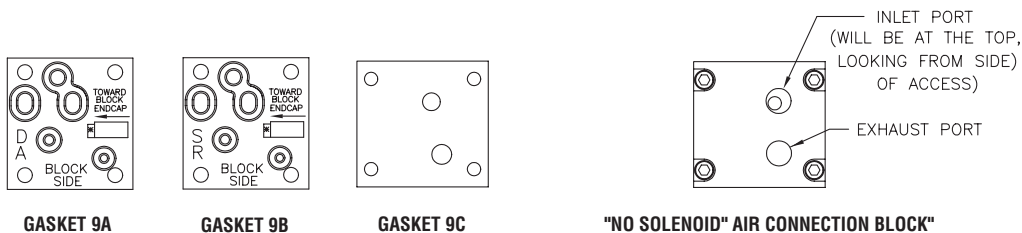


Figure 2





## OPERATION

- A. Double-Acting with Control Block – Air is supplied to the ¼" NPT port on the block. When the solenoid is energized, the spring-loaded plunger is withdrawn, allowing the supply air to shift the spring-loaded spool within the block, which opens the supply path to the center chamber of the actuator. Air from the end chambers of the actuator is allowed to pass through the block and exhaust to atmosphere.

When the solenoid is de-energized, the spring-loaded plunger blocks the flow of air to the spool seal within the block and the spool spring shifts the spool within the block to a position which opens the supply path to the end chambers of the actuator. Air from the center chamber of the actuator is allowed to pass through the block and exhaust to atmosphere.

The actuator is electrically fail-safe. That is, it will return to its de-energized position upon electrical failure.

The unit has two independently adjustable speed control screws that can be used to adjust the speed of operation for the opening and/or closing stroke (see figure 1). If the speed control screws are too tight, the unit will fail to operate.

**NOTE:** Speed control screws are shipped from the factory in the full-open position.

- B. Spring-Return with Control Block – Air is supplied to the ¼" NPT port on the block. When the solenoid is energized, the spring-loaded plunger is withdrawn, allowing the supply air to shift the spring-loaded spool within the block, which opens the supply path to the center chamber of the actuator. Air from the end chambers of the actuator is allowed to pass through the block and exhaust to atmosphere.

When the solenoid is de-energized, the spring-loaded plunger blocks the flow of air to the spool within the block and the spring-loaded spool returns to a position which allows air from the center chamber of the actuator to pass through the block and exhaust to atmosphere as the actuator is cycled by the springs in the end chambers of the actuator. The end chambers are exhausted to atmosphere at all times.

The actuator is fail-safe. That is, it will return to its de-energized position upon electrical or pneumatic failure.

The unit has one speed control screw, which can be used to adjust the speed of operation for the closing stroke (on a fail-closed unit) or opening stroke on a fail-open unit, and one port plugged with a red plastic plug (see figure 1). If the speed control screw is too tight, the unit will fail to operate.

**NOTE:** Speed control screws are shipped from factory in the full-open position.

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**CAUTIONS:** If converting a double-acting actuator to a spring-return actuator or vice-versa, be sure the correct control block gasket is used. Also, be sure that all gaskets are properly installed. See figure 2 below and actuator exploded view. Do not apply any grease to gasket, it must be installed dry. Be sure red plastic plug is installed in plugged port (see figure 1) for spring-return actuators.

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- C. Double-Acting with No Solenoid and No Control Block – Air is supplied to the ¼" NPT port on the air connection block to the center chamber of the actuator through a remotely mounted four-way solenoid (or similar supply system). The other ¼" NPT port on the air connection block to the end chambers is exhausted through solenoid (or similar supply system). When solenoid is de-energized (energized) supply air is now supplied to end chambers and center chamber is simultaneously exhausted through solenoid.

- D. Spring-Return with No Solenoid and No Control Block – Air is supplied to the ¼" NPT port on the air connection block to the center chamber of the actuator through a remotely mounted solenoid or similar supply system. The other ¼" NPT port on the air connection block is the exhaust port for the end chambers and may be exhausted to atmosphere or through customer's system.

When the remotely mounted solenoid or similar supply system blocks the supply air to the center chamber of the actuator, a means must be supplied to exhaust this chamber and the actuator is cycled by the springs in the end chambers.

- E. Stroke Times – For stroke times of the Access I Series 39 actuator with solenoid and control block, consult factory. Times will be measured in seconds and will represent average times under 50% load conditions with an air supply pressure of 80 psig. Times will be per stroke for double-acting actuators. For spring-return actuators, the opening stroke times may be slightly longer; stroke times for the closing (spring) stroke will be dependent upon the number of springs used. Cycle times for customer air supply systems will be dependent upon customer equipment.
- F. Manual Operation – In the event of air failure, the Access I Series 39 actuator can be cycled manually. This is accomplished by applying a wrench to the exposed top shaft of the actuator and turning it in the desired direction.

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**▲ WARNING:** Care must be taken to ensure that the actuator is not operated automatically while manual operation is being performed.

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If a routine cycle check is to be performed on an actuator with a control block, the actuator can be cycled manually by shifting the spool valve within the control block. This can be done by pushing the override button in the control block. See figure 1 on page 8 for location of button. Care must be taken to hold the spool valve in the desired position until the actuator has cycled. Provided the air supply is still on, the actuator will cycle to its original position as soon as the manually applied pressure on the override button is released.

## MAINTENANCE

**CAUTION: The actuator must be isolated both pneumatically and electrically before any maintenance activity is begun.**

Periodic checks should be performed to make certain that all fasteners remain tight. Care should be taken when tightening the end cap retaining bolts since these fasteners are METRIC. All other fasteners are UNIFIED IMPERIAL.

All actuators are supplied with sufficient lubrication for their normal working life. If required, recommended lubrication for all standard actuators is a #1 grease.

Depending upon the conditions under which the actuator must work, such as extended duty, non-compatible operating media or abnormal operating conditions, periodic replacement of internal seals is recommended. Repair kits containing all necessary seals can be obtained through any authorized Worcester/McCANNNA distributor.

On spring-return actuators, the springs may need replacement after extended duty since springs may fatigue and break. SPRINGS SHOULD ALWAYS BE REPLACED IN COMPLETE SETS. Spring kits are available through any authorized Worcester/McCANNNA distributor.

## SPARE PARTS

The following are recommended spare parts that should be kept on hand for Series 39 pneumatic actuators:

Repair Kit(s) – Kits contain all necessary seals, bearings and instructions.

Spring Kit(s) – For spring-return actuators.

## TROUBLESHOOTING

Before disassembling actuator for any reason, consult rebuilding instructions contained in following section.

A. If actuator does not function, check to ascertain:

1. That valve is free to rotate. This can be done as described above in Manual Operation.
2. That actuator is the correct size.
3. That speed control screws or exhaust ports are not blocked.
4. That correct voltage is supplied to solenoid.
5. That sufficient air supply is available at inlet to control block. Inlet pressure to control block should be at least 40 psig for double-acting, 80 psig for spring-return (unless a reduced spring complement is installed (fewer springs)). When checking supply pressure, place gage in line at control block inlet and monitor gage for unexpected pressure drops.
6. If the ACCESS unit is equipped with a 120 VAC circuit board, check for a blown fuse (F1). Using an ohmmeter, the fuse should read about 6 ohms if it is good. Remove the fuse from

the circuit board in order to check it. If it is good, reinstall the fuse. If the fuse is bad, replace it with a Littlefuse PICO II very fast-acting fuse rated at 62 mA (Newark part number 94F2146) or the spare fuse, which may be found on some circuit boards and located below capacitor C1. Try to determine what caused the fuse to blow before turning power back on. The most likely cause is a bad solenoid coil.

- B. If proper voltage and air pressure have been verified and valve is free, proceed as follows:
  1. Turn on signal voltage. Check solenoid for clicking sound.
  2. If no sound is detected, remove air pressure and turn off signal voltage.
    - a. Carefully unscrew solenoid and solenoid stem from end cap.
    - b. Reapply signal voltage and observe solenoid plunger. If it does not retract, replace solenoid.
  3. Manually override control block. If correct operation is not obtained, replace the control block.
  4. If control block and solenoid are operating correctly, proceed to Section C.
- C. If the actuator functions but exhibits leakage, or power loss accompanied by leakage, proceed as follows:
  1. Check voltage. Voltage must be within 10% of the specified voltage. Low voltage will cause leakage out of the back of the solenoid and burn out of the coil.
  2. Check air supply. Be certain that no sharp air pressure drops occur as unit is cycled. Loss of air pressure can cause incomplete shifting of the spool valves, which results in bypass leakage and substantial actuator torque losses.
  3. If air supply and voltage are adequate, proceed as follows:
    - a. If leak is at solenoid exhaust port, replace the solenoid.
    - b. If leak occurs at exhaust ports in the block itself, the trouble will be in either the spool valve in the block, or at one of the piston seals of the actuator. A leaking piston seal will usually leak on either cycle.
 

If the block is replaced and leakage continues from the exhaust port, remove the actuator from the valve, disassemble (per Rebuilding Instructions) and check the following:

      1. Make sure that all internal porting is free and clear of any obstructions. End caps, guide rods and the piston with hole are air-transporting components.
 

**NOTE:** The most common problem encountered on 39 actuators is the improper replacement of the piston with hole relative to seals in end caps. See Step 5 on page 11.
      2. Make certain that the actuator has lubrication, 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.
- b) If solidified grease between the pinion and the piston racks is present, clean, dry, regrease and reassemble.
- 3. Verify that actuator pinion shaft and/or pistons are not bound. If bound, reassemble per Rebuilding Instructions.
- 4. If unit exhibits excessive amounts of backlash, check teeth on piston racks for wear. If worn, replace piston assemblies.
- 5. In spring-return actuators, 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.
- 6. If actuator is free, valve is free and control block, if used, is shifting air properly, reassemble the actuator and retest. If unit still fails to operate, consult Flowserve.

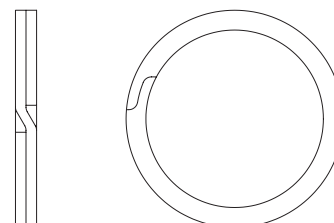
- NOTE:** If block gasket removed, with or without small black block plug, differs from those illustrated in this IOM, replace with new style or note orientation for proper reassembly.
- 5. Each end cap (5A and 5B) is aligned onto the body (1) over a “fool-proof pin”. This ensures that the end caps can only be assembled to their respective end of the actuator. Remove all four metric screws (5C) from and remove both end caps. Remove the two bearings (6A) and O-rings (15A and 15B) from each end cap.

**CAUTION:** If 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 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. On larger actuators with springs use caution when removing end caps. End cap screws are long enough to allow springs to relieve before disengaging.

After the screws are removed, gently pry off each end cap, being careful not to damage the end cap O-rings.

- 6. The two piston guide rod (4) assemblies 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 (4) and their respective piston (3). For Rev. R6 actuators, 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 (3).
- 7. The shaft (2) can only be removed after piston assemblies are taken out. Remove the position indicator (17), if any, the shaft clip (15F), not a reusable part! (see note below) 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 and throughst 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 below. 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.



## REBUILDING INSTRUCTIONS

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

After actuator has been repaired, mark rebuild label accordingly and apply to actuator.

## ACTUATOR DISASSEMBLY

- 1. Disconnect the air supply and electrical service to the actuator.
- 2. Remove the actuator and its mounting bracket from the valve. 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. For all the valves listed in Installation Section D, the actuator bracket can be removed without loosening or removing any valve body bolts.

- 3. Remove the actuator bracket from the actuator to begin repair. Note mounting of removed bracket for easy reassembly.
- 4. It is not necessary to remove the control block (7A) or air connection block (7B) to rebuild actuator. However, if it becomes necessary to remove the block, begin by removing the block bolts (7D). Use care to retain the block gasket (9A, 9B or 9C).

## ACTUATOR REASSEMBLY

1. Be sure 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 parts should be obtained from the factory. Light tracking, barely detectable to touch, is acceptable.

2. All rebuilding kit O-rings and bearings may now be installed. Lubricate the standard actuator thoroughly with a #1 grease. Apply a light film of grease to all O-rings. (Note that kits also contain some parts for earlier revisions of actuators that will not be needed.)

3. 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 ID groove(s) in each piston (3). Install O-rings (15C) onto pistons.

4. Replace O-ring (15E) and bearing (15H) on the bottom of shaft. On the top of the shaft add the two stainless steel washers with the throughst bearing (10) between them. Locate the top bearing (15G) and O-ring (15D) into the body. NOTE: For Rev. R6 actuators, top bearing (15G) is flat, the same as and interchangeable with throughst bearing (10). Replace the shaft through the larger opening in the bottom of the body.

5. Very carefully align the piston guide rod assemblies inside the body. Keep the pistons square to the body.

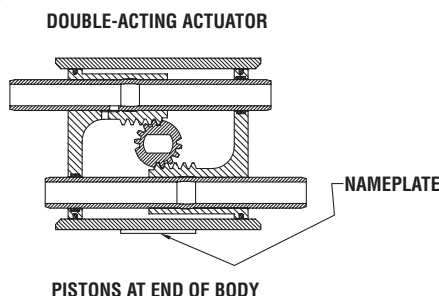
**IMPORTANT:** One piston guide rod assembly has a through hole drilled in it. It can be easily located by looking down the ends of both guide rods. This piston assembly must be reassembled, with its respective guide rod, opposite the nameplate on the body, as it was removed.

6. 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 3.

**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 3.

**IMPORTANT:** Note the relative location of the shaft teeth and the piston assembly’s rack teeth. Figure 3 is viewed when looking at the top of the actuator.

Figure 3



7. 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. NOTE: The “normal position” of the shaft is when the top flats are parallel to the main axis of the actuator body.

8. 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).

9. Once the shaft and pistons are properly engaged, ensure that smooth movement and full-closed operation can occur without moving the pistons out of the actuator body. This is important!

10. 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. For spring-return actuators, see spring installation section on page 12 before installing 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.**

11. Replace the stainless steel washer over the top shaft extension.

12. **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 in paragraph 7 of Actuator Disassembly for installation of spiral ring type shaft clip, which newer rebuilding kits will contain.

13. If control block (7A) or air connection block (7B) was removed:

Properly insert appropriate gasket (9A, 9B or 9C) between control block or air connection block and end cap (see Figure 2 on page 8 and actuator exploded view), and attach block securely to end cap. See note in disassembly paragraph 4 on page 10. Do not apply any grease to gasket, it must be installed dry.

14. Replace position indicator (17), if any. See Section D.8 in Installation Section for proper installation and to determine position indication.

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

## SPRING-RETURN ACTUATOR

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

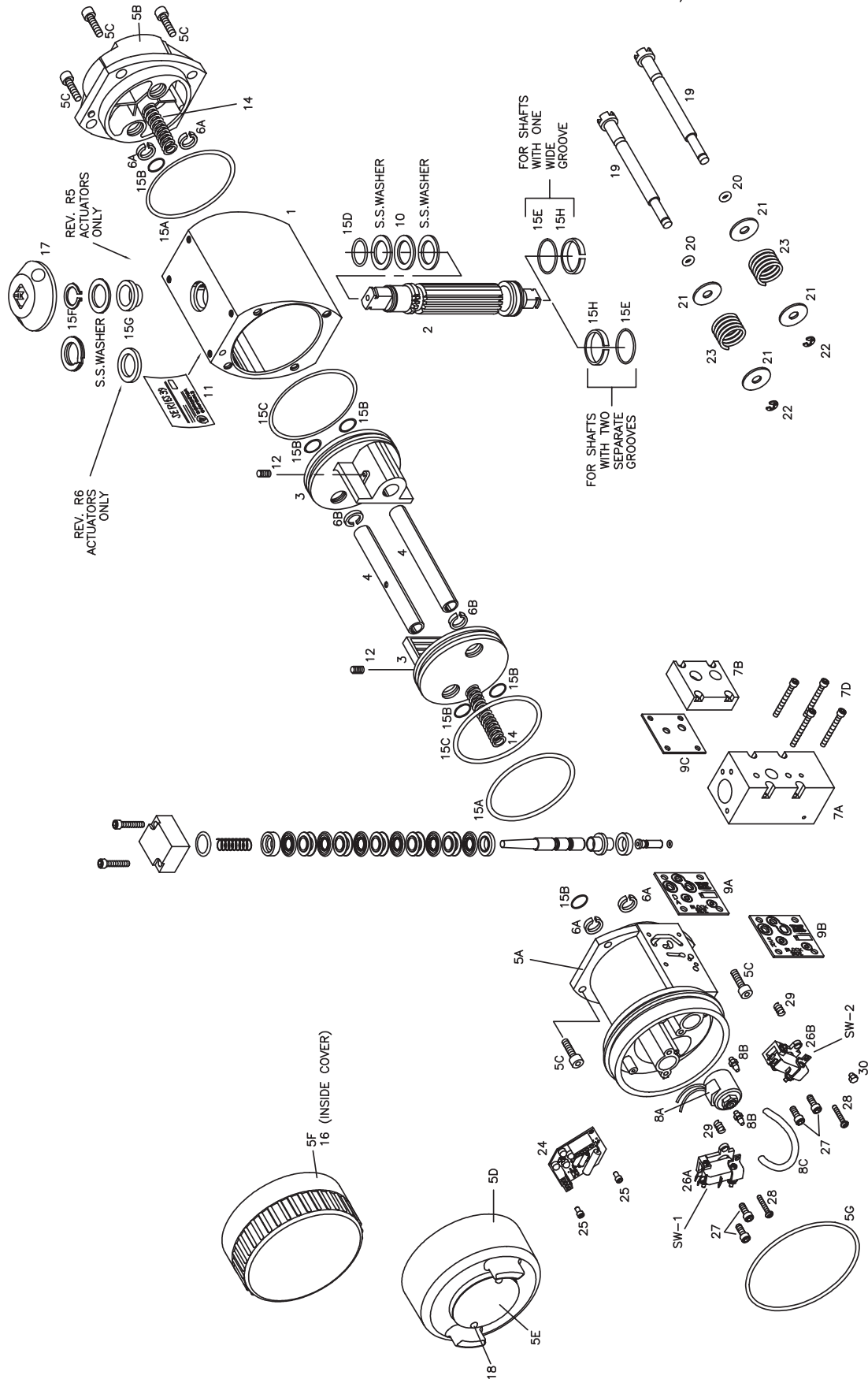
Sizes 10–20	
70 psi - 8 springs - 4 per end cap.	Remove center spring.
60 psi - 8 springs - 4 per end cap.	Remove center spring.
50 psi - 6 springs - 3 per end cap.	Use 3 on a diagonal.
40 psi - 4 springs - 2 per end cap.	Use 2 in opposite corners.

The values listed below are for standard and less than the standard air pressure as required per the ordering code.

**NOTE: Maximum operating pressure does not change.**

Ordering Code	4	5	6	7	( )
Supply Pressure (psi)	40	50	60	70	80
Actuator Size	End of Spring Torque (In.-Lbs.)				
10	35	55	75	75	95
15	65	105	145	145	185
20	125	195	265	265	335

- If a spring-return actuator is being repaired due to a failed spring, REPLACE all the springs in this actuator, as well as any other parts that may have been damaged.
- When replacing the springs in a spring-return actuator, place the springs in the end cap pocket after thoroughly lubricating each spring. Be generous with lubricant!
- 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, as there is a “fool-proof” pin in the end cap that aligns with a hole in the body.
- Force the body down and begin by engaging two end cap screws (5C) 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 the springs to prevent any spring from buckling.
- In a similar manner, as in the previous steps, replace the springs in the other end of the actuator body.



**PARTS LISTING**

ITEM	QTY.	DESCRIPTION	ITEM	QTY.	DESCRIPTION
1	1	Actuator Body	12	2	Piston Set Screws (if any)
2	1	Shaft (10-2039)	13	1	Conduit Plug – Not Shown
3	2	Pistons	14		Springs – See Table Above
4	2	Guide Rods	15A	2	End Cap O-Rings
5A	1	Access End Cap	15B	6	Guide Rod O-Rings
5B	1	End Cap	15C	2	Piston O-Rings
5C	8	End Cap Screws (Metric)	15D	1	Top Shaft O-Ring
5D	1	Cover "Z"	15E	1	Bottom Shaft O-Ring
5E	1	Caution Nameplate "Z"	15F	1	Shaft Clip
5F	1	Cover "W"	15G	1	Top Pinion Bearing
5G	1	O-Ring – Cover	15H	1	Bottom Pinion Bearing
6A	4	End Cap Bearing (Split Ring Style)	16	1	Wiring Diagram – Not Shown
6B	2	Piston Bearing (Split Ring Style)	17	1	Position Indicator
7A	1	Control Block Assembly	18	2	Drive Screw
7B	1	Air Connection Block (No Solenoid)	19	2	Probes
7C		Not Used	20	2	O-Rings – Probe
7D	4	Block Bolts	21	4	Washers – Probe
8A	1	Solenoid Assembly	22	2	Retaining Clips – Probe
8B	2	Solenoid Exhaust Port Fittings	23	2	Spring – Probe
8C	1	Solenoid Exhaust Tubing	24	1	Printed Circuit Board or Terminal Strip (Circuit Board Shown)
9A	1	Gasket – Control Block (Double-Acting) (Fig. 2)	25	2	Mounting Screws – PCB/Terminal Strip
9B	1	Gasket – Control Block (Spring-Return) (Fig. 2)	26A	1	Limit Switch (proximity sensor) Assembly – left
9C	1	Gasket – Air Conn. Block (No Solenoid) (Fig. 2)	26B	1	Limit Switch (proximity sensor) Assembly – right
10	1	Thrust bearing	27	4	Mounting Screws – Limit Switch (proximity sensor)
11	1	Nameplate	28	2	Switch (sensor) Adjustment Screw
			29	2	Switch (sensor) Adjustment Spring
			30	1	Exhaust Port Plug (if no solenoid)

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 through 15H, 6A and 6B, 10 and stainless steel washers. Color of some replacement parts, such as bearings, may vary from the parts removed.

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