

# Fisher® 585CLS Long Stroke Piston Actuator

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Figure 1. Fisher 585CLS Piston Actuator



W2795-1

## Introduction

### Scope of Manual

This instruction manual provides information on installation, maintenance, and parts ordering for the Fisher 585CLS Long Stroke piston actuator. Refer to separate instruction manuals for information about other equipment and accessories used with these actuators.

Do not install, operate, or maintain a 585CLS actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your Emerson Process Management sales office before proceeding.

### Description

585CLS piston actuators are available with travel capabilities exceeding 203 mm (8 inches) up through 610 mm (24 inches). This actuator is available with a manual handwheel, which can be used to open, close, or position the valve. The manual handwheel may also be used as a stop to limit the upward travel of the valve plug.

The 585CLS actuator typically is equipped with either a FIELDVUE™ DVC6200 digital valve controller or 3600 positioner for throttling service. For on-off service, the actuator cylinder is loaded and unloaded through the operation of a solenoid valve, pneumatic switch, or similar equipment.



## Specifications

Specifications for 585CLS piston actuators are given in table 1. Some individual actuators come from the factory with specifications stamped on a nameplate attached to the yoke.

## Educational Services

For information on available courses for Fisher 585CLS piston actuators, as well as a variety of other products, contact:

Emerson Process Management  
Educational Services, Registration  
P.O. Box 190; 301 S. 1<sup>st</sup> Ave.  
Marshalltown, IA 50158-2823  
Phone: 800-338-8158 or  
Phone: 641-754-3771  
FAX: 641-754-3431  
e-mail: [education@emerson.com](mailto:education@emerson.com)

## Principle of Operation

The 585CLS piston actuator uses a piston that moves inside the actuator cylinder.

From an equilibrium state, the actuator reacts to a force unbalance that is created by increasing supply pressure on one side of the piston, and decreasing it on the other. This moves the piston up or down, and results in a repositioning of the valve control element.

For more detailed information on the 3610 positioner and DVC6200 digital valve controllers, refer to the Principle of Operation section in the 3610 and DVC6200 Instruction Manuals.

**Table 1. 585CLS Specifications (Fabricated Yoke Actuators)**

<p><b>Operating Pressure<sup>(1)</sup></b>  <b>Minimum Recommended:</b> For valves with low thrust requirements--2.4 bar (35 psig); for all other valves--3.4 bar (50 psig)  <b>Maximum Allowable:</b> 127 mm (5-inch) to 305 mm (12-inch) diameter cylinders--17.2 bar (250 psig) unless limited by maximum allowable supply pressure of positioner or switching devices; 356 mm (14-inch) diameter cylinder--13.8 bar (200 psig) unless limited by maximum allowable supply pressure of positioner or switching device</p> <p><b>Travel Information</b>  <b>All Types:</b> 229 mm (9 inches) through 610 mm (24 inches) in 25 mm (1-inch) increments as shown in figure 3  <b>Travel Ratio for Handwheel Construction:</b> 10 complete revolutions of the wheel moves the stem 25 mm (1 inch)</p> <p><b>Thrust Information</b>                  See table 3</p> <p><b>Operative Ambient Temperature<sup>(1)</sup></b>  <b>Standard:</b>                  -23 to 74°C (-10 to 165°F)  <b>Optional:</b>  <i>Low Temperature:</i> -46 to 66°C (-50 to 150°F)  <i>High Temperature:</i> -23 to 121°C (-10 to 250°F)</p>	<p><b>Piston Diameters and Areas</b>                  See table 3</p> <p><b>Yoke Boss and Valve Stem Diameters</b>                  See table 2</p> <p><b>Pressure Connections</b>                  Standard is 1/4 NPT. For larger sizes, consult your Emerson Process Management sales office</p> <p><b>Construction Materials</b></p> <table border="1"> <thead> <tr> <th>Part</th> <th>Material</th> </tr> </thead> <tbody> <tr> <td>Cylinder Body: 127 mm through 356 mm (5-inch through 14-inch)</td> <td>Steel, chrome plated</td> </tr> <tr> <td>Piston Rod</td> <td>Steel, chrome plated</td> </tr> <tr> <td>Yoke</td> <td>Structural steel</td> </tr> <tr> <td>Stem Connector</td> <td>Stainless steel</td> </tr> <tr> <td>Piston</td> <td>Aluminum</td> </tr> <tr> <td>Bolting and fasteners</td> <td>NCF</td> </tr> <tr> <td>O-rings</td> <td>Nitrile</td> </tr> </tbody> </table> <p><b>Options</b>                  ■ Fisher 377 trip valves to fail actuator up, down, or lock in last position, ■ Limit switches, ■ Integral side-mounted handwheel</p>	Part	Material	Cylinder Body: 127 mm through 356 mm (5-inch through 14-inch)	Steel, chrome plated	Piston Rod	Steel, chrome plated	Yoke	Structural steel	Stem Connector	Stainless steel	Piston	Aluminum	Bolting and fasteners	NCF	O-rings	Nitrile
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1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.

**Table 2. Yoke Boss and Valve Stem Diameters**

ACTUATOR SIZE	YOKE BOSS DIAMETER		VALVE STEM DIAMETER	
	mm	Inches	mm	Inches
All	127	5H <sup>(1)</sup>	25.4 or 31.8	1 or 1-1/4
	178	7	50.8	2

1. Heavy actuator to bonnet bolting.

Table 3. Thrust

PISTON DIAMETER	STROKE	PISTON ROD SIZE	PISTON AREA	TOTAL THRUST <sup>(1)</sup>						
				Operating Pressure, bar						
				2.8	4.1	5.5	6.9	8.3	9.7	10.3
mm		mm	mm <sup>2</sup>	Force, Newtons						
127	Push	---	127	3500	5250	6980	8720	10500	12200	13100
152			182	5030	7560	10100	12600	15100	17600	18900
203			323	8940	13400	17900	22400	26800	31300	33500
254			507	14000	21000	27900	34900	41900	48900	52500
305			730	20100	30200	40300	50300	60500	70300	75600
356			993	27400	41100	54700	68500	82300	96100	103000
127	Pull	44.5	111	3060	4580	6140	7650	9210	10700	11500
152			167	4580	6890	9210	11500	13800	16100	17300
203			309	8500	12800	17000	21300	25500	29800	31900
254			491	13600	20300	27100	33900	40700	47600	50700
203	Pull	63.5	293 <sup>(2)</sup>	8050	12100	16100	20200	24200	28200	30200
254			475 <sup>(3)</sup>	13100	19700	26200	32700	39300	45800	48900
305			698	19300	28900	38500	48000	57800	67200	72100
356			961	26500	39800	52900	66300	79600	93000	99600
PISTON DIAMETER	STROKE	PISTON ROD SIZE	PISTON AREA	Operating Pressure, psig						
Inches		Inches	Inches <sup>2</sup>	40	60	80	100	120	140	150
				Force, Pounds						
5	Push	---	19.6	786	1180	1570	1960	2360	2750	2950
6			28.3	1130	1700	2260	2830	3390	3960	4240
8			50.3	2010	3020	4020	5030	6030	7040	7540
10			78.5	3140	4710	6280	7850	9420	11000	11800
12			113.1	4520	6790	9050	11300	13600	15800	17000
14			153.9	6160	9240	12300	15400	18500	21600	23100
5	Pull	1.75	17.2	689	1030	1380	1720	2070	2410	2580
6			25.9	1030	1550	2070	2590	3100	3620	3880
8			47.9	1910	2870	3830	4790	5740	6700	7180
10			76.1	3050	4570	6090	7610	9140	10700	11400
8	Pull	2.5	45.4 <sup>(2)</sup>	1810	2720	3630	4540	5440	6350	6800
10			73.6 <sup>(3)</sup>	2950	4420	5890	7360	8840	10300	11000
12			108.2	4330	6490	8660	10800	13000	15100	16200
14			149.0	5960	8940	11900	14900	17900	20900	22400

1. For operating pressures above 10.3 bar (150 psig), consult your Emerson Process Management sales office.  
2. For travels greater than 406 mm (16 inches) with 10.3 to 17.3 bar (150 to 250 psig) operating pressure.  
3. For travels greater than 406mm (16 inches).

## Installation

### ▲ WARNING

To avoid personal injury or property damage caused by cylinder fracture as a result of piston impact, install the stem connector securely before supplying pressure to the positioner. Use only a regulator-controlled air supply to move the actuator piston so that you can install the stem connector. Do not use the positioner to move the actuator piston before installing the stem connector.

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 cylinder pressure or other pressure ratings do not exceed the limits listed in table 1. Use pressure-limiting or pressure-relieving devices to prevent cylinder pressure or other pressure ratings from exceeding these limits.

**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 sections in this instruction manual.**

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When an actuator and valve are shipped together as a control valve assembly, the actuator is normally mounted on the valve. Follow the valve instructions when installing the control valve in the pipeline. If the actuator is shipped separately or if it is necessary to mount the actuator on the valve, perform the Actuator Mounting procedures in this instruction manual corresponding to your actuator size. For information on mounting valve positioners, refer to the 3610 or DVC6200 instruction manuals for details.

If a 585CLS actuator is being installed without a positioner, the cylinder loading pressures should be supplied through a 4-way solenoid valve or a switching valve.

The supply pressure medium should be clean, dry filtered air. If the supply source is capable of exceeding the maximum actuator operating pressure or positioner supply pressure, appropriate steps must be taken during installation to protect the positioner and all connected equipment against overpressure.

### **▲ WARNING**

**Dropping the actuator and any attached accessories and/or valve may cause personal injury and/or equipment damage. For all mounting procedures use an adequately sized chain, sling, hoist, or crane to handle the actuator and any attached accessories and/or valve. Use caution during lifting and handling to prevent slippage, swinging, faulty equipment connections, or sudden shock loads.**

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### **CAUTION**

**To avoid damage to actuator parts and difficult operation of actuator handwheels, open the bypass valve before using a handwheel.**

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If manual operation is required, the actuator should be equipped with a manual handwheel. To manually move the piston rod with the handwheel, first open the bypass needle valve (key 54, figure 2), place the handwheel indicator in the neutral position, and insert the locking pin in the sleeve assembly. Then turn the handwheel in the selected direction as indicated on the wheel.

The control valve should be located where it will be accessible for servicing. Room should be left above and below the control valve to permit removal of the actuator and valve plug.

## **Bypass Assembly**

The bypass is furnished as shown in figure 2 only when a handwheel actuator is specified. The bypass allows the pressure to equalize on either side of the piston, so that the manual actuator can be used to position the valve.

Flow through the bypass tubing is controlled by an angle needle valve (key 54, figure 2), which is operated manually. This valve should be closed when air pressure is being used to operate the valve.

## Three-Way Valve Applications Note

### **▲ WARNING**

**To avoid loss of control of process fluid and subsequent personal injury or property damage caused by bursting of pressure-retaining parts, be sure the cylinder pressure does not exceed 80 psig in high cycle-rate, fast stroking speed, three-way valve applications.**

In three-way valve applications where the actuator fully strokes at a frequency of once per minute or faster, and the stroking speed is rapid (less than 0.5 seconds per stroke), there is a possibility that the stem can fracture at the plug if the actuator cylinder pressure is greater than 80 psig. This can cause loss of control of process fluid and further damage to the actuator. Consideration should be given to the use of high-strength, fatigue-resistant stem materials in these applications.

## Actuator Mounting

The following procedure describes how to mount a 585CLS actuator on a push-down-to-close valve so that the piston stem to valve plug stem connection allows full travel and proper shutoff. Key numbers referenced in the following steps are shown in figures 2 and 3.

If you purchase a 585CLS actuator for field installation on a control valve, mount the actuator on the valve and secure it to the bonnet with the eight bonnet-to-actuator bolts. The stem connection should then be made up to clamp the actuator stem and valve plug stem together to provide proper valve travel.

### **CAUTION**

**To avoid damaging the seating surfaces, do not rotate the valve plug while it is seated. Avoid damage to the valve plug stem by careful use of tools during travel adjustments.**

1. With the valve assembled and actuator mounted, make sure the valve plug is in the closed position. Then turn the two stem locknuts (key 23) all the way onto the stem thread.
2. Starting with the cylinder fully retracted, manually or with air pressure extend the piston rod extension the specified valve travel.
3. Attach the stem connector (key 22), clamping the piston rod extension to the valve stem. Be sure you also attach the feedback arm (key 4) and travel indicator (key 3).
4. Cycle the actuator to check availability of desired total travel and that the valve plug seats before the cylinder reaches the end of its stroke. You can make minor travel adjustments, if necessary, by loosening the stem connector slightly, tightening the locknuts together, and (with the valve plug off the seat) screwing the stem either into or out of the stem connector by means of a wrench on the locknuts.
5. If the total travel is adequate, tighten the stem connector (key 22) securely, lock the stem locknuts (key 23) against the connector, and adjust the indicator scale (key 7) on the yoke (key 1) to show valve plug position.
6. Provide a gauge, if necessary, to measure the pressure to the actuator. Make a final adjustment on the positioner to set the starting point of valve travel and to obtain full travel for the given instrument range.

## Handwheels

Key numbers referenced in the following steps are shown in figures 2 and 3.

With the pointer (key 42) in the neutral position, automatic operation is possible throughout full travel. The locking pin (key 10) should be left out during automatic operation, and the needle valve (key 54) must be closed.

For manual operation, the locking pin (key 10) must be inserted into the hole in the sleeve assembly before you open the needle valve (key 54). Rotation of the handwheel (key 32) in either direction causes the valve stem to move because of the pinned connection between the piston rod extension and sleeve. There is a directional arrow and the word "OPEN" cast on the handwheel to indicate the rotation required to open the valve. To shift from manual to automatic operation, return the handwheel pointer (key 42) to the neutral position, close the needle valve (key 54), and remove the tapered pin (key 10).

The handwheel assembly can provide a travel stop to restrict upward travel of the valve plug. When you set the travel stop, the tapered pin (key 10) should be left out. As an example, consider the control valve with a push-down-to-close valve plug action. To restrict full opening, turn the handwheel (key 32) to lower the sleeve assembly (key 9). In normal operation, as the valve opens, the stem connector (key 22) contacts the lower part of the sleeve before full valve travel is reached. You can note the amount of restriction on the travel scale (key 7).

---

**Note**

If an emergency arises, you can close the valve (push-down-to-close) quickly without inserting the pin into the sleeve assembly. First, turn the handwheel to move the sleeve against the stem connector (key 22), then open the needle valve and turn the handwheel to force the valve plug closed.

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## Maintenance

Instructions are given below for complete disassembly of the actuator. When inspection or repair is necessary, disassemble the actuator only as far as is required to accomplish the job.

### **⚠ WARNING**

**Avoid personal injury from sudden release of process pressure or uncontrolled process fluid. Before starting disassembly:**

- Do not remove the actuator from the valve while the valve is still pressurized.
  - Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
  - Disconnect any operating lines providing air pressure to the actuator. Be sure the actuator cannot suddenly open or close the valve.
  - Use bypass valves or completely shut off the process to isolate the valve from 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.
  - Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
  - The valve packing box 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, or when loosening the packing box pipe plug.
  - Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- 

## Non-Handwheel Construction

Key numbers used below are shown in the figure 3 assembly drawing.

1. Disconnect the cylinder tubing from the cylinder (key 11) and positioner.
2. Break the stem connection by loosening the two locknuts (key 23) and removing the four cap screws from the stem connector.

---

**Note**

Refer to the appropriate instruction manual for any maintenance or adjustments that need to be made on the positioner.

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3. You can remove the cylinder (key 11) by unscrewing the four cap screws (key 14) that fasten it to the yoke (key 1).

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**Note**

Refer to the manufacturer's instruction manual for disassembly, maintenance and parts ordering instructions for the cylinder.

---

4. Reassemble the actuator in the reverse order of the above instructions. Refer to the section Stem Connection Procedure to properly attach the valve stem to the cylinder rod extension.

## Handwheel Construction

Key numbers used below are shown in the figure 2 assembly drawing.

1. Disconnect the cylinder tubing (key 47) from the cylinder (key 11) and positioner.
2. Disengage the locking pin (key 10), if necessary. Then break the stem connection by loosening the two locknuts (key 23) and removing four cap screws from the stem connector (key 22).

---

**Note**

Refer to the appropriate instruction manual for any maintenance or adjustments that need to be made on the positioner.

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3. Unscrew the four cap screws (key 14) that fasten the cylinder (key 11) to the handwheel extension (key 8). Then pull the cylinder, piston, and piston rod extension out of the sleeve (key 9).
4. Unscrew the piston rod extension from the cylinder piston rod using a wrench on the cylinder piston rod flats to keep the two from turning together.

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**Note**

Refer to the manufacturer's instruction manual for disassembly, maintenance and parts ordering instructions for the cylinder.

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5. To continue disassembly, remove the six cap screws (key 13) in order to take off the handwheel extension. Be careful not to lose the key (key 28).
6. Loosen the set screws (key 36) in the gear case (key 18) and handwheel cap (key 35). Unscrew the handwheel cap and remove the handwheel (key 32).
7. Unscrew the worm retainers (keys 29 and 30) and rotate the worm shaft (key 31) to remove it from the gear case.
8. Unscrew the cap screws (key 44) and remove the gear case.



- 
9. One thrust bearing (key 20) is now exposed. To expose the other thrust bearing, unscrew the gear (key 19) from the sleeve (key 9).

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**Note**

The bearing retainer (key 21) sits on top of six set screws (key 27). If the gear case is just going to be repacked and no parts are changed which would change the free play in the bearings, you do not need to make any adjustment with the set screws.

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10. Upon reassembly, pack the bearings (keys 20 and 40) with lithium grease. Also apply lithium grease to the surfaces of the sleeve and the bearing surfaces of the worm shaft. Use the zerk fitting for periodic lubrication after assembly.
11. Reassemble in the reverse order of the above steps observing the following points:
- Line up the key (key 28) with the slot in the sleeve.
  - After the unit is reassembled, adjust the set screws (key 27), if necessary, to eliminate free play in the bearings. Lock the set screws in place with the hex nuts (key 41).

---

**Note**

Over-tightening the set screws will make handwheel operation difficult.

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## Stem Connection Procedure

The following procedure is for a push-down-to-close valve. The objective of this procedure is that the stem connection must be made so that the valve strokes from full open to closed before the actuator reaches full stroke.

### CAUTION

**To avoid damaging the seating surfaces, do not rotate the valve plug while it is seated. Avoid damage to the valve plug stem by careful use of tools during travel adjustments.**

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- With the valve assembled and actuator mounted, make sure the valve plug is in the closed position. Then turn the two stem locknuts (key 23) all the way onto the stem thread.
- Starting with the cylinder fully retracted, manually or with air pressure extend the piston rod extension the specified valve travel.
- Attach the stem connector (key 22), clamping the piston rod extension to the valve stem. Be sure you also attach the feedback arm and travel indicator (key 3).
- Cycle the actuator to check availability of desired total travel and that the valve plug seats before the cylinder reaches the end of its stroke. You can make minor travel adjustments, if necessary, by loosening the stem connector (key 22) slightly, tightening the locknuts (key 23) together, and (with the valve plug off the seat) screwing the stem either into or out of the stem connector (key 22) by means of a wrench on the locknuts.
- If the total travel is adequate, tighten the stem connector (key 22) securely, lock the stem locknuts (key 23) against the connector, and adjust the indicator scale (key 7) on the yoke to show valve plug position.
- Provide a gauge, if necessary, to measure the pressure to the actuator. Make a final adjustment on the positioner to set the starting point of valve travel and to obtain full travel for the given instrument range.

## Parts Ordering

When corresponding with your Emerson Process Management sales office about this equipment, refer to the serial number found on the actuator nameplate (key 21). Also, specify the complete 11-character part number from the following Parts List when ordering replacement parts.

**⚠ 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 may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

## Parts List

**Note**

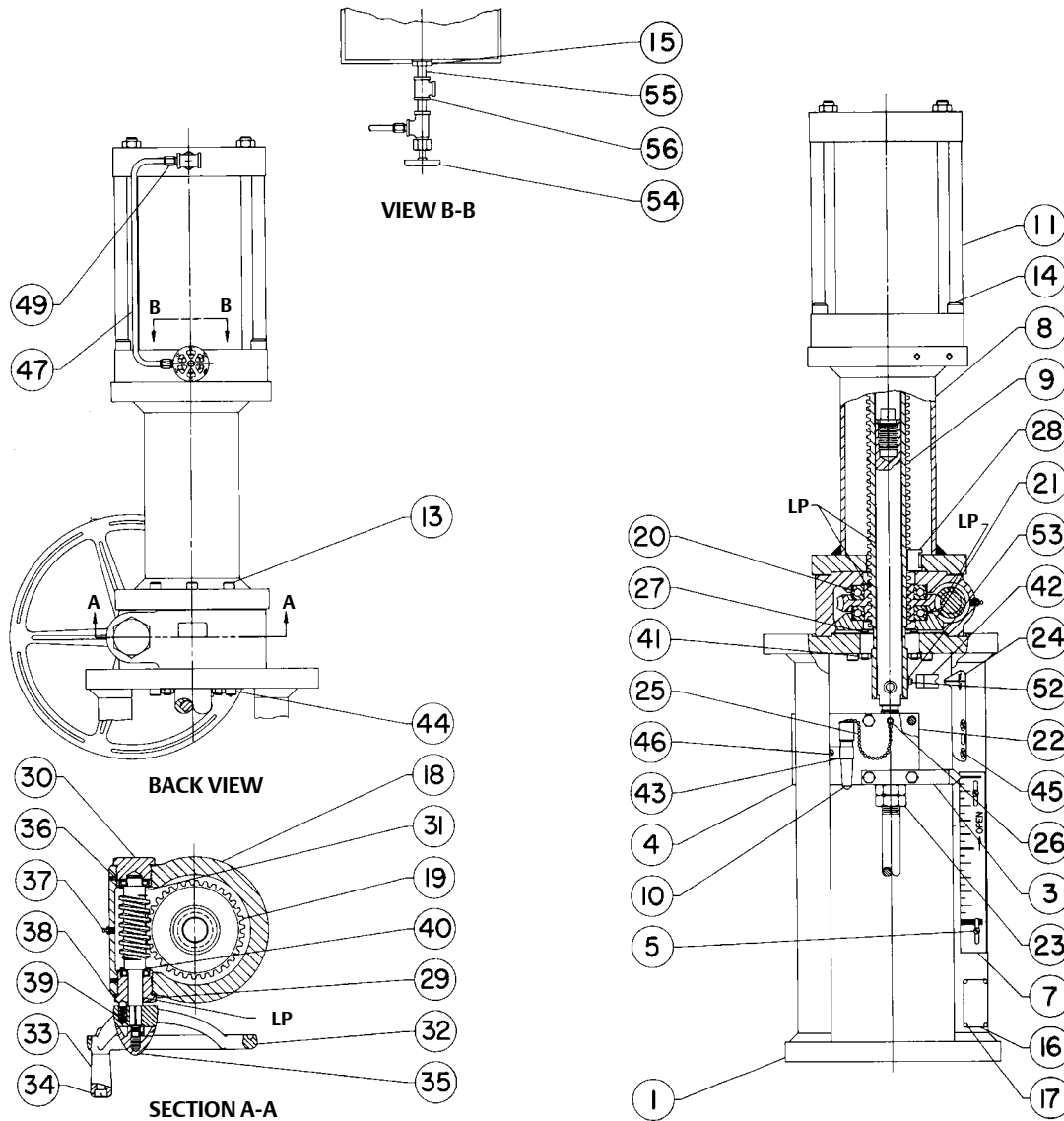
Part numbers are shown for recommended spares only. For part numbers not shown, contact your Emerson Process Management sales office.

In the listing below, some parts are related to a 6-inch wide channel yoke leg or an 8-inch wide channel yoke leg. This refers to the size of the vertical channel iron member of the yoke. This is not to be confused with a 5H or 7-inch diameter yoke boss, which refers to the actuator-to-valve mounting design.

Some parts are also related to the piston rod or piston rod extension diameter. This measurement should be taken above the stem connector where the rod is full diameter.

Key	Description	Key	Description
1	Yoke	24	Handwheel Indicator, SST
2	Cable Protector, galvanized steel	25	Chain, SST
3	Travel Indicator, SST	26	Drive Screw, plated steel
4	Feedback Arm, pl steel	27	Set Screw, steel
4	Anti-Rotator, steel	28	Key, steel
5	Machine Screw, steel pl	29	Front Worm Retainer, steel
6	Washer, steel pl	30	Back Worm Retainer, steel
7	Travel Scale, aluminum	31	Worm Shaft, steel
8	Handwheel Extension	32	Handwheel, cast iron
9	Sleeve Assembly	33	Handgrip, steel
10	Locking Pin, 416 SST	34	Handgrip bolt, steel
11	Air Cylinder	35	Handwheel Cap, cast iron
	Refer to the nameplate attached to the cylinder. Order all replacement parts for the cylinder from the cylinder manufacturer. Also, if the handwheel is specified, order its replacement parts from the cylinder manufacturer. When corresponding with the cylinder manufacturer, include the cylinder serial number, model number, and all other pertinent nameplate information.	36	Set Screw, steel
12	Pipe Plug, steel	37	Zerk Fitting
13	Cap Screw, plated steel	38	Ball, alloy steel
14	Cap Screw, plated steel	39	Spring, phosphor bronze
15	Bushing	40	Ball Bearing
16	Nameplate, SST	41	Hex Nut, plated steel
17	Drive Screw, SST	42	Pointer, SST
18	Gear Case, cast iron	43	Conduit Clamp
19	Worm Gear, bronze	44	Cap Screw, plated steel
20	Bearing	45	Machine Screw, plated steel
21	Bearing Retainer, steel	46	Machine Screw, plated steel
22	Stem Connector, 410 SST	47	Tubing, copper (specify length)
23	Hex Nut, plated steel	49	Connector, brass
		50	Elbow, brass
		51	Positioner
		52	Machine Screw, SST
		53	Lock Washer, SST
		54	Needle Valve
		55	Pipe Nipple, steel
		56	Pipe Tee, steel

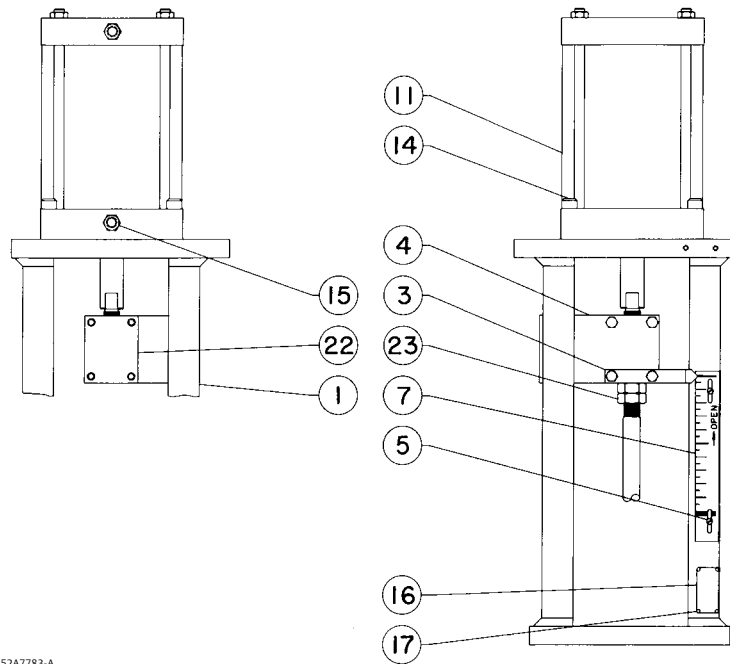
Figure 2. Fisher 585CLS Actuator



LP-LUBRIPLATE NO. 130AA  
PACK PARTS 20 AND 40 WITH MULTIPURPOSE GREASE

52A7782-A

Figure 3. Fisher 585CLS Actuator



52A7783-A

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