

Type 1035/EI-O-Matic Rack-and-Pinion Rotary Actuator

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Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts ordering information for Type 1035/EI-O-Matic rack-and-pinion rotary actuators (figure 1). These actuators are available in both double-acting and spring-return (figure 2) configurations. Spring return units provide fail action in response to spring compression. The actuator is field reversible. Instructions for the valve and for any accessories used with the actuator are found in separate manuals.

Do not install, operate, or maintain a Type 1035 actuator without first • being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance, and • carefully reading and understanding the contents of



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Figure 1. Type 1035/EI-O-Matic Actuator
with Type A41 Valve

this manual. If you have any questions about these instructions, contact your Emerson Process Management™ sales office before proceeding.

Note

Neither Emerson, Emerson Process Management, nor any of their affiliated entities assumes responsibility for the selection, use and maintenance of any product. Responsibility for the selection, use, and maintenance of any product remains with the purchaser and end-user.



1035/EI-O-Matic Actuator

Table 1. Specifications

<p>Type 1035 Actuator:</p> <table border="0"> <tr> <td>Double Acting</td> <td>Spring Return</td> </tr> <tr> <td>EDA 25</td> <td>ESA 25</td> </tr> <tr> <td>EDA 40</td> <td>ESA 40</td> </tr> <tr> <td>EDA 65</td> <td>ESA 65</td> </tr> <tr> <td>EDA 100</td> <td>ESA 100</td> </tr> <tr> <td>EDA 200</td> <td>ESA 200</td> </tr> <tr> <td>EDA 350</td> <td>ESA 350</td> </tr> <tr> <td>EDA 600</td> <td>ESA 600</td> </tr> <tr> <td>EDA 950</td> <td>ESA 950</td> </tr> <tr> <td>EDA 1600</td> <td>ESA 1600</td> </tr> <tr> <td>PDA 2500</td> <td>PSA 2505</td> </tr> <tr> <td>PDA 4000</td> <td>PSA 4005</td> </tr> </table> <p><i>Output Shaft:</i> ■ Double D insert for Type A41 valves ■ Optional ISO 5211 square insert, ■ Recessed ISO 5211 square drive for P Series actuators</p> <p><i>Dual Stop Adjustment:</i> ■ E Series actuators are furnished with dual stop adjustments (DSA) as a standard feature. ■ P Series actuators provide dual stops with the use of the "Limit Stop Plate" (LSP) option. The LSP is mounted between the actuator and yoke.</p> <p>Supply Pressure⁽¹⁾ (Operating Pressure)</p> <p>2.8 to 8.3 bar (40 to 120 psig) for both double acting and spring return actuators</p> <p>Temperature Range⁽¹⁾</p> <p>Standard: -20 to 79°C (-4 to 175°F) with Nitrile O-rings Optional: <i>High Temperature:</i> -20 to 121°C (-4 to 250°F) with fluorocarbon O-rings (a "V" in model number), or <i>Low Temperature:</i> -40 to 79°C (-40</p>	Double Acting	Spring Return	EDA 25	ESA 25	EDA 40	ESA 40	EDA 65	ESA 65	EDA 100	ESA 100	EDA 200	ESA 200	EDA 350	ESA 350	EDA 600	ESA 600	EDA 950	ESA 950	EDA 1600	ESA 1600	PDA 2500	PSA 2505	PDA 4000	PSA 4005	<p>to 175°F) with EPDM and special lubricant (an "LT" in model number)</p> <p>Performance Characteristics</p> <p>See tables 2 and 3</p> <p>Rotation for Code A Construction</p> <p>Rotation is counterclockwise with port "A" pressurized with standard code A construction. Spring return actuators fail clockwise with standard construction for standard code A actuators (see figure 3 for optional constructions)</p> <p>Maximum Output Torque</p> <p>See Catalog 14</p> <p>Lubrication</p> <p>Factory lubricated for the normal life of the actuator (see temperature range shown above)</p> <p>Coating</p> <p>All units feature a two component polyurethane coating system as standard</p> <p>Actuator Tubing Size</p> <p>3/8 inch O.D. standard for all sizes</p> <p>Options</p> <p>■ Parts kits: O-ring kits provides O-rings only, and repair kits provide O-rings, guide bushings and soft parts. Kits are available for standard and high temperature or for low temperature applications ■ Unit is field reversible</p>
Double Acting	Spring Return																								
EDA 25	ESA 25																								
EDA 40	ESA 40																								
EDA 65	ESA 65																								
EDA 100	ESA 100																								
EDA 200	ESA 200																								
EDA 350	ESA 350																								
EDA 600	ESA 600																								
EDA 950	ESA 950																								
EDA 1600	ESA 1600																								
PDA 2500	PSA 2505																								
PDA 4000	PSA 4005																								

1. The pressure-temperature limits in this manual and any applicable code or standard installation should not be exceeded.

2. For more information, contact your Emerson Process Management sales office.

Description

The Type 1035 actuator is a rack-and-pinion, pneumatic quarter-turn actuator. The actuator utilizes a double rack and single pinion design (see figure 2). The actuator uses three carbon filled PTFE guide bands, with a balanced piston which prevents metal-to-metal contact between the pistons and cylinder wall.

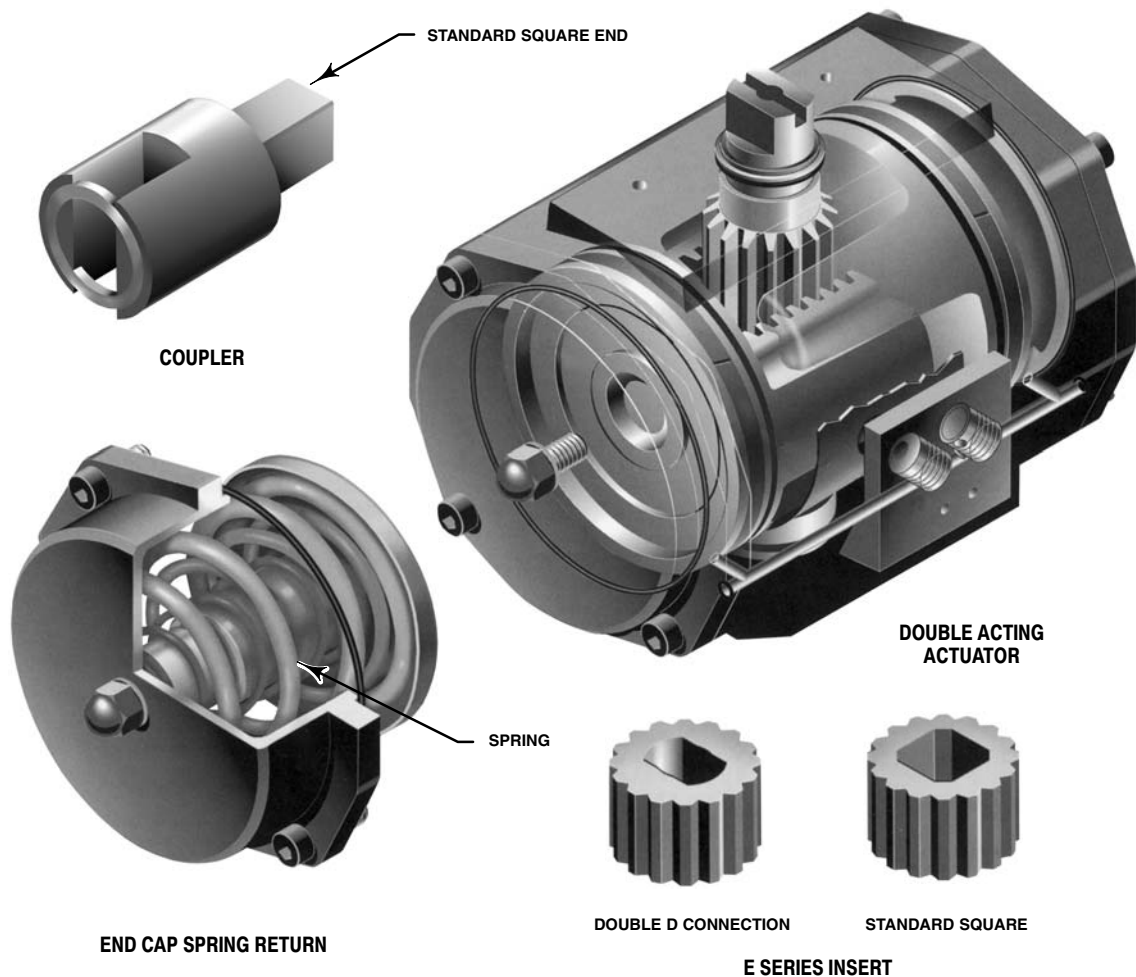
The E Series actuator uses a recessed bushing

inserted into the end of the actuator drive shaft. Standard recessed double-D bushings match the Type A41 valve drive shaft. In most applications, the valve shaft is inserted directly into the recessed actuator shaft bushing. The P Series actuators provide a recessed square output shaft for coupling the actuator to the valve shaft. The Type A41 valve uses a square-to-double-D drive coupler construction. Optional couplings are available for other applications.

Table 2. Performance Characteristics

E SERIES ACTUATOR SIZE	BORE		STROKE		AVERAGE STROKE TIME (SEC) ⁽¹⁾	FREE AIR VOLUME ⁽²⁾			FREE AIR VOLUME ⁽²⁾
	mm	Inch	mm	Inch		Port "A"(liter)	Port "A"(in ³)	Port "B"(liter)	
E25	56	2.2	15.7	0.62	0.5	0.1	6.1	0.11	6.7
E40	70	2.8	18.8	0.74	0.7	0.16	9.8	0.22	13.4
E85	80	3.1	22.0	0.87	1.1	0.33	20.1	0.36	22.0
E100	91	3.6	25.1	0.99	1.2	0.35	21.4	0.49	29.9
E200	110	4.3	37.7	1.48	2.2	0.8	48.8	1.0	61.0
E350	145	5.7	37.7	1.48	3.7	1.8	110	1.9	116
E600	175	6.9	44.0	1.73	3.3	2.9	177	3.1	189
E950	200	7.9	50.3	1.98	5.4	4.7	287	4.9	299
E1600	230	9.1	62.8	2.47	5.8	7.3	445	8.0	488
P2500/P2505	300	11.8	56.5	2.22	6.7	8.0	488	9.3	567
P4000/P4005	325	12.8	81.7	3.22	12.4	13.5	824	17.5	1068

1. These times assume smaller solenoids for smaller actuators and larger solenoids for larger actuators with varying Cvs, but a constant air supply pressure of 80 psi (5.51 bar). E25 to E350 assume a 0.09 Cv (0.08 Kv); E600 & E9500 a 0.26 Cv (0.22 Kv); E1600, P2505 & P4005 a 0.51 Cv (0.44 Kv).
2. To calculate air consumption per stroke multiply free air volume X air supply pressure (absolute).



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Figure 2. Typical Actuator Assembly

1035/EI-O-Matic Actuator

Table 3. Approximate Weights

ACTUATOR SIZE	kg		lbs	
	EDA	ESA	EDA	ESA
E25	1.2	1.7	2.7	3.7
E40	1.8	2.4	4.0	5.3
E65	2.4	3.6	5.3	7.9
E100	2.8	4.6	6.1	10.1
E200	5.8	9.1	12.8	20.1
E350	10.4	16.9	22.9	37.3
E600	19.4	27.6	42.8	60.8
E900	26.4	38.6	58.2	85.0
E1600	42.7	65.8	94.1	145
P2500/P2505	56.7	88.0	125	194
P4000/P4005	86.2	132.0	190	291

Table 4. Bolting Torques between 1035 and Yoke

ACTUATOR SIZE	Bolt Diameter, Inches	Torque, N•m	Torque, lbf•ft
E25	1/4	11	8.3
E40 E65 E100	5/16	22	16.5
E200 E350	3/8	39	29
E600	1/2	91	67
E950	5/8	163	120
E1600	3/4	258	190
P2500/P2505 P4000/P4005	3/4	203	150

Installation

When an actuator and a valve are shipped together, the actuator is normally mounted on the valve. Follow the valve body instructions when installing the control valve in the pipeline. If the actuator is shipped separately from the valve or if it is necessary to mount the actuator on the valve, perform the procedures in the Actuator Mounting section.



WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage caused by bursting of pressure-retaining parts, be certain the service conditions do not exceed the limits given in table 1. Use pressure-limiting devices or

pressure-relieving devices to prevent the cylinder pressure from exceeding these limits.

If hoisting the valve and actuator assembly or the actuator by itself, take precautions to prevent people from being injured in case the hoist or sling slips unexpectedly. Refer to table 3 for actuator weights. Carefully position the sling to prevent damage to tubing or any accessories.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Actuator Mounting

Use the following steps to connect a valve and actuator that has been ordered separately.

The Type 1035 E Series is offered with a Double D insert as standard to allow direct coupling to the Type A41 valve drive shaft. A few actuator/valve combinations will require the use of an external coupler: E100 with a 1-inch drive shaft, E200 and E350 with a 1-1/2-inch drive shaft.

P Series applications, the actuators feature an ISO 5211 recessed square drive shaft and requires an external coupler to engage the valve drive shaft. P Series actuators also require the use of a Limit Stop Plate (LSP) if a Type 1080 Declutchable Manual actuator is not being used.

Assemble the bracket, actuator, LSP (if necessary) and valve assembly as follows:

1. Rotate the valve drive shaft to the position necessary to match the valve/actuator operation. See figure 3 for mounting style codes and positions.
2. Attach the yoke/mounting bracket to the actuator or the LSP (if necessary). Do not fully tighten cap screws at this time. You will need to align the valve and actuator, or valve, coupler, LSP and actuator before tightening the mounting screws to the required torque. The 5/8-inch screws should not be used to mount the actuator to the yoke/mounting bracket. These screws are only to be used for mounting the LSP. Only the 3/4-inch screws are to

be used to mount the actuator to the yoke/mounting actuator.

 **WARNING**

Exceeding any torque requirement may impair the safe operation of this actuator by causing broken or damaged parts. Refer to table 4 for bolting torque requirements.

The LSP, if used, will also have to be attached to the Type 1035. Use 4 screws for size P2500/P2505 and 8 screws for size P4000/P4005. The bolting torque for these 5/8-inch screws will be 10.2 N•m (90 in•lb).

3. The P Series and a few E Series actuator combinations require a coupler. Insert the square end of the coupler into the drive shaft recess in the actuator, making sure the coupler engages properly.
4. Lower the actuator, and coupling assembly onto the valve, making sure that the male valve stem engages into the coupler or insert.
 - a. Secure the mounting bracket to the valve using cap screws and lock washers provided in the mounting kit.
 - b. At this time, make sure that the actuator is in the operation mode desired, and that the valve is in the correct position required for your application.
5. For E Series actuators with Type A41 valves, insert the valve drive shaft end (double-D) into the recessed insert.
6. Align the valve shaft with the actuator drive shaft by changing the positioning on the mounting bracket between them.

Operation

Units supplied from the factory as an assembly are adjusted per specifications supplied to the factory on the original order.

Unless the valve/actuator assembly has been damaged during shipment, or the actuator removed for maintenance, the assembly should be factory adjusted and ready for service.

Actuator Orientation: The Type 1035 actuator is normally installed with its major axis parallel to the pipeline (see code A, figure 3). However, the actuator can also be oriented 90 degrees to the pipeline. See figure 3 for standard and optional orientations. (Note: Code B is not available in the E Series.)

The P or E Series actuator drive shaft turns a full 90 degrees and the stroke is adjustable for the valve closed position. When necessary, refer to the actuator adjustment steps in this manual.

Note

The Type A41 High Performance Butterfly valve should not be turned by the power actuator more than 90 degrees of rotation. Pre-adjust actuator stops to limit travel to 90 degrees or less until adjustment steps are completed.

A double acting actuator can be changed in the field to a spring return unit, or vice-versa (requires different end caps). Code A actuators can be converted to a code D unit by turning the pistons 180 degrees from the position shown for code A (See figure 3 for piston and shaft orientation).

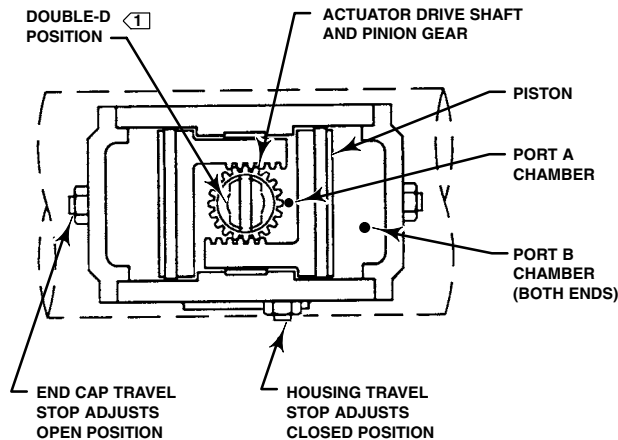
Adjustments

E Series actuators provide end cap adjustment screws to limit outward travel of the piston. The inward movement of the piston is limited by the housing stop (see figure 4).

P Series actuators have a Limit Stop Plate option (LSP) which is used with standard actuator constructions. The LSP is not used when a Type 1080 is used. The LSP, or the Type 1080, limits travel in either direction for any construction. Refer to figure 4.

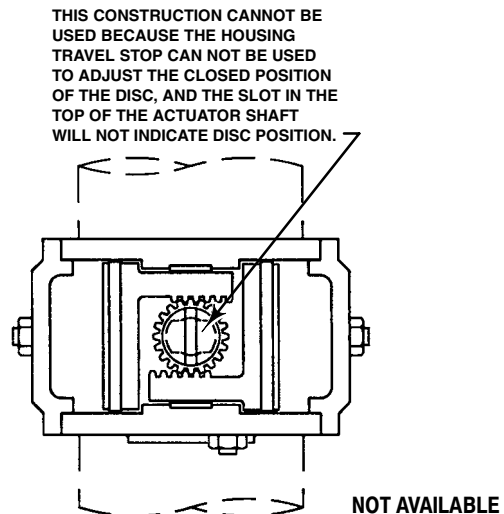
To adjust the travel stops, refer to the valve instruction manual for open and closed positions of the valve. Upon assembly, ensure that the power actuator does not drive the valve past 90 degrees of rotation. Valve component parts can be damaged if high actuator air pressure is applied past 90 degrees. Travel limits must be set in the actuator, not in the valve. It is recommended that the valve be out of the pipeline when adjusting travel limits.

1035/El-O-Matic Actuator



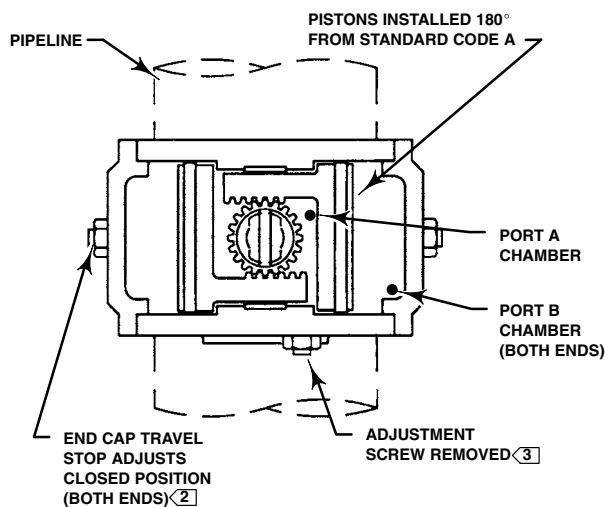
CODE A STANDARD CONSTRUCTION

- CODE A VALVE-ACTUATOR POSITION IS SHOWN.
- ACTUATOR IS PARALLEL WITH PIPELINE (TOP VIEW).
- AIR AT PORT A ROTATES PINION GEAR CCW, AND AIR AT PORT B ROTATES PINION CW.
- HOUSING TRAVEL STOP ADJUSTS VALVE CLOSED POSITION, AND END CAP TRAVEL STOP ADJUSTS VALVE OPEN POSITION.



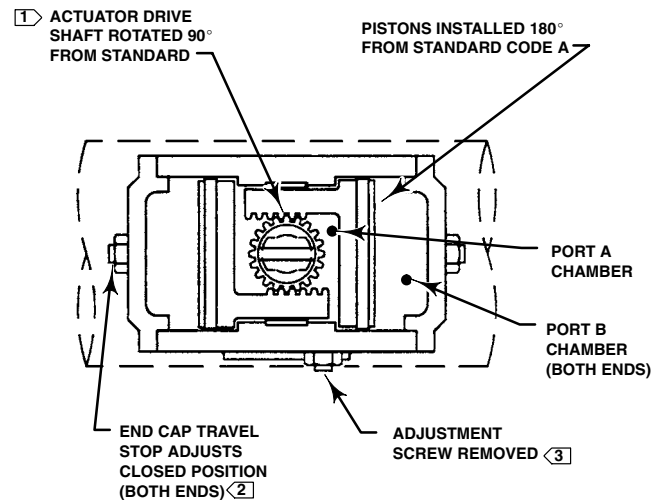
CODE B CONSTRUCTION

- CODE B VALVE-ACTUATOR POSITION IS SHOWN.
- NOT AVAILABLE.



CODE C OPTIONAL CONSTRUCTION

- CODE C VALVE-ACTUATOR POSITION IS SHOWN.
- ACTUATOR IS PERPENDICULAR WITH PIPELINE.
- AIR AT PORT A ROTATES PINION GEAR CW, AND AIR AT PORT B ROTATES PINION CCW.
- END CAP TRAVEL STOP ADJUSTS VALVE CLOSED POSITION, AND HOUSING STOP IS NOT AVAILABLE.



CODE D OPTIONAL CONSTRUCTION

- CODE D VALVE-ACTUATOR POSITION IS SHOWN.
- ACTUATOR IS PARALLEL WITH PIPELINE (TOP VIEW).
- AIR AT PORT A ROTATES PINION GEAR CW, AND AIR AT PORT B ROTATES PINION CCW.
- END CAP TRAVEL STOP ADJUSTS VALVE CLOSED POSITION, AND HOUSING STOP IS NOT AVAILABLE.

NOTES:

- 1 DRAWING SHOWS THE ORIENTATION OF THE DOUBLE-D VALVE CONNECTION ON THE SHAFT WITH RESPECT TO THE SLOT IN THE TOP OF THE DRIVE SHAFT.
- 2 ADJUST THE TRAVEL STOP SCREWS EQUALLY ON BOTH ENDS OF THE ACTUATOR.
- 3 FROM A STANDARD CONSTRUCTION CODE A, REMOVE HOUSING ADJUSTMENT SCREW AND LOCKNUT, AND REPLACE IT WITH A CAP SCREW FOR CODE C AND D.

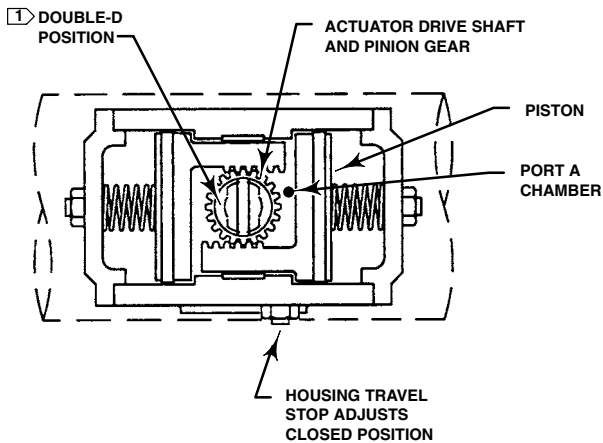
E SERIES DOUBLE ACTING ACTUATOR CODES

Figure 3. Mounting Style Codes and Positions (Section 1)

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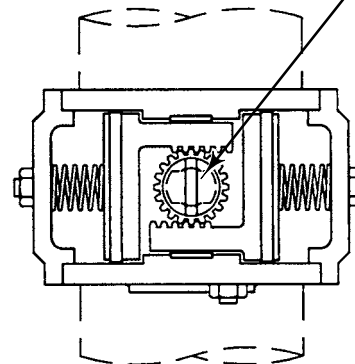
1035/El-O-Matic Actuator



CODE A STANDARD CONSTRUCTION

- CODE A VALVE-ACTUATOR POSITION IS SHOWN.
- ACTUATOR IS PARALLEL WITH PIPELINE (TOP VIEW).
- AIR AT PORT A ROTATES PINION GEAR CCW, AND SPRING COMPRESSION ROTATES PINION CW.
- SPRING FAILS DISC TO CLOSED POSITION.
- HOUSING TRAVEL STOP ADJUSTS VALVE CLOSED POSITION, AND END CAP TRAVEL STOP ADJUSTS VALVE OPEN POSITION.

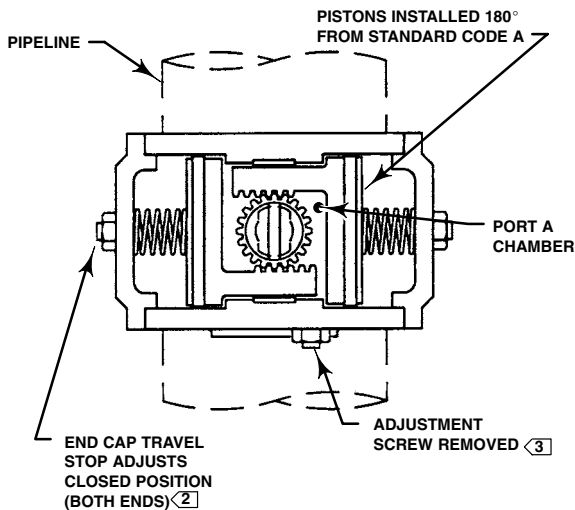
THIS CONSTRUCTION CANNOT BE USED BECAUSE THE HOUSING TRAVEL STOP CAN NOT BE USED TO ADJUST THE CLOSED POSITION OF THE DISC, AND THE SLOT IN THE TOP OF THE ACTUATOR SHAFT WILL NOT INDICATE DISC POSITION.



NOT AVAILABLE

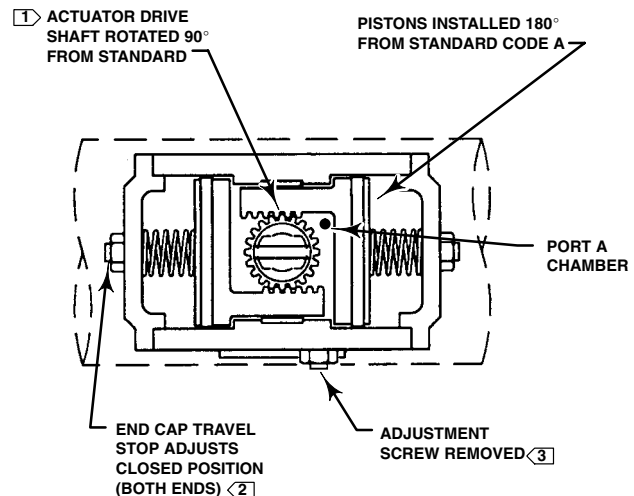
CODE B CONSTRUCTION

- CODE B VALVE-ACTUATOR POSITION IS SHOWN.
- NOT AVAILABLE.



CODE C OPTIONAL CONSTRUCTION

- CODE C VALVE-ACTUATOR POSITION IS SHOWN.
- ACTUATOR IS PERPENDICULAR WITH PIPELINE.
- AIR AT PORT A ROTATES PINION GEAR CW, AND SPRING COMPRESSION ROTATES PINION CCW.
- SPRING FAILS DISC TO OPEN POSITION.
- END CAP TRAVEL STOP ADJUSTS VALVE CLOSED POSITION, AND HOUSING STOP IS NOT AVAILABLE.



CODE D OPTIONAL CONSTRUCTION

- CODE D VALVE-ACTUATOR POSITION IS SHOWN.
- ACTUATOR IS PARALLEL WITH PIPELINE (TOP VIEW).
- AIR AT PORT A ROTATES PINION GEAR CW, AND SPRING COMPRESSION ROTATES PINION CCW.
- SPRING FAILS DISC TO OPEN POSITION.
- END CAP TRAVEL STOP ADJUSTS VALVE CLOSED POSITION, AND HOUSING STOP IS NOT AVAILABLE.

NOTES:

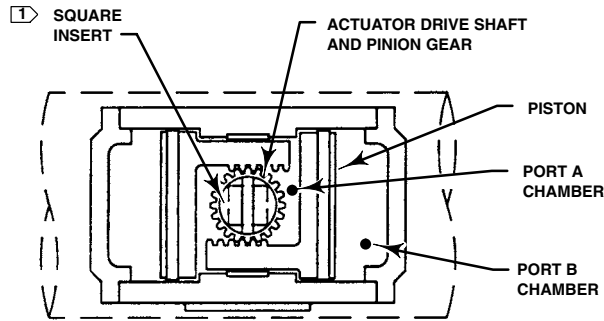
- 1 DRAWING SHOWS THE ORIENTATION OF THE DOUBLE-D VALVE CONNECTION ON THE SHAFT WITH RESPECT TO THE SLOT IN THE TOP OF THE DRIVE SHAFT.
- 2 ADJUST THE TRAVEL STOP SCREWS EQUALLY ON BOTH ENDS OF THE ACTUATOR.
- 3 FROM A STANDARD CONSTRUCTION CODE A, REMOVE HOUSING ADJUSTMENT SCREW AND LOCKNUT, AND REPLACE IT WITH A CAP SCREW FOR CODE C AND D.

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E SERIES SPRING RETURN ACTUATOR CODES

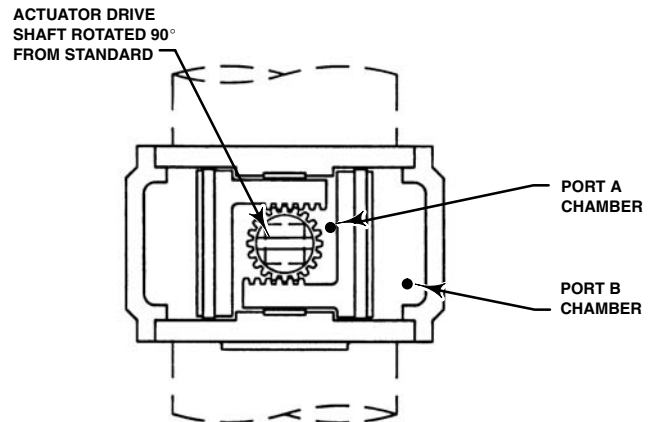
Figure 3. Mounting Style Codes and Positions (Section 2)

1035/El-O-Matic Actuator



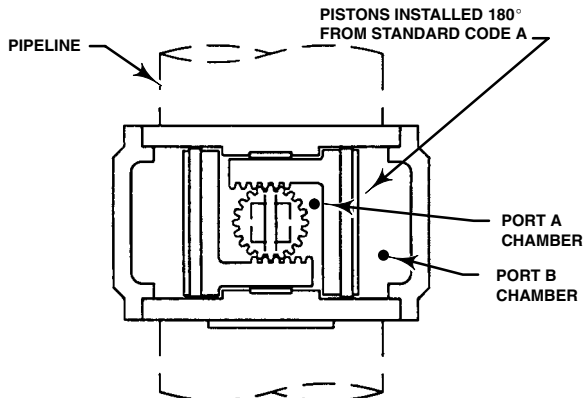
CODE A STANDARD CONSTRUCTION

- CODE A VALVE-ACTUATOR POSITION IS SHOWN.
- ACTUATOR IS PARALLEL WITH PIPELINE (TOP VIEW).
- AIR AT PORT A ROTATES PINION GEAR CCW, AND AIR AT PORT B ROTATES PINION CW.
- LIMIT STOP PLATE ADJUSTS BOTH OPEN AND CLOSE POSITIONS. LSP IS MOUNTED BETWEEN ACTUATOR AND MOUNTING BRACKET. SEE FIGURE 4 FOR DETAILS.



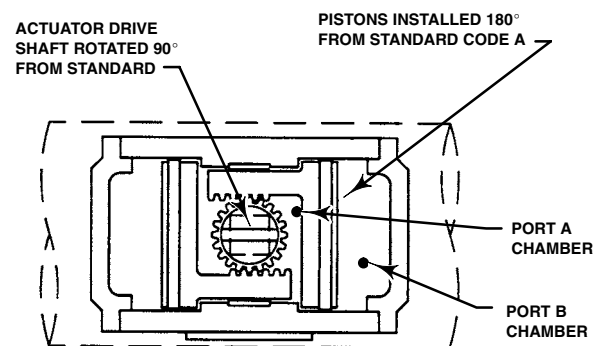
CODE B OPTIONAL CONSTRUCTION

- CODE B VALVE-ACTUATOR POSITION IS SHOWN.
- ACTUATOR IS PERPENDICULAR WITH PIPELINE.
- AIR AT PORT A ROTATES PINION GEAR CCW, AND AIR AT PORT B ROTATES PINION CW.
- LIMIT STOP PLATE ADJUSTS BOTH OPEN AND CLOSE POSITIONS. LSP IS MOUNTED BETWEEN ACTUATOR AND MOUNTING BRACKET. SEE FIGURE 4 FOR DETAILS.



CODE C OPTIONAL CONSTRUCTION

- CODE C VALVE-ACTUATOR POSITION IS SHOWN.
- ACTUATOR IS PERPENDICULAR WITH PIPELINE.
- AIR AT PORT A ROTATES PINION GEAR CW, AND AIR AT PORT B ROTATES PINION CCW.
- LIMIT STOP PLATE ADJUSTS BOTH OPEN AND CLOSE POSITIONS. LSP IS MOUNTED BETWEEN ACTUATOR AND MOUNTING BRACKET. SEE FIGURE 4 FOR DETAILS.



CODE D OPTIONAL CONSTRUCTION

- CODE D VALVE-ACTUATOR POSITION IS SHOWN.
- ACTUATOR IS PARALLEL WITH PIPELINE (TOP VIEW).
- AIR AT PORT A ROTATES PINION GEAR CW, AND AIR AT PORT B ROTATES PINION CCW.
- LIMIT STOP PLATE ADJUSTS BOTH OPEN AND CLOSE POSITIONS. LSP IS MOUNTED BETWEEN ACTUATOR AND MOUNTING BRACKET. SEE FIGURE 4 FOR DETAILS.

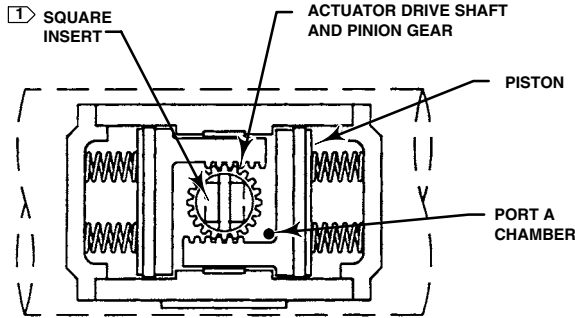
NOTES:

1 DRAWING SHOWS THE ORIENTATION OF THE SQUARE INSERT VALVE CONNECTION ON THE SHAFT WITH RESPECT TO THE SLOT IN THE TOP OF THE DRIVE SHAFT.

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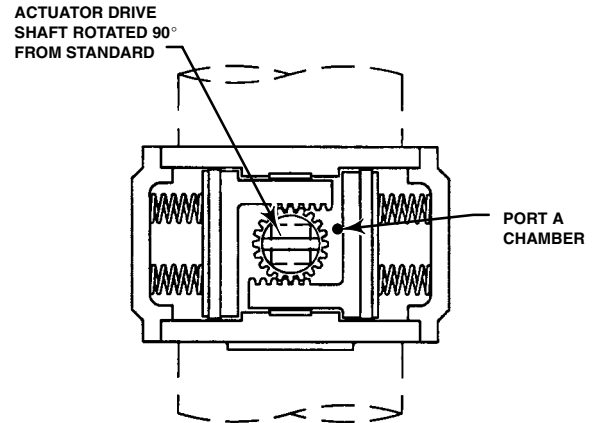
P SERIES DOUBLE ACTING ACTUATOR CODES

Figure 3. Mounting Style Codes and Positions (Section 3)



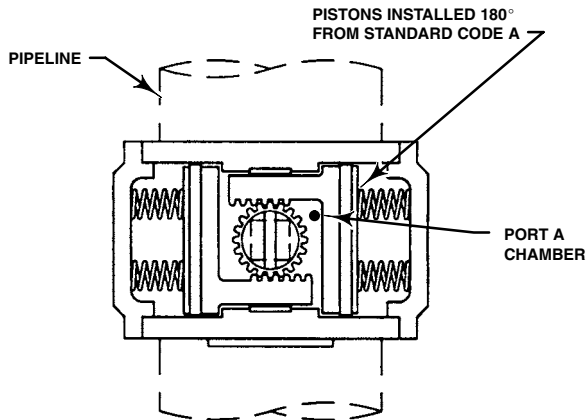
CODE A STANDARD CONSTRUCTION

- CODE A VALVE-ACTUATOR POSITION IS SHOWN.
- ACTUATOR IS PARALLEL WITH PIPELINE (TOP VIEW).
- AIR AT PORT A ROTATES PINION GEAR CCW, AND SPRING COMPRESSION ROTATES PINION CW.
- SPRING FAILS DISC TO CLOSED POSITION.
- LIMIT STOP PLATE ADJUSTS BOTH OPEN AND CLOSE POSITIONS. LSP IS MOUNTED BETWEEN ACTUATOR AND MOUNTING BRACKET. SEE FIGURE 4 FOR DETAILS.



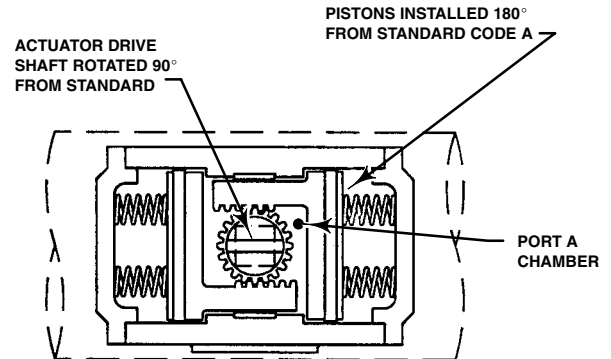
CODE B CONSTRUCTION

- CODE B VALVE-ACTUATOR POSITION IS SHOWN.
- ACTUATOR IS PERPENDICULAR WITH PIPELINE.
- AIR AT PORT A ROTATES PINION GEAR CCW, AND SPRING COMPRESSION ROTATES PINION CW.
- SPRING FAILS DISC TO CLOSED POSITION.
- LIMIT STOP PLATE ADJUSTS BOTH OPEN AND CLOSE POSITIONS. LSP IS MOUNTED BETWEEN ACTUATOR AND MOUNTING BRACKET. SEE FIGURE 4 FOR DETAILS.



CODE C OPTIONAL CONSTRUCTION

- CODE C VALVE-ACTUATOR POSITION IS SHOWN.
- ACTUATOR IS PERPENDICULAR WITH PIPELINE.
- AIR AT PORT A ROTATES PINION GEAR CW, AND SPRING COMPRESSION ROTATES PINION CCW.
- SPRING FAILS DISC TO OPEN POSITION.
- LIMIT STOP PLATE ADJUSTS BOTH OPEN AND CLOSE POSITIONS. LSP IS MOUNTED BETWEEN ACTUATOR AND MOUNTING BRACKET. SEE FIGURE 4 FOR DETAILS.



CODE D OPTIONAL CONSTRUCTION

- CODE D VALVE-ACTUATOR POSITION IS SHOWN.
- ACTUATOR IS PARALLEL WITH PIPELINE (TOP VIEW).
- AIR AT PORT A ROTATES PINION GEAR CW, AND SPRING COMPRESSION ROTATES PINION CCW.
- SPRING FAILS DISC TO OPEN POSITION.
- LIMIT STOP PLATE ADJUSTS BOTH OPEN AND CLOSE POSITIONS. LSP IS MOUNTED BETWEEN ACTUATOR AND MOUNTING BRACKET. SEE FIGURE 4 FOR DETAILS.

NOTES:

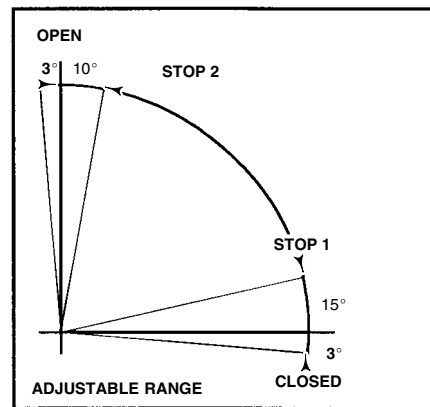
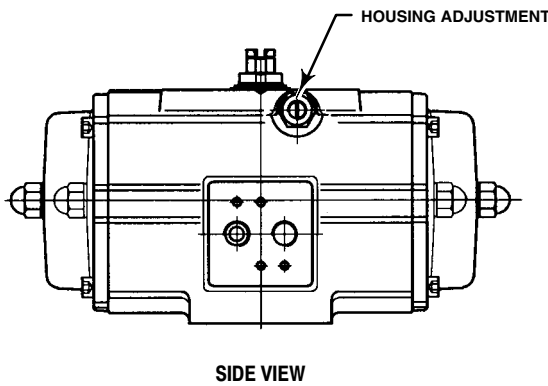
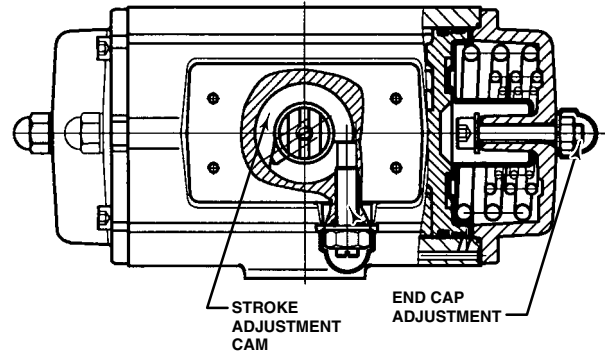
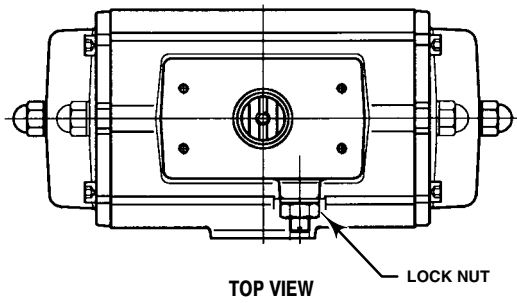
1 DRAWING SHOWS THE ORIENTATION OF THE SQUARE INSERT VALVE CONNECTION ON THE SHAFT WITH RESPECT TO THE SLOT IN THE TOP OF THE DRIVE SHAFT.

P SERIES SPRING RETURN ACTUATOR CODES

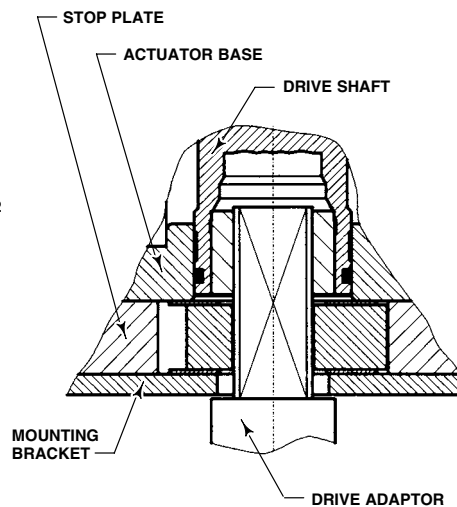
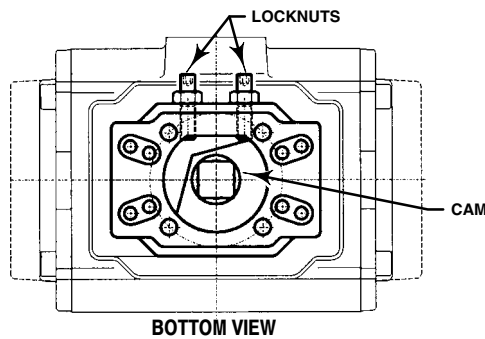
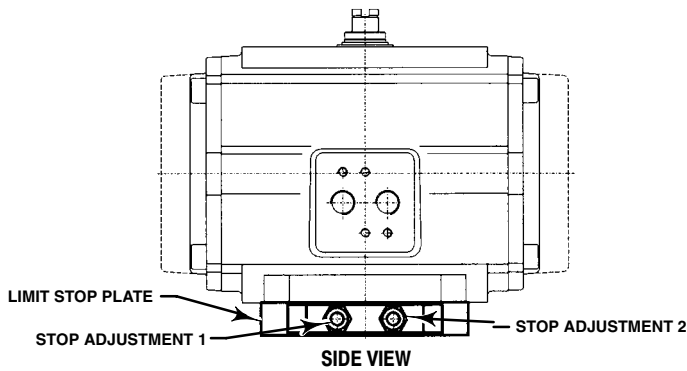
Figure 3. Mounting Style Codes and Positions (Section 4)

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1035/EI-O-Matic Actuator



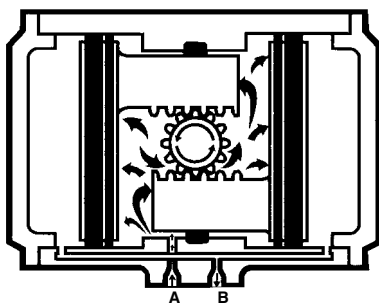
DUAL STOP DETAIL FOR E-SERIES ACTUATORS



LIMIT STOP PLATE DETAIL FOR P SERIES ACTUATORS

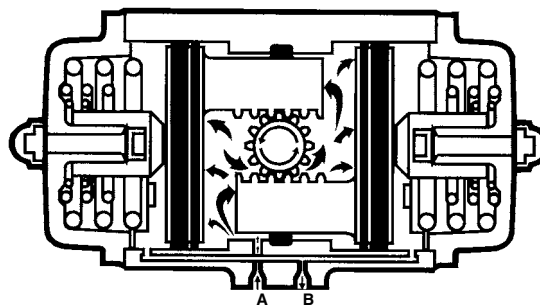
Figure 4. Travel Stop Adjustments

ELO A 1.501.05 5/96
ELO A 1.503.05 5/96
A6952-1 / IL



DOUBLE ACTING

A7047 / IL



SPRING RETURN

Figure 5 . Code A Assemblies

Troubleshooting

If the actuator does not function, make the following checks:

1. Check for worn teeth on piston racks, if the actuator exhibits excessive amounts of backlash. If worn, replace piston/gear rack assembly.
2. Check supply pressure to ensure the air supply is reaching the actuator. Place a gauge in the line at the inlet of the actuator. Monitor the gauge for unexpected pressure drops when operating pressure is applied to the actuator.
3. Check piston seal leakage. **For spring return actuators**, piston seal leakage will show at port B when port A is pressurized. **For double acting actuators**, piston seal leakage will show at port B when port A is pressurized, or vice versa.
4. Check actuator movement. Remove the actuator from the valve. Apply reduced air pressure [0.7 to 1.0 bar (10 to 15 psi) for double acting, or 1.4 to 2.0 bar (20 to 30 psi) for spring return] to see if the actuator will cycle under a no-load condition.

- If the actuator cycles under a no-load condition, please refer to the valve instruction manual for valve troubleshooting or contact your Emerson Process Management sales office.
- If the spring set number is 5 or 6, it may not cycle with the reduced air pressure amounts listed above and may require retesting with up to 5.5 bar (80 psi) to stroke a full 90 degrees.
- If the actuator does not cycle, disassemble the actuator using the Actuator Disassembly procedures. Inspect and replace parts as necessary.

If the actuator and valve are moving freely, reassemble the valve/actuator assembly and re-test.

If unit still fails to operate, consult your Emerson Process Management sales office for assistance.

Maintenance

Actuators parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions. Instructions are given in subsequent sections for disassembly and assembly of the actuator and for inspecting the actuator parts.

WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- **Disconnect any operating lines providing air pressure, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve during maintenance.**
- **Use bypass valves or completely shut off the process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the power actuator loading pressure and relieve any actuator spring precompression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you are work on the equipment.**
- **Always wear protective gloves, clothing and eyewear when performing**

1035/EI-O-Matic Actuator

any maintenance operations to avoid personal injury.

- The valve packing area may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline.* Process fluids may spray out under pressure when removing the packing hardware or packing rings.

- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Actuator Disassembly

Remove the actuator from the valve, and remove any other auxiliary equipment from the actuator. (Note the positions of the mounting bracket and accessories for re-assembly). Steps explaining the disassembly and assembly of parts apply to both ends of the actuator. If necessary, refer to the valve instruction manual for removing and replacing the valve in the pipeline.

Key numbers are shown in figure 11 for E Series, and figure 12 for P Series actuators, unless otherwise noted.

CAUTION

Butterfly valves must be in the closed position before attempting to remove them from the pipeline. The valve disc can be damaged if the disc is not moved to the closed position.

1. Remove the actuator mounting bracket and any accessories.
2. When removing the actuator end caps, carefully follow the steps below.

Operationally check the actuator to ensure that the pistons are moved all the way to the center (towards

the drive shaft), before removing the actuator end caps. Use the index mark on the top of the drive shaft (see figure 4).

a. For Double Acting E and P Series

Actuators: Remove socket head screws from both end caps with a metric hex key. After the screws are removed, gently pry off each end cap. Be careful not to damage the end cap sealing surfaces.

b. For Spring Return E Series Actuators

It is very important to ensure that the springs are fully extended by retracting the piston (key 2) inwards toward the drive shaft (key 3). Refer to figure 6.

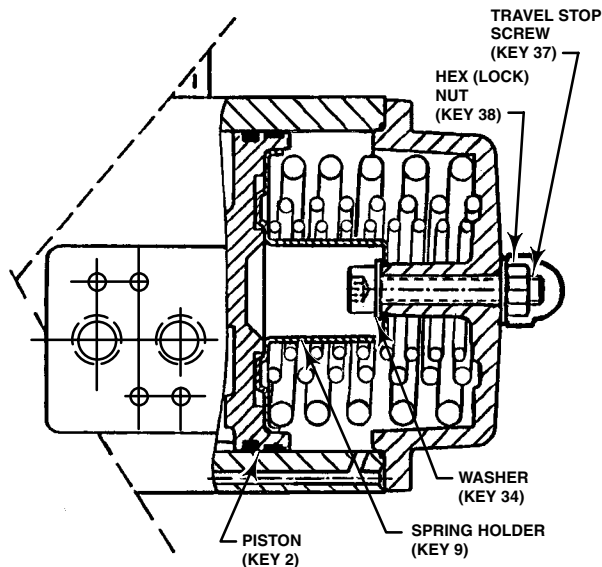
WARNING

The pre-loaded spring pressure rests on the pistons when they are extended outward. If the end cap screws are removed before the spring loading is reduced, the end cap (key 5) can fly off the end of the actuator causing personal injury or property damage.

Ensure that the pistons are moved fully toward the drive shaft. If this is not possible, provide a means of containing the end cap while removing the socket head cap screws.

The springs are retained within the end cap by the spring holder (key 9).

- Unscrew end cap socket head screws (key 36) a few turns. Be sure the spring compression is resting on the socket head cap screws. Equally release the spring compression while removing the socket head cap screws. The spring precompression should be released before the screws are completely removed. Remove the spring cap assembly from the actuator body.



NOTE:
THE PISTON IS SHOWN IN THE FULLY RETRACTED POSITION. SPRINGS ARE FULLY EXTENDED AND CONTAINED WITHIN THE SPRING HOLDER BY THE WASHER (KEYS 9 AND 34). THE WASHER KEEPS THE SPRING RETAINER CONNECTED TO THE END CAP.

ELO A4.204.03
A7038 / IL

Figure 6. Spring Return End Cap Assembly

Note

If re-using springs, mark the springs and their location during disassembly. The springs must be replaced in the same location as removed when re-assembling the actuator (see figure 8).

- Disassembly of the spring end cap assembly: Remove the nut cover (key 42). Remove the hex (lock) nut, washer, and O-ring (keys 38, 22, and 29). Spring precompression on the spring holder is released while unscrewing the travel stop screw (key 37). When the travel stop screw (key 37) is removed from the end cap assembly, it will release the spring clip, washer (key 34), and spring(s) (key 9, 34, and 6, 7, and 8 if used). If reusing springs, return them to the same location as removed. If replacing springs, replace all the springs in both end caps.

c. For Spring Return P Series Actuators

It is very important to ensure that the springs are fully extended by retracting the piston (key 2) inwards toward the drive shaft (key 3).

Operationally check the actuator to ensure that the pistons are moved all the way to the center (towards the drive shaft), before removing the socket head cap screws (key 25, figure 12). Read the steps in this sub-section before removing the end cap screws (key 25).

WARNING

The pre-loaded spring pressure rests on the pistons when they are extended outward. If the end cap screws are removed **before** the spring loading is reduced, the end cap (key 5) can fly off the end of the actuator causing personal injury or property damage.

Ensure that the pistons are moved fully toward the drive shaft. If this is not possible, provide a means of containing the end cap while removing the socket head cap screws.

- The springs are in-between the end cap and piston. Be careful when removing the end cap as the springs may fall out of the body or end cap. If reusing the springs, re-install them in the same position as removed.
- On a flat working surface, block-up the actuator so it is vertical to avoid the springs falling out of the actuator while removing the end cap. Repeat on both ends of the actuator.

Note

If re-using springs, mark the springs and their location during disassembly. The springs must be replaced in the same location as removed when re-assembling the actuator (see figure 9).

- Unscrew end cap socket head screws (key 25) a few turns. Be sure the spring compression is resting on the socket head cap screws. Equally release the spring compression while removing the socket head cap screws. The spring precompression should be released before the screws are completely removed. Remove the spring cap assembly from the actuator body.

3. Clean, inspect, and/or obtain replacement parts. When reassembling the actuator, replace all soft parts provided in the Parts Kits listed at the end of this manual.

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4. Remove the adjustable travel stop/ housing adjustment (see figure 4).

5. **Removing the Pistons:** The two pistons (key 2) can now be removed by rotating the drive shaft, moving the piston assemblies outward until the pinion gear has released them.

The gear rack in E Series actuators is machined into the piston, and so does not have to be removed separately. If the gear rack is damaged, replace both pistons.

Removing the Drive Shaft

1. Remove the spring clip (E Series key 35, P Series key 20) with a pin spanner. Use caution, as the spring clip is under a great deal of tension. Also, remove the E Series washers (keys 27 and 21) or P Series washer and O-ring (keys 21 and 19) from the shaft.

2. Remove the drive shaft (E Series key 3, P Series key 5, figures 11 and 12) through the bottom of the actuator.

3. For P Series actuators: remove the Piston Gear Rack. The gear rack in the P Series actuators is a separate part (key 6) and is held in place with a socket head cap screw (key 22). Both gear racks can be removed and replaced by removing them from the pistons.

4. Ensure that all actuator parts are clean and ready for assembly. Inspect the actuator body and component parts for wear or scratches. If the inside wall of the body is scored the actuator will leak. Light traces of scoring, barely detectable to the touch, are acceptable. Obtain replacement parts from your Emerson Process Management sales office.

Actuator Assembly

Repair Kits

Repair kits are available for re-assembly. The large repair kit provides O-rings, guide bands, bushings, and bearings. The small kit provides a set of soft parts only for the actuator. Repair kits are available for standard, low temperature, and high temperature actuators. Refer to the Repair Kits table at the end of this manual.

Lubrication

Refer to the Specifications table for temperature ranges.

Standard and High Temperature Actuator:

Lubricate the actuator moderately with a complex calcium sulphonate grease suitable for the application's temperature range. Use the Parts Kit for the appropriate temperature application.

Low Temperature Actuator: Lubricate the actuator moderately with low temperature silicone grease. Use the Parts Kit for standard and low temperature applications.

Lubricate the actuator moderately with an appropriate grease. Apply a light film of grease to all O-rings, gear racks, bearings, bushings, and guide bands. In the following steps, lubricate all moving parts during re-assembly.

Installing the Drive Shaft

E Series actuators: Some constructions use a Dual Stop arrangement. The housing adjustment screw is used with a pin located in the drive shaft, and a stroking adjustment cam mounted on the shaft for the stop. Ensure the cam is aligned correctly with respect to the housing adjustment screw. Use figure 4 as a guide for alignment.

1. Replace the top and bottom shaft bearings (keys 20 and 12) in the actuator body.

2. Insert the adjustment screw, if applicable, and thread it into the body a few turns, and hand tighten the hex nut. The adjustment screw should be loose enough to allow full travel of the cam and pistons.

3. Place the cam (see figure 4) on the small end of the drive shaft. Position the cam on the shaft so the pin is located in the open section of the cam.

4. Install the O-rings and guide bushing on the drive shaft. The guide bushing may have to be cleaned of grease, rolled tightly around the drive shaft and held in place while inserting into the actuator housing.

CAUTION

When inserting the drive shaft, be sure to keep the O-Rings from becoming trapped and damaged between the pinion and the actuator body. To verify the condition of the O-Rings at the end of the installation, cycle the actuator 5 times and run a soap bubble test on the seal on both the top and bottom of the drive shaft.

Note

Some constructions do not have a housing adjustment screw. If your

construction does not use the adjustment screw, install the drive shaft, and go to step 6 below.

5. Note the alignment of the cam with respect to the housing adjustment screw while installing the shaft into the body. Install the drive shaft.

6. Install the washer, thrust washer, and spring clip (keys 27, 21 and 35) onto the drive shaft. Use the pin spanner carefully to install the spring clip.

7. Go to the Installing Pistons steps below.

P Series Actuators (without a Type 1080) use a Limit Stop Plate (see figure 4) for travel stops. The cam for the travel stops is mounted on the actuator after the actuator is fully assembled.

1. Replace the top and bottom shaft bearings in the actuator body. Install the O-ring and guide bushing in the shaft. The guide bushing may have to be cleaned of grease, rolled tightly around the drive shaft and held in place while inserting into the actuator housing.

2. Insert the small end of the drive shaft (key 5) into the bottom of the actuator housing.

3. Install the thrust washer, and spring clip (keys 21 and 20) onto the drive shaft. Use the pin spanner carefully to install the spring clip.

Installing Pistons

Figure 7 shows the alignment of the slot in the top of the shaft with the pistons for code A constructions. See figure 3 for piston and slot alignment for other constructions.

1. Install the O-ring and guide bushing on both pistons. For P Series actuators: you will need to install the gear racks on the pistons if they were removed.

2. Lightly lubricate parts and inside of actuator bore before final assembly.

3. If you have not already done so, follow the steps in the Installing the Drive Shaft section.

4. Very carefully align the pistons square to the actuator housing.

5. Align the drive shaft so that the teeth on the center gear will "pick-up" the piston assembly rack teeth when turning the top extension of the center gear clockwise.

To ensure proper meshing of teeth, rotate the index mark on the drive shaft 45 degrees beyond the open mark on the top of the housing.

Note

Figure 3 shows the different orientation of the piston in relationship to the slot in the shaft, versus the actuator body.

6. With the piston assemblies in the actuator body, gently push them simultaneously into the housing. Turn the top shaft extension clockwise. At the proper point of engagement between the center gear and piston assemblies, both piston assemblies will move toward the center of the housing.

7. Once the drive shaft and pistons are properly engaged, ensure smooth movement at 90 degree operation can occur without moving the pistons out of the actuator body. Do this by turning the top shaft extension to the closed position and back a few times.

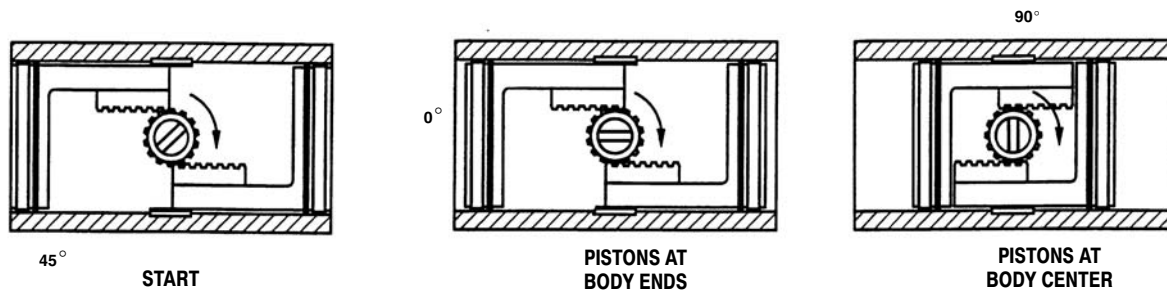
8. If not already done, replace the washer over the top shaft extension. Install the spring clip onto the mating groove on the top shaft extension with a pin spanner.

9. Replace the actuator end caps taking care to properly seal them with O-rings. Use the metric hex keys to replace the socket head screws.

10. The adjustment screw and nut, if applicable, should now be set to stop travel at the desired position.

Changing Rotation Direction

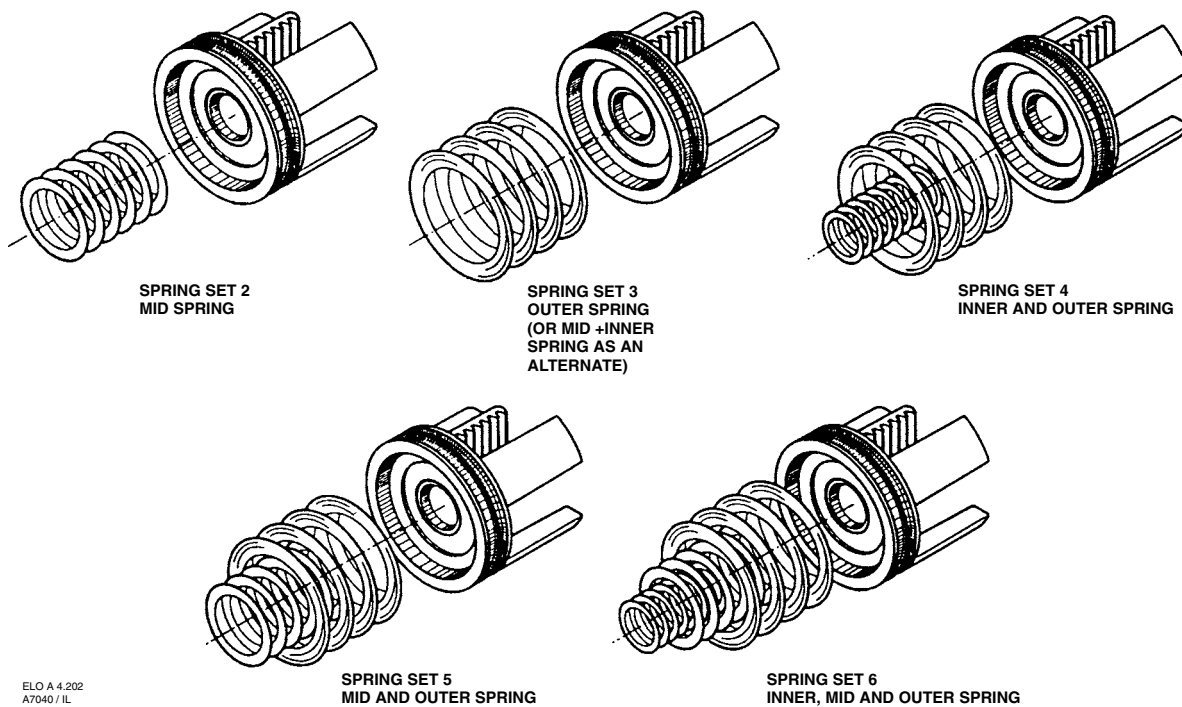
Use the disassembly and assembly procedures provided in this section. In general, you will be removing the pistons, turning them 180 degrees and reinstalling them. This action changes the direction of rotation. In figure 3, compare Code A and Code D piston positions.



NOTE: PISTONS ARE SHOWN IN THE CODE A POSITION

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Figure 7. Installing Actuator Pistons



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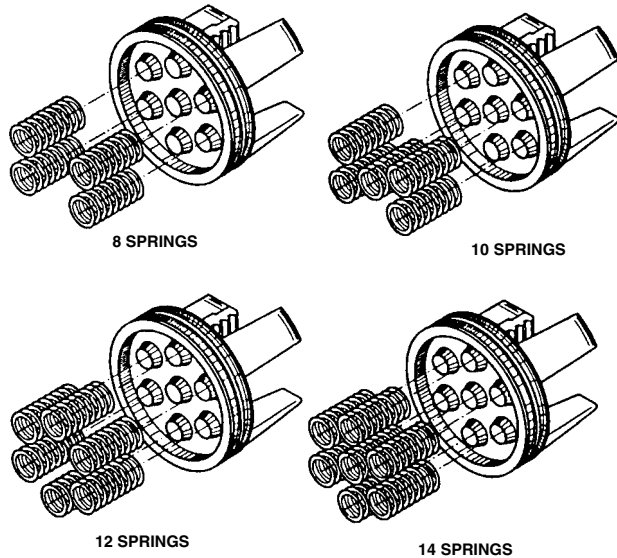
Figure 8. Spring Arrangement for E Series Actuators

Spring Return E Series Actuators

Spring return E Series actuators use from two to a maximum of six springs. One, two, or three springs are inserted into each end cap (see figure 8). Refer to the nameplate to verify the number of springs required.

Each end cap spring pack incorporates a travel stop adjustment screw (key 37). This may be used to adjust the end of the stroke for valve seating in either the “fail open” or “fail closed” arrangements.

1. When installing used springs in a spring return actuator, ensure that the springs are replaced in the identical position from which they were removed.
2. If a spring return actuator is being repaired due to spring failure, replace all the springs in the actuator.
3. To assemble the spring assembly, install the spring(s) into the end cap. Be sure that all springs are seated correctly in the end cap (key 5) and in the spring holder (key 9). Place the spring holder and washer on top of the springs, and install the adjustment screw (keys 34 and 37).



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A7041-1 / IL

Figure 9. Spring Arrangement for P Series Actuators

4. Place the end cap bolts through the retention holes of the end cap. If converting a double acting unit to a spring return unit, be sure to use new end cap screws (key 25, figure 12).
5. Engage the bolts with the tapped holes in the actuator body by forcing down slightly on the cap. Tighten each bolt in small, equal amount of turns, compressing the springs equally.

Spring Return P Series Actuators

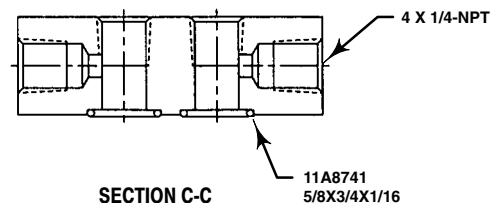
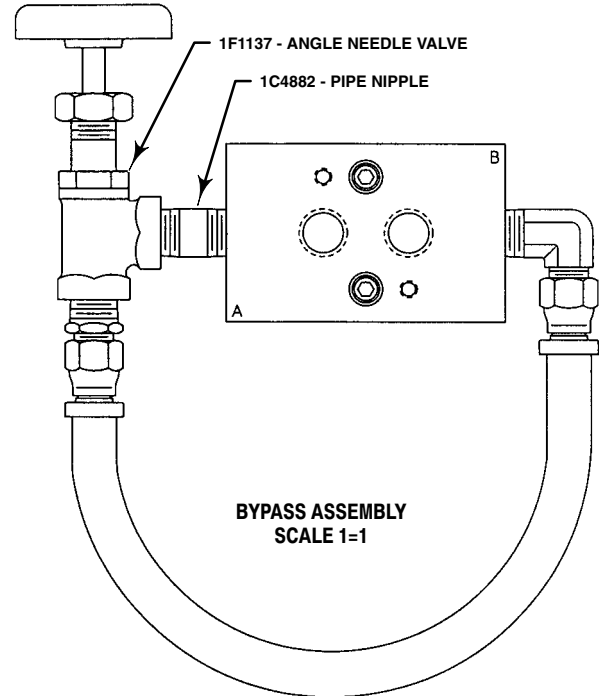
Spring return actuators use from four to a maximum of fourteen springs. One through seven springs are inserted into each end cap (see figure 9). Refer to the nameplate to verify the number of springs required.

1. When installing used springs in a spring return actuator, ensure that the springs are replaced in their identical position in the end cap from where they were removed.

Note

When less than the standard number of seven springs are used in each end cap, the springs should be positioned as shown in figure 9.

2. If a spring return actuator is being repaired due to a failed spring, replace all the springs in the actuator.



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Figure 10. Bypass Valve

3. Ensure that the pistons are stroked fully inward, towards the center of the actuator (this may be done by rotating the actuator shaft with a wrench).
4. When replacing the springs in a P Series spring-return actuator, position the actuator so that it stands on one end.
5. Place the springs on the piston face, engaging them with the alignment nibs cast into the piston.
6. Place the end cap over the springs. Align them with the corresponding nibs which are cast into the end cap.
7. If converting a double acting unit to a spring return unit, be sure to use new end cap screws (key 25, figure 12). Install the end cap screws.
8. Engage the screws with the tapped holes in the actuator body by forcing down slightly on the cap. Tighten each bolt in small, equal amount of turns, compressing the springs equally.

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Installing the Bypass Valve

The optional bypass valve should be used when pressure needs to be stabilized between port A and port B (see figure 10). **The following steps provide installation** of the bypass valve. Removing the bypass valve simply requires performing these steps in the reverse order.

1. Position the O-rings between the bypass block and the Namur mounting area. Attach the screws through the bypass block to the Namur mounting area.
2. Attach the tubing to the fittings.
3. Attach the angle needle valve and the bypass block to the tubing.
4. Pressure the ports and check for leakage. Check the pressure to both ports A and B.

Parts Ordering

Two types of kits are available. The repair kits provide O-rings and guide bushing/bearings, and the O-ring kit provides the O-rings only. Refer to tables 5 and 6 for kit numbers.



WARNING

Use only genuine Fisher® replacement parts. Components that are not supplied by Emerson Process Management should not, under any circumstances, be used in any Fisher valve, because they will void your warranty, might adversely affect the performance of the valve, and could give rise to personal injury and property damage.

Note

Neither Emerson, Emerson Process Management, nor any of their affiliated entities assumes responsibility for the selection, use and maintenance of any product. Responsibility for the selection, use, and maintenance of any product remains with the purchaser and end-user.

Key numbers and part descriptions are shown in tables 7 and 8.

Recommended spare parts are marked with an asterisk (*) following the key number.

Typical actuator assemblies are shown in figures 11 and 12.

When corresponding with your Emerson Process Management sales office, please identify the Actuator as a Type 1035 and provide the actuator serial number located on the nameplate.

Parts Kits

Table 5. Repair Kits

Actuator	Standard Construction Nitrile O-Rings	High Temperature Fluorocarbon O-Rings	Low Temperature EPDM O-Rings
E25	75B0594X012	75B0595X012	75B0596X012
E40	75B0594X022	75B0595X022	75B0596X022
E65	75B0594X032	75B0595X032	75B0596X032
E100	75B0594X042	75B0595X042	75B0596X042
E200	75B0594X052	75B0595X052	75B0596X052
E350	75B0594X062	75B0595X062	75B0596X062
E600	75B0594X122	75B0595X122	75B0596X122
E950	75B0594X132	75B0595X132	75B0596X132
E1600	75B0594X142	75B0595X142	75B0596X142
P2500/P2505	75B0594X102	75B0595X102	75B0596X102
P4000/P4005	75B0594X112	75B0595X112	75B0596X112

Table 6. O-Ring Kits

Actuator	High Temperature Fluorocarbon	Low Temperature EPDM
E25	75B0592X012	75B0593X012
E40	75B0592X022	75B0593X022
E65	75B0592X032	75B0593X032
E100	75B0592X042	75B0593X042
E200	75B0592X052	75B0593X052
E350	75B0592X062	75B0593X062
E600	75B0592X122	75B0593X122
E950	75B0592X132	75B0593X132
E1600	75B0592X142	75B0593X142
P2500/P2505	75B0592X102	75B0593X102
P4000/P4005	75B0592X112	75B0593X112

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Parts Reference

Table 7. E Series Parts List

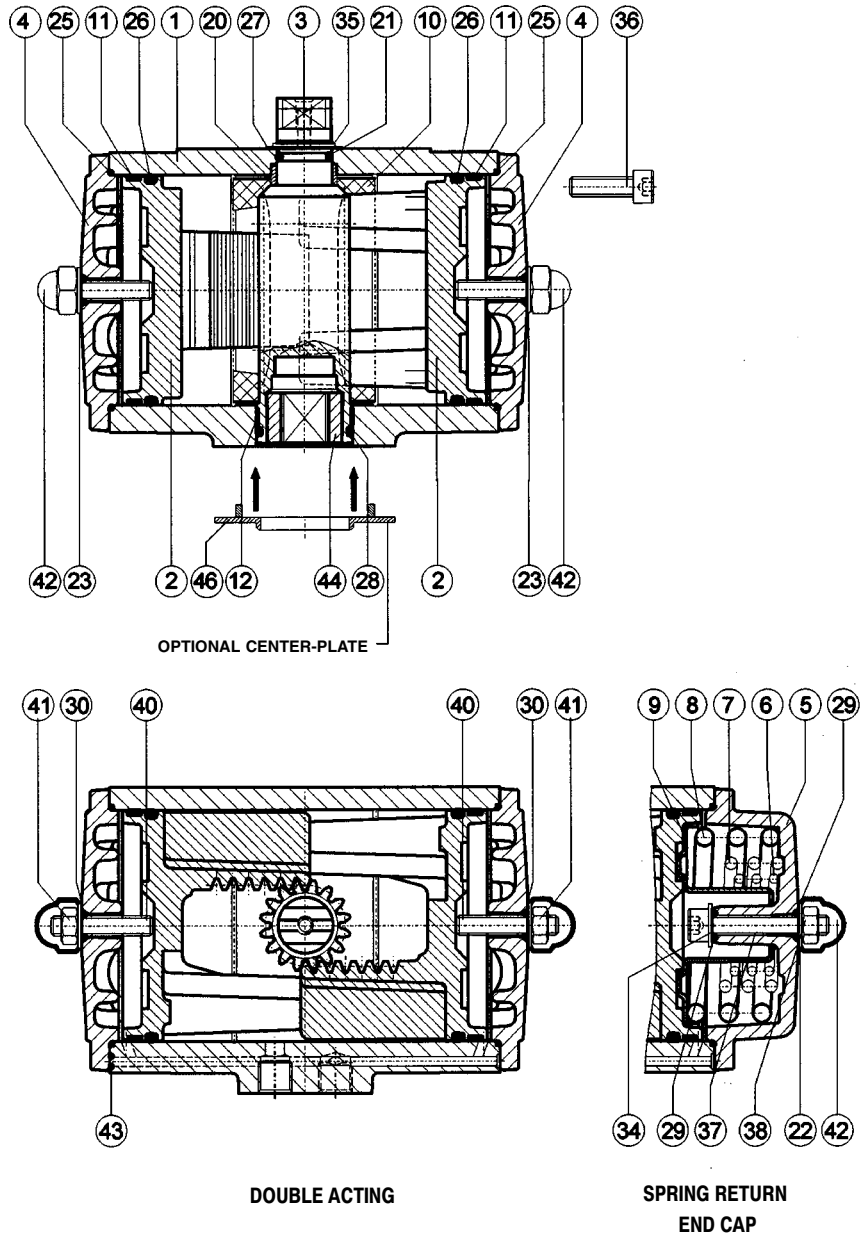
Key Number	Description	Quantity
1	Body, If you need an actuator body (key 1) as a replacement part , order by actuator size, serial number, and desired material. Contact your Emerson sales office.	1
2	Piston, Aluminum alloy	2
3	Drive shaft, Aluminum	1
4	End cap (EDN), Aluminum alloy	2
5	End cap (ESN), Aluminum alloy	2
6	Spring – inner, Steel	2
7	Spring – mid, Steel	2
8	Spring – outer, Steel	2
9	Spring holder, Steel	2
10*	Guide band, Nylon	1
11*	Guide band, PTFE carbon filled	2
12*	Bearing Bushing Bottom, Nylon	1
20*	Top bearing bushing, POM ⁽¹⁾	1
21*	Trust washer, POM ⁽¹⁾	1
22*	Washer, PTF	1
23*	Washer, PTF	1
22*	Body O-ring, Nitrile	2
23*	Piston O-ring, Nitrile	2
25*	End cap O-ring, Nitrile	1
26*	Shaft Bottom O-ring, Nitrile	1
27*	Washer, PTFE	1
28*	O-ring, Nitrile	1
29*	End cap O-ring, Nitrile	2
30*	End cap O-ring, Nitrile	2
34	Washer, steel	2
35*	Spring clip	1
36	Socket Head Cap Screw, Steel	8
37	Travel Stop Screw (ESN), Steel	2
38	Hex nut, Steel	2
39	Nut cover, Polyethylene	2
40	Travel stop screw (EDN), Screw	2
41	Hex nut, steel	2
42	Nut cover, polyethylene	2
43*	O-ring, Nitrile	2
44	Insert	1
---	Housing adjustment screw, steel (figure 4)	1
---	Stroking adjustment cam, steel (figure 4)	1
---	Hex (lock) nut, steel (figure 4)	1
---	Hex (lock) nut, polyethylene (figure 4)	1
---	Lubricant, Standard and High Temperature Construction	CCSG ⁽²⁾
---	Lubricant, Low Temperature Construction	Low Temperature Silicone Grease 1M5964X0012

* Recommended spare parts (contained in a repair kit).
 1. Polyoxymethylene.
 2. Complex Calcium Sulphonate Grease.

Table 8. P Series Parts List

Key Number	Description	Quantity
1	Body, If you need an actuator body (key 1) as a replacement part , order by actuator size, serial number, and desired material. Contact your Emerson sales office.	1
2	Piston, Aluminum alloy	2
3	End cap (EDN), Aluminum alloy	2
4	End cap (ESN), Aluminum alloy	2
5	Central drive shaft, steel	1
6	Gear rack, steel	2
8	Spring, steel	14
9*	Bearing bushing, Nylon	1
10*	Bearing bushing, POM ⁽¹⁾	1
14*	Guide band, PTF	2
15*	Guide band, PTF	2
16*	Piston O-ring, Nitrile	2
17*	End cap O-ring, Nitrile	2
18*	Shaft O-ring, Nitrile	1
19*	Shaft O-ring, Nitrile	1
20*	Spring clip, steel	1
21*	Trust washer, POM ⁽¹⁾	1
22	Socket head cap screw	2
24	Socket head cap screw	8
25	Socket head cap screw	8
26*	O-ring, Nitrile	2
---	Limit stop plate, steel (figure 4)	1
---	Cam, steel (figure 4)	1
---	Adjustment screw, steel (figure 4)	2
---	Hex (lock) nut, steel (figure 4)	2
---	Socket head cap screw, steel (not shown)	4
---	Drive adapter, steel (figure 4)	1
---	Lubricant, Standard and High Temperature Construction	CCSG ⁽²⁾
---	Lubricant, Low Temperature Construction	Low Temperature Silicone Grease 1M5964X0012

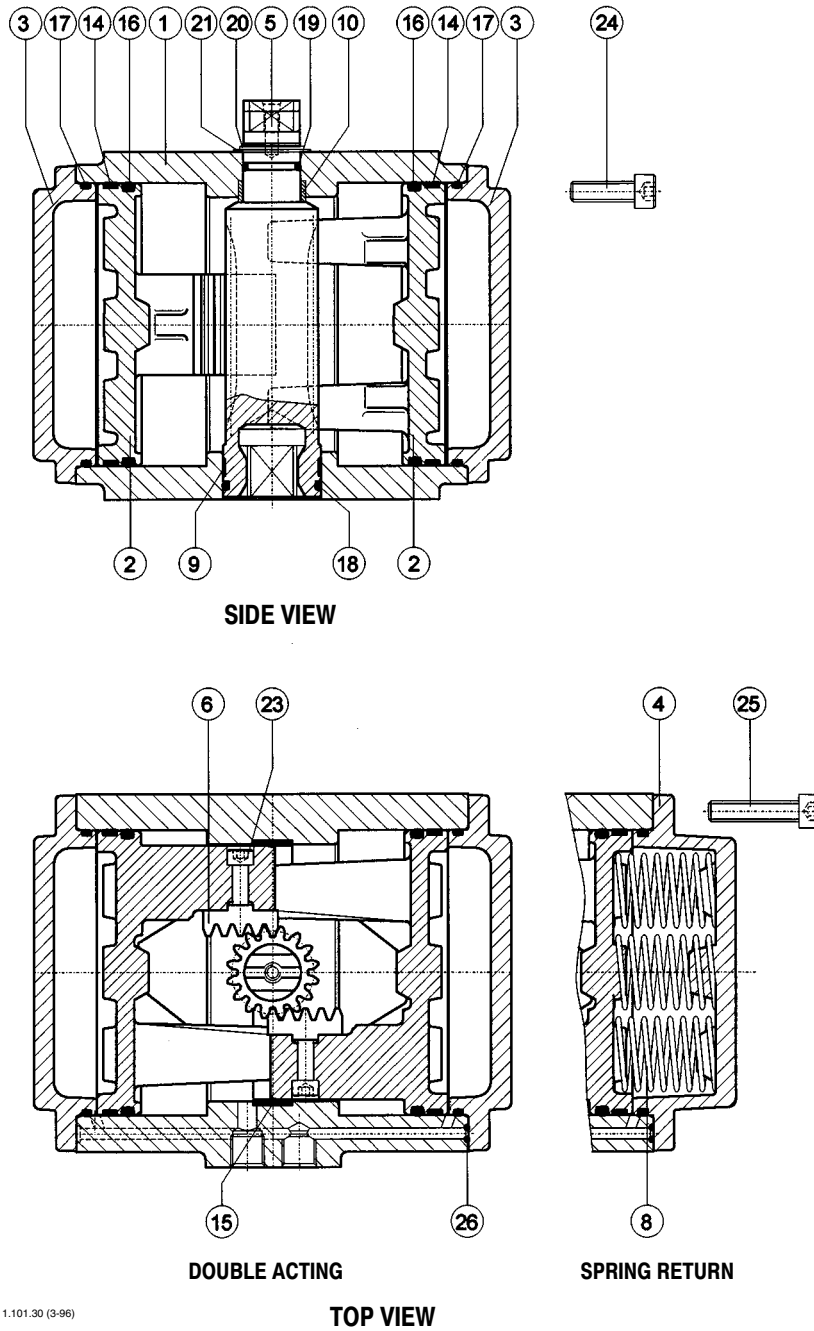
* Recommended spare parts (contained in a repair kit).
 1. Polyoxymethylene.
 2. Complex Calcium Sulphonate Grease.



NOTE:
PARTS NOT SHOWN ARE HOUSING ADJUSTMENT SCREW, HEX (LOCK)
NUT AND STROKING CAM. REFER TO FIGURE 4 FOR LOCATION OF
PARTS.

ELO A 1.101.33 (3-96)

Figure 11. Type 1035 E Series Actuator Assembly



A 1.101.30 (3-96)

Figure 12. Type 1035 P Series Actuator Assembly

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