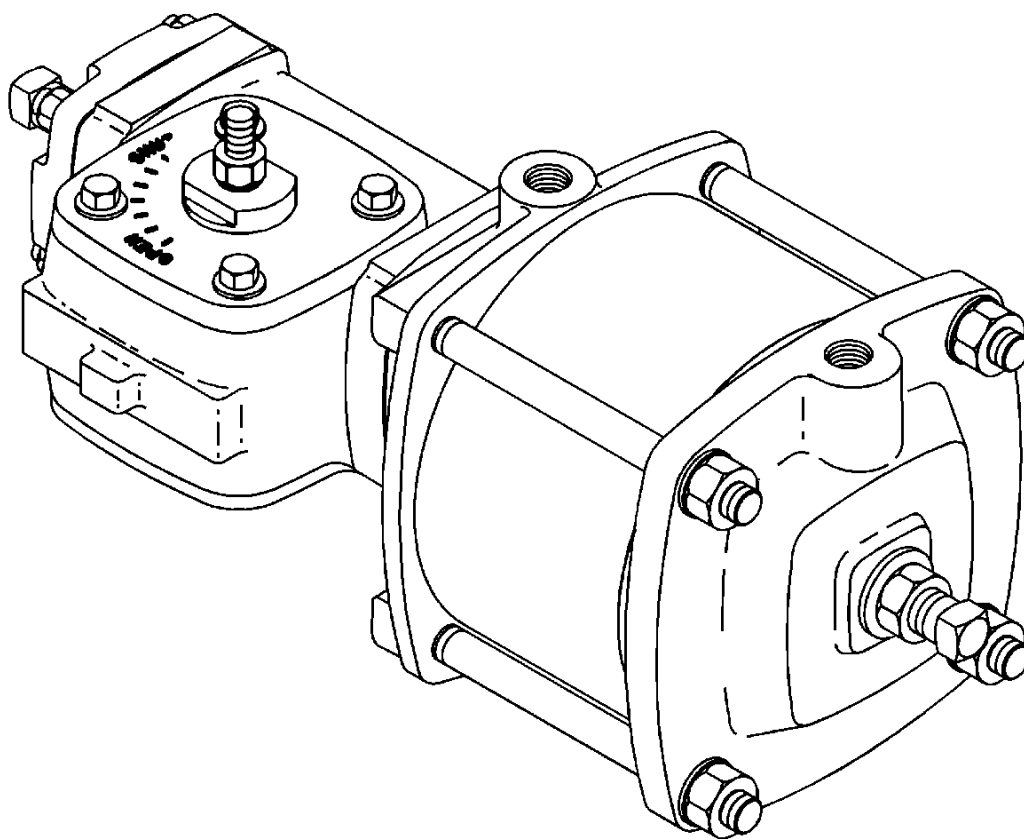


DEZURIK R1 POWERRAC® ACTUATOR

USED ON ½ - 3" PEC ECCENTRIC VALVES



Instruction D10381
November 2020

Instructions

These instructions are for use by personnel who are responsible for the installation, operation and maintenance of DeZURIK valves, actuators or accessories.

Safety Messages

All safety messages in the instructions are identified by a general warning sign and the signal word CAUTION, WARNING or DANGER. These messages indicate procedures to avoid injury or death.

Safety label(s) on the product indicate hazards that can cause injury or death. If a safety label becomes difficult to see or read, or if a label has been removed, please contact DeZURIK for replacement label(s).

⚠WARNING

Personnel involved in the installation or maintenance of valves should be constantly alert to potential emission of pipeline material and take appropriate safety precautions. Always wear suitable protection when dealing with hazardous pipeline materials. Handle valves which have been removed from service with suitable protection for any potential pipeline material in the valve.

Inspection

Your DeZURIK product has been packaged to provide protection during shipment; however, items can be damaged in transport. Carefully inspect the unit for damage upon arrival and file a claim with the carrier if damage is apparent.

Parts

Replaceable wear parts are listed on the assembly drawing. These parts can be stocked to minimize downtime. Order parts from your local DeZURIK sales representative or directly from DeZURIK. When ordering parts please provide the following information:

If the valve has a data plate: please include the 7-digit part number with either 4-digit revision number (example: 9999999R000) or 8-digit serial number (example: S1900001) whichever is applicable. The data plate will be attached to the valve assembly. Also, include the part name, the assembly drawing number, the balloon number and the quantity stated on the assembly drawing.

If there isn't any data plate visible on the valve: please include valve model number, part name, and item number from the assembly drawing. You may contact your local DeZURIK Representative to help you identify your valve.

DeZURIK Service

DeZURIK service personnel are available to maintain and repair all DeZURIK products. DeZURIK also offers customized training programs and consultation services. For more information, contact your local DeZURIK sales representative or visit our website at DeZURIK.com.

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R1 PowerRac® Actuator on 1/2 - 3" PEC Eccentric Valves

Description

The R1 PowerRac® actuator is a quarter-turn enclosed rack and gear cylinder actuator. The PowerRac® is used for on-off or modulating control on 1/2" through 3" PEC Eccentric Valves. The R number designates the 1" radius of the actuator gear. A choice of 4" and 6" (100 mm and 150 mm) cylinder diameters is offered.

The actuator is available as a double-acting actuator or as a spring-return actuator, either spring-to-open or spring-to-close. The cylinder mounting interface is the same for all actuators. The spring action may be reversed by ordering the alternate spring-return cylinder assembly, and exchanging the positions of the two cylinders.

These instructions include information for the three actuator configurations, and for changing from one to another. Refer to Figure 1 to identify the applicable configuration; refer to Figures 2 through 4 to identify the components within the configuration.

A lockable model of the R1 PowerRac® actuator is available. Operation of the lockable model is described in the *Lockable Model* section.

Installation

Pneumatic connections are required as shown in Figure 1, and as described below. All cylinder port connections are 1/4" NPT.

Double-Acting Cylinder

The double-acting actuator requires two pneumatic connections—one to each port on opposite ends of the cylinder. Air to the connection closest to the actuator drives the actuator clockwise, towards the “shut” position on the dial; air to the connection farthest from the actuator drives the actuator counterclockwise, towards the “open” position on the dial.

Spring-Return Cylinder

The spring-return actuator requires one pneumatic connection—to the fitting on the tubing that connects the two cylinders. With a spring-to-open spring cartridge, air to the connection drives the actuator clockwise, towards the “shut” position on the dial; with a spring-to-close spring cartridge, air to the connection drives the actuator counterclockwise, towards the “open” position on the dial.

As the spring-return actuator is cycled, air is alternately exhausted and drawn in through two breathers—one on each cylinder as shown in Figure 1. The breathers must be protected from water because water inside of the actuator will cause sticking and premature wear of the internal components.

If the actuator is located outdoors or in an area that will be hosed down, the breathers must be oriented vertically. The “umbrella” top of the breathers will then prevent water from being drawn in through the breathers. In locations that are submerged or subject to flooding, the breathers must be removed and remotely piped to a protected location.

R1 PowerRac® Actuator on 1/2 - 3" PEC Eccentric Valves

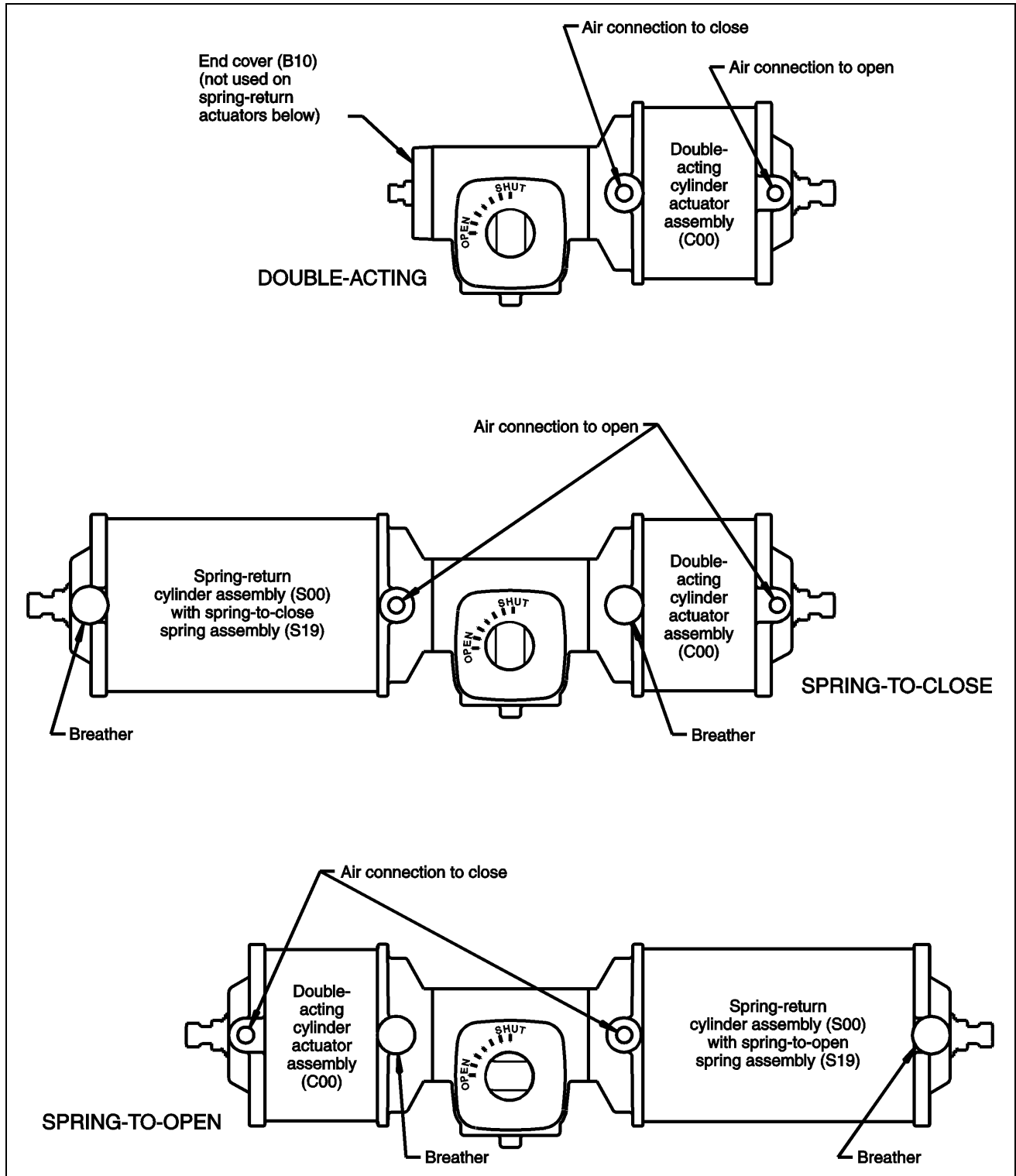


Figure 1—R1 PowerRac™ Actuator Configurations

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R1 PowerRac® Actuator on 1/2 - 3" PEC Eccentric Valves

Operation

The R1 PowerRac® Actuator is powered pneumatically, and rotates 90° between the open and closed positions, in the direction as described above. The double-acting cylinder is sized for 60 psi or 80 psi (415 kPa or 550 kPa), and the spring-return cylinder is sized for a 60 psi (415 kPa) spring only. All cylinders are limited to 100 psi (690 kPa) maximum.

Lubrication

The actuator has been lubricated at the factory and requires no routine lubrication. If the actuator is disassembled (see Figures 2 thru 4 for actuator parts identification);

apply a paint-like coating using one of these lubricants:

- Dow Corning Molykote No. 44 (**recommended**)
- Shell Retinax AM (alternate)
- Shell Lithall MDS (alternate)

to the following surfaces:

- Inside diameter of cylinder tube (C6 or S6)
- Chamfer for cylinder tube on cylinder cap (C11 or S11) and cylinder head of housing (C1 or S1)
- O-rings (C5 or S5, C8 or S8, and C14 or S14) and grooves
- Seals (C3 or S3 and C9 or S9) and grooves
- Thread seal (C16 or S16)
- Inside diameter of bearing (C2 or S2) located in cylinder head housing.
- Outside diameter of piston rod (C4 or S4).

apply a paint-like coating using one of these lubricants:

- Keystone Zeniplex-1 (**recommended**)
- Amoco Amolith Grease #1-EP (alternate)
- Amsoil GHD (alternate)
- Mobil Mobilux EP 1 (alternate)
- Petro-Canada Vultrex MPG EP 1 (alternate)
- Shell Alvania EP 1 (alternate)
- Texaco Multifak EP 1 (alternate)

to the following surfaces:

- Flat side of rack bearing (B3), before assembly
- Back side of rack (B5) that contacts rack bearing, before assembly
- Both bearing hubs of gear (B8), before assembly
- Top cover O-ring (B10) and groove in top cover (B11), before assembly
- Teeth in rack (B5) and gear (B8) after assembly (so witness marks are visible during assembly).

Position Stops

The adjustable open and closed position stops prevent the actuator from rotating beyond the open and closed positions of the valve. If the actuator is factory-mounted on the valve, the stops are preset, and do not require further adjustment.

If the actuator is not factory-mounted on the valve, or if the actuator is removed and/or disassembled, the stops will require adjustment as described below. Refer to the valve instructions for closed-position information, and adjust the stops after the actuator is mounted on the valve.

Double-Acting Cylinder

The closed position stop is located in the cylinder cap, and the open position stop is located in the actuator end cover.

Spring-Return Cylinder

With a spring-to-open spring cartridge, the closed position stop is located in the spring cylinder (the longer cylinder), and the open position stop is located in the other (shorter) cylinder.

With a spring-to-close spring cartridge, the open position stop is located in the spring cylinder (the longer cylinder), and the closed position stop is located in the other (shorter) cylinder.

Closed Position Stop Adjustment

1. Loosen the jam nut on the Closed Position stop screw. See Figure 1 for stop screw identification.
2. While cycling the valve open and closed, gradually adjust the closed stop screw until a slight popping or hesitation occurs as the plug is coming off the seat during the opening stroke. This indicates that the plug is contacting the seat.
3. After the stop is adjusted to the desired position, hold the screw from turning, and tighten the jam nut to the torque value shown in Table A.

Open Position Stop Adjustment

1. Loosen the jam nut on the Open Position stop screw. See Figure 1 for stop screw identification.
2. Cycle the valve open. Using the Pointer (B9F) as a guide, adjust the open position stop screw until the flats on the Pointer line up with the word "Open" on the actuator cover.
3. Hold the stop screw from turning, and tighten the jam nut to the torque value shown in Table A.

Table A: Jam Nut Torques

Jam Nut	Carbon Steel		Stainless Steel	
	Foot Pounds	Newton Meters	Foot Pounds	Newton Meters
1/2" Nut on 4" Cylinder Cap	63 ± 8	85 ± 11	38 ± 5	52 ± 7
5/8" Nut on 6" Cylinder Cap	130 ± 20	176 ± 27	77 ± 10	104 ± 14
5/8" Nut on End Cover	130 ± 20	176 ± 27	77 ± 10	104 ± 14

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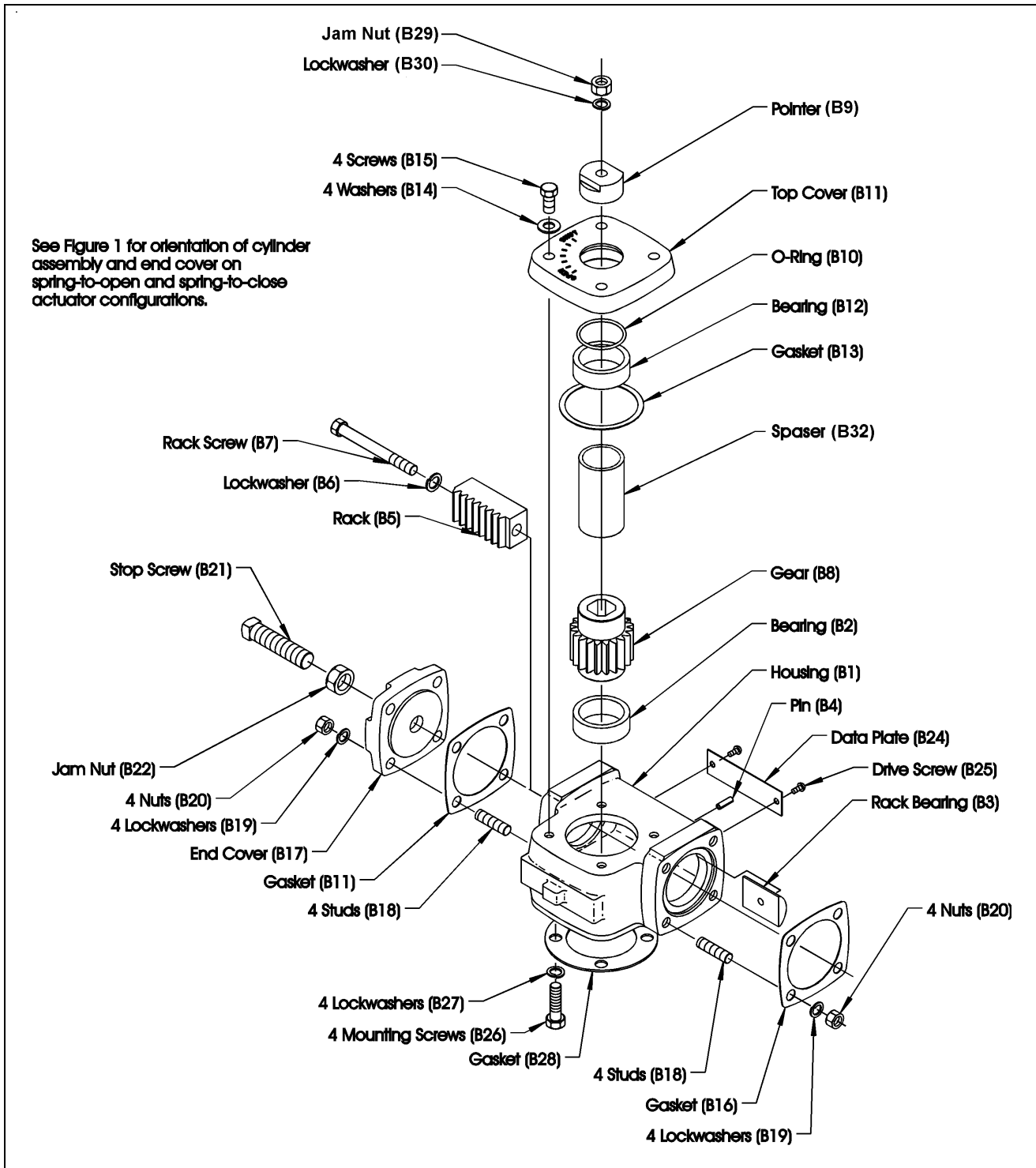


Figure 2—Actuator Assembly without Cylinder(s)

Note: The double-acting cylinder assembly is part number C00—see Figure 3.

The spring-return cylinder assembly is part number S00—see Figure 4.

Removing Actuator

Refer to Figure 2 for component identification.



WARNING!

Continued flow in the pipeline when the actuator is removed can cause the valve to slam close and cause personal injury or equipment damage. Shut down the flow in the pipeline before removing the actuator from the valve.

1. Shut down the flow in the pipeline.



WARNING!

Moving parts from unexpected operation of a powered actuator can cause personal injury or equipment damage. Disconnect and lock out power to the actuator before servicing.

2. Disconnect and lockout the pneumatic power to the actuator to prevent accidental operation of the actuator.
3. Remove the jam nut (B9D), and remove the threaded pointer (B9F) and Spacer (B32) from the stud.
4. Remove the four mounting screws (B26) that fasten the actuator to the valve.
5. Remove the actuator from the valve by lifting the actuator from the valve shaft.

Disassembly

Actuator

Refer to Figure 2 for component identification.

1. Remove the four top cover screws (B15) and remove the top cover (B11).
2. Remove the top cover gasket (B13) and the O-ring (B10).
3. Remove the gear (B8).
4. Remove the four cylinder assembly nuts (B20) and lockwashers (B19), and remove the double-acting cylinder assembly (C00) and gasket (B16).

Note: The double-acting cylinder assembly is shown in Figure 3.
5. Remove the rack screw (B7) and lockwasher (B6), and separate the rack (B5) from the piston rod (C4) [C4 is shown in Figure 3].
6. Remove the rack bearing (B3) from the pin (B4).
7. Complete the disassembly for the applicable model:
 - If the actuator is *double-acting*, remove the four end cover nuts (B20) and lockwashers (B19), and remove the end cover (B17) and gasket (B16).
 - If the actuator is *spring-return*, remove the four cylinder assembly nuts (B20) and lockwashers (B19), and remove the spring-return cylinder assembly (S00) and gasket (B16).

Note: The spring-return cylinder assembly (S00) is shown in Figure 4.

Disassembly (continued)

Double-Acting Cylinder

Refer to Figure 3 for component identification.

1. Remove the tie rod nuts (C15) and washers (C13) from the tie rods (C12).
2. Remove the cylinder cap (C11).
3. Push the piston rod (C4) through the cylinder head (C1), and remove the piston (C7) and piston rod (C4).
4. Remove the piston nut (C10), the piston (C7), and the O-ring (C14) from the piston rod (C4).
5. Remove the cylinder tube (C6) from the cylinder head (C1).
6. Remove the piston seal (C9) and the O-ring (C8) from the piston (C7).
7. Remove the piston rod seal (C3) from the cylinder head (C1).
8. Remove the two cylinder tube O-rings (C5) from the cylinder head (C1) and from the cylinder cap (C11).

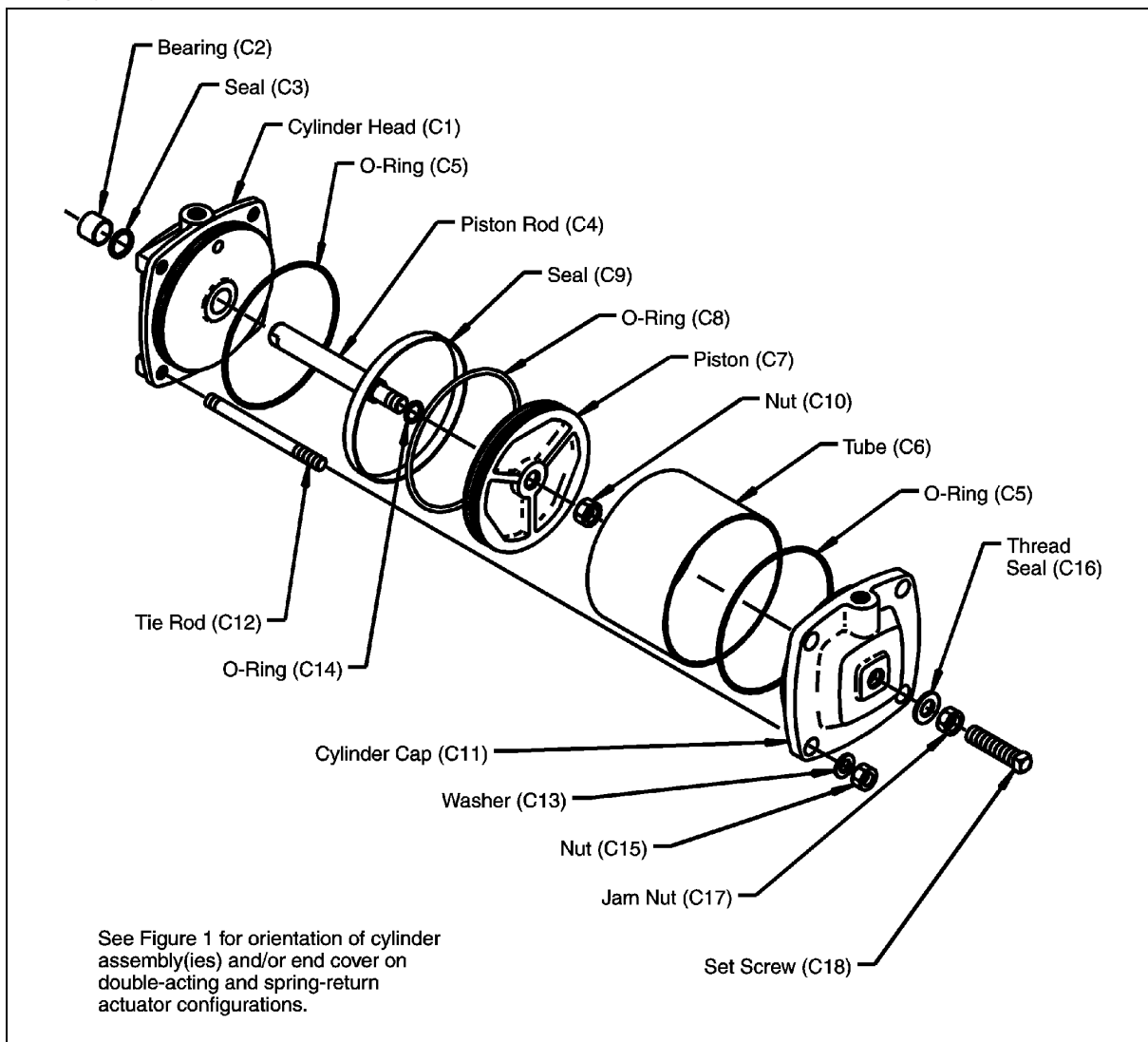


Figure 3—Double-Acting Cylinder Assembly

Note: The entire double-acting cylinder assembly is part number C00.

Disassembly (continued)

Spring-Return Cylinder

Refer to Figure 4 for component identification.



DANGER!

The spring assembly (S19) contains a compressed spring that can cause death or personal injury if the cylinder tie rod nuts are removed while the spring force is on the tie rod nuts. DO NOT REMOVE THE CYLINDER TIE ROD NUTS UNLESS THE SPRING FORCE DECREASES TO ZERO!

1. Loosen the tie rod nuts (S15) on the tie rods (S12).

Note: Force from the spring assembly will be felt during the first few turns of the nuts. As the cylinder tie rod nuts are loosened, the force from the spring assembly must decrease to zero before the nuts can be removed from the tie rods. The nuts and washers (S13) may be removed safely after the force from the spring assembly decreases to zero. **If the spring force does not decrease to zero, re-tighten the nuts and contact the factory.**

2. Remove the cylinder cap (S11).
 3. Push the piston rod (S4) through the cylinder head (S1) so that the spring assembly (S19) is accessible.
-



DANGER!

The spring assembly (S19) contains a compressed spring that can cause death or personal injury if the assembly is taken apart.

DO NOT DISASSEMBLE THE SPRING ASSEMBLY!

4. Remove the spring assembly (S19) carefully from the cylinder tube (S6).

Note: Do not damage the cylinder wall with the spring assembly during this step. **Do not disassemble the spring assembly!**

5. Remove the cylinder tube (S6), the piston (S7) and the piston rod (S4) from the cylinder head (S1).
6. Remove the piston (S7) and the piston rod (S4) from the cylinder tube (S6).
7. Remove the piston nut (S10), the piston (S7) and the O-ring (S14) from the piston rod (S4).
8. Remove the piston seal (S9) and the O-ring (S8) from the piston (S7).
9. Remove the piston rod seal (S3) from the cylinder head (S1).
10. Remove the two cylinder tube O-rings (S5) from the cylinder head (S1) and from the cylinder cap (S11).

Reassembly

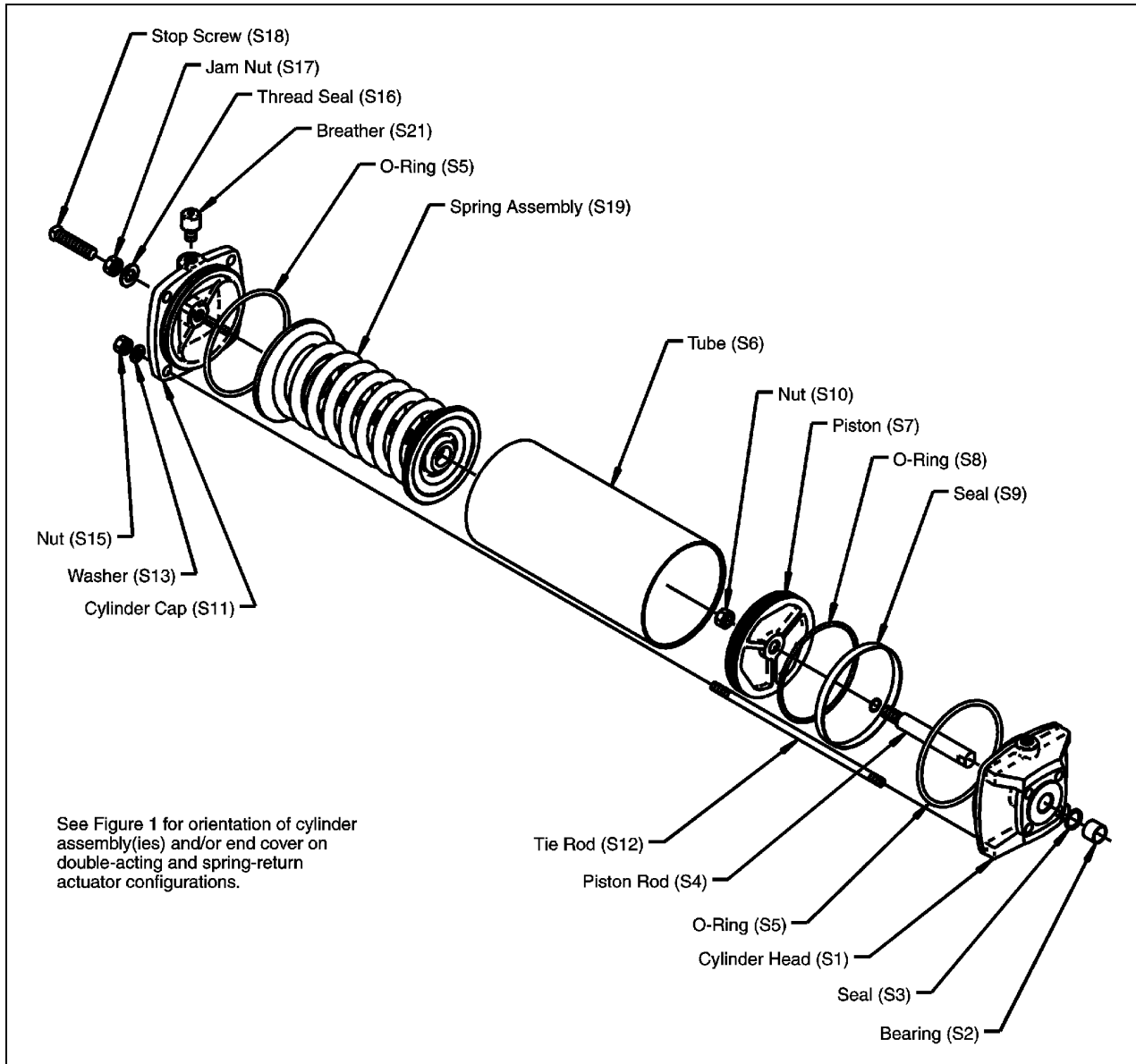


Figure 4—Spring-Return Cylinder Assembly

Note: The entire spring-return cylinder assembly is part number S00.

1. Replace worn parts, especially sealing components such as O-rings, other seals, and the cylinder tube.
2. Lubricate O-rings, other seals, and the cylinder tube walls.
3. With the O-ring and groove toward the piston rod, place the O-ring (S14), the piston (S7), and the nut (S10) on the piston rod (S4). Tighten the nut to 45 ± 5 foot pounds (61 ± 7 Nm).
4. Place the O-ring (S8) in the smaller groove of the piston (S7). Place the piston seal (S9) in the larger groove of the piston as far around the circumference as possible without stretching the seal. Angle the remaining portion of the seal, and carefully slip it over the edge of the piston and into the groove.

Reassembly (continued)

5. Place the piston rod seal (S3) in the cylinder head (S1).
6. Push the piston rod (S4) through the cylinder head (S1) so that the piston (S7) is against the cylinder head.
7. Place the two cylinder tube O-rings (S5) in the groove in the cylinder head (S1) and in the groove in the cylinder cap (S11).
8. If the cylinder tube (S6) diameter is 6" (150 mm), place the cylinder tube over the piston (S7) at about a 45° angle. Carefully square the cylinder tube into alignment with the piston, and push the cylinder tube into position on the cylinder head (S1). If the cylinder tube diameter is 4" (100 mm), push the cylinder tube on straight, without the angle. On all sizes, use care to avoid damage to the piston seal (S9).
9. Note the end of the spring assembly (S19) that has a 1-1/8" (29 mm) diameter machined hole. With the hole toward the piston (S7), carefully insert the spring assembly into the cylinder tube (S6) so that the hole fits over the piston nut (S10). Do not damage the cylinder wall with the spring assembly during this step.
10. Align the holes in the cylinder cap (S11) with the tie rods (S12) and insert the cylinder cap into the cylinder tube (S6). Place the tie rod nuts (S15) and washers (S13) on the tie rods. If the cylinder tube diameter is 4" (100 mm), tighten the nuts (5/16") to 12 ± 2 foot pounds (16 ± 3 Nm); if the cylinder tube diameter is 6" (150 mm), tighten the nuts (1/2") to 16 ± 2 foot pounds (22 ± 3 Nm).

Double-Acting Cylinder

Clean and inspect all parts. Refer to Figure 3 for component identification.

1. Replace worn parts, especially sealing components such as O-rings, other seals, and the cylinder tube.
2. Lubricate O-rings, other seals, and the cylinder tube walls.
3. With the O-ring and groove toward the piston rod, place the O-ring (C14), the piston (C7), and the nut (C10) on the piston rod (C4).
4. Tighten the nut to 45 ± 5 foot pounds (61 ± 7 Nm).
5. Place the O-ring (C8) in the smaller groove of the piston (C7). Place the piston seal (C9) in the larger groove of the piston as far around the circumference as possible without stretching the seal. Angle the remaining portion of the seal, and carefully slip it over the edge of the piston and into the groove.
6. Place the piston rod seal (C3) in the cylinder head (C1).
7. Push the piston rod (C4) through the cylinder head (C1) so that the piston (C7) is against the cylinder head.
8. Place the two cylinder tube O-rings (C5) in the groove in the cylinder head (C1) and in the groove in the cylinder cap (C11).
9. If the cylinder tube (C6) diameter is 6 or 8" (150 mm), place the cylinder tube over the piston (C7) at about a 45° angle. Carefully square the cylinder tube into alignment with the piston, and push the cylinder tube into position on the cylinder head (C1). If the cylinder tube diameter is 4" (100 mm), push the cylinder tube on straight, without the angle. On all sizes, use care to avoid damage to the piston seal (S9).

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Reassembly (continued)

10. Align the holes in the cylinder cap (C11) with the tie rods (C12) and insert the cylinder cap into the cylinder tube (C6). Place the tie rod nuts (C15) and washers (C13) on the tie rods. If the cylinder tube diameter is 4" (100 mm), tighten the nuts (5/16") to 12 ± 2 foot pounds (16 ± 3 Nm); if the cylinder tube diameter is 6" (150 mm), tighten the nuts (1/2") to 16 ± 2 foot pounds (22 ± 3 Nm).

Actuator

Clean and inspect all parts. Refer to Figures 2, 3 and 4 for parts identification.

1. Replace worn parts, especially sealing components such as O-rings and gaskets.
2. Lubricate the following surfaces:
 - The flat side of the rack bearing (B3)
 - Both bearing hubs of the gear (B8)
 - The teeth in the rack (B5) and in the gear (B8)

3. Place the rack bearing (B3) on the pin (B4).

Note: A dab of grease on the curved side of the bearing will help hold it in place.

4. Note the witness mark(s) on the teeth near one end of the rack (B5). Assemble the end of the rack opposite the witness marks to the end of the double-acting piston rod (C4) with the rack screw (B7) and lockwasher (B6). Do not tighten the screw until step number 12.
5. With the pneumatic connections facing upwards (towards the top of the actuator), mount the double-acting cylinder assembly (C00) and the gasket (B16) to the housing (B1) following the steps for the appropriate action:

- **Double-Acting and Spring-to-Close**

Mount the cylinder assembly (C00) on the **left-hand** side of the housing {as viewed when facing the data plate (B24) on the housing}. Using the four studs (B18) on the side of the housing, place the nuts (B20) and lockwashers (B19) on the studs. Tighten the nuts to 26 ± 3 foot pounds (35 ± 4 Nm) if carbon steel, or to 15 ± 2 foot pounds (20 ± 3 Nm) if stainless steel.

- **Spring-to-Open**

Mount the cylinder assembly (C00) on the **right-hand** side of the housing {as viewed when facing the data plate (B24) on the housing}. Using the four studs (B18) on the side of the housing, place the nuts (B20) and lockwashers (B19) on the studs. Tighten the nuts to 26 ± 3 foot pounds (35 ± 4 Nm) if carbon steel, or to 15 ± 2 foot pounds (20 ± 3 Nm) if stainless steel.

6. With the four tapped holes facing down, place the gear (B8) into the housing bearing (B2), and engage the gear teeth with the rack (B5) teeth so that the marked tooth on the rack meshes between the two teeth with painted dots on the R1 gear.
7. Place the O-ring (B10) in the groove of the top cover (B11).
8. Mount the top cover (B11) and gasket (B13) to the housing (B1) with the four screws (B15) and washers (B14). Tighten the nuts to 26 ± 3 foot pounds (35 ± 4 Nm) if carbon steel, or to 15 ± 2 foot pounds (20 ± 3 Nm) if stainless steel.

Reassembly (continued)

9. Place the actuator in the appropriate position for the action:
 - **Double-Acting and Spring-to-Close**
Place the actuator in **open** position (piston rod (C4) extended into actuator).
 - **Spring-to-Open**
Place actuator in **closed** position (piston rod (C4) retracted into cylinder).
10. Tighten the rack screw (B7) to 35 ± 5 foot pounds (47 ± 7 Nm).
11. Turn the jam nut (B22) onto the stop screw (B21), and turn the stop screw into the center hole in the end cover (B17) until the end of the stop screw protrudes about 1/4" (6 mm) through the end cover. Turn the jam nut finger tight.
12. Complete the assembly following the procedure for the appropriate model:
 - **Double-Acting**
Mount the end cover (B17) and the gasket (B16) to the housing studs (B18) with the four nuts (B20) and lockwashers (B19). Tighten the nuts to 26 ± 3 foot pounds (35 ± 4 Nm) if carbon steel, or to 15 ± 2 foot pounds (20 ± 3 Nm) if stainless steel.
 - **Spring Return**
Mount the spring-return cylinder assembly (S00) and the gasket (B16) to the housing studs (B18) with the four nuts (B20) and lockwashers (B19). Tighten the nuts to 26 ± 3 foot pounds (35 ± 4 Nm) if carbon steel, or to 15 ± 2 foot pounds (20 ± 3 Nm) if stainless steel.

Mounting Actuator

Refer to Figure 2 for component identification.

1. Determine which of the four actuator-to-valve mounting positions is desired, as shown on the valve installation drawing.
2. Match the open or closed position of the valve with the position of the actuator.
3. Note the position of the word "open" on the top cover (B11).
4. Position the cover must on the housing (B1) so that dial hash mark for "open" will be parallel with the pipeline when the valve is installed.

Note: One or more of the steps below may be required, depending upon the mounting position selected, the type of valve shaft, and the positions of the valve, actuator, and actuator cover.

- a. Rotate the valve shaft.
- b. Stroke the actuator.
- c. Select a different actuator-to-valve mounting position.
- d. Remove and re-index the cover (B11): Remove the four cover screws (B15), rotate cover, and replace the four cover screws (B15) and washers (B14). Tighten the nuts to 26 ± 3 foot pounds (35 ± 4 Nm) if carbon steel, or to 15 ± 2 foot pounds (20 ± 3 Nm) if stainless steel.

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Mounting Actuator (*continued*)

5. Place the gasket between the actuator and the valve, engage the actuator with the valve shaft in the desired mounting position as determined in step 1, and slide the actuator onto the valve shaft.

Note: Certain high-temperature valves include and require a high-temperature gasket (B28). If the valve includes a gasket, use the gasket included with the valve rather than the gasket included with the actuator.

6. Insert the four actuator mounting screws (B26) with lockwashers (B27) through the actuator adaptor on the valve, through the gasket (B28) and into the actuator.
7. Tighten the actuator mounting screws (B26) to 26 ± 3 foot pounds (35 ± 4 Nm) if carbon steel, or to 15 ± 2 foot pounds (20 ± 3 Nm) if stainless steel.
8. Slide the spacer (B32) onto the stud. Screw the Pointer (B9F) onto the valve stem stud with the flats of the Pointer facing up. Turn the pointer until it contacts the spacer, then line up the flats on the pointer to correspond with the valve position. ie, pointing to close if the valve is closed, open if the valve is open.
9. Install the Lockwasher (B9E) and Nut (B9D) against the Pointer. With a wrench on the flats of the pointer, tighten the nut to 26 ± 3 foot pounds (35 ± 4 Nm) if carbon steel, or 15 ± 2 foot pounds (20 ± 3 Nm) if stainless steel.
10. Adjust the open and closed position stops—see *Position Stops* section.
11. Operate the actuator and valve three full cycles to ensure that the unit operates smoothly in both directions—do not exceed 100 psi (690 kPa) in cylinder(s).

Changing Actuator Action

From Double-Acting to Spring-Return Spring-to-Close

1. Relieve the cylinder pressure, if any, to the actuator.
2. If an actuator accessory will be mounted on the actuator, refer to the Accessory Kit Instructions for cylinder orientation requirements. Certain actuator accessories require the cylinder ports to be rotated 180° to provide piping clearance.
3. Remove the end cover (B17) and gasket (B16) by removing the four nuts (B20) and lockwashers (B19). The end cover, including the stop screw (B21) and jam nut (B22), are not required on a spring-return actuator.
4. Loosen the jam nut (C17) and back out the stop screw (C18) on the double-acting cylinder assembly (C00).
5. Mount the spring-return cylinder assembly (S00) and gasket (B16) to the studs from which the end cover was removed. Use the same four nuts (B20) and lockwashers (B19). Tighten the nuts to 26 ± 3 foot pounds (35 ± 4 Nm) if carbon steel, or to 15 ± 2 foot pounds (20 ± 3 Nm) if stainless steel.
6. If actuator sizing requires a larger (or smaller) double-acting cylinder, replace the double-acting cylinder by following the steps in the following section; however the locations of the two cylinders with respect to the actuator must remain unchanged.
7. Adjust the open and closed position stops as explained in *Position Stops* section.

Changing Actuator Action (continued)

From Double-Acting to Spring-Return Spring-to-Open

1. If the actuator is on a valve, remove the actuator from the valve as described in the Removing Actuator From Valve section.
2. If an actuator accessory will be mounted on the actuator, refer to the Accessory Kit Instructions for cylinder orientation requirements. Certain actuator accessories require the cylinder ports to be rotated 180° to provide piping clearance.
3. Remove the four top cover screws (B15), and remove the top cover (B11) and gear (B8).
4. Remove the four cylinder assembly nuts (B20) and lockwashers (B19), and remove the cylinder assembly (C00).
5. Remove the end cover (B17) and gasket (B16) by removing the four nuts (B20) and lockwashers (B22). The end cover, including the stop screw (B21) and jam nut (B22), may be discarded.
6. Loosen the rack screw (B7), but do not remove the rack screw and rack (B5) from the piston rod (C4). Rotate the rack 180° on the rack screw.
7. Ensure that the rack bearing (B3) has stayed in position on the pin (B4). A dab of grease on the curved side of the rack bearing will help to hold it in place if necessary.
8. Mount the double-acting cylinder assembly and gasket (B16) to the studs from which the end cover was removed. Place the nuts (B20) and lockwashers (B19) on the studs. Tighten the nuts to 26 ± 3 foot pounds (35 ± 4 Nm) if carbon steel, or to 15 ± 2 foot pounds (20 ± 3 Nm) if stainless steel.
9. With the four tapped holes facing down, place the gear (B8) into the housing bearing (B2), and engage the gear teeth with the rack (B5) teeth so that the marked tooth on the rack is meshed between the two teeth with painted dots on the R1 gear.
10. Mount the top cover (B11) and gasket (B13) to the housing (B1) with the four screws (B15) and washers (B14). Tighten the nuts to 26 ± 3 foot pounds (35 ± 4 Nm) if carbon steel, or to 15 ± 2 foot pounds (20 ± 3 Nm) if stainless steel.
11. Place the actuator in the open position (with the rack B5 extended into the actuator) before the next step.
12. Tighten the rack screw (B7) to 35 ± 5 foot pounds (47 ± 7 Nm).
13. Loosen the jam nut (C17) and back out the stop screw (C18) on the double-acting cylinder assembly (C00).
14. Mount the spring-return cylinder assembly (S00) and gasket (B16) to the same studs from which the double-acting cylinder assembly was removed. Place the nuts (B20) and lockwashers (B19) on the studs. Tighten the nuts to 26 ± 3 foot pounds (35 ± 4 Nm) if carbon steel, or to 15 ± 2 foot pounds (20 ± 3 Nm) if stainless steel.
15. Replace the actuator on the valve as described in the Mounting Actuator on Valve section.

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Changing Actuator Action (*continued*)

From Spring-Return Spring-to-Close to Double-Acting

1. Relieve the cylinder pressure, if any, to the actuator.
2. Remove the four cylinder assembly nuts (B20) and lockwashers (B19), and remove the spring-return cylinder assembly (S00) and gasket (B16).
3. Mount the new end cover (B17) and gasket (B16) to the studs from which the cylinder assembly was removed. Use the same four nuts (B20) and lockwashers (B19). Tighten the nuts to 26 ± 3 foot pounds (35 ± 4 Nm) if carbon steel, or to 15 ± 2 foot pounds (20 ± 3 Nm) if stainless steel.
4. If actuator sizing requires a different sized cylinder, replace the double-acting cylinder by following the steps in the next section.

From Spring-Return Spring-to-Open to Double-Acting

1. If the actuator is on a valve, remove the actuator from the valve as described in the Removing Actuator From Valve section.
2. Disassemble the actuator as described in the Actuator Disassembly section.
3. Assemble the actuator as described in the Double-Acting Actuator Reassembly section.
4. Replace the actuator on the valve as described in the Mounting Actuator on Valve section.

Reversing Action of a Spring-Return Actuator

Cylinder assemblies with opposite action are not interchangeable; thus a spring-to-close cylinder may not be used for spring-to-open, and a spring-to-open cylinder may not be used for spring-to-close.

Note: The spring action is not reversible with included parts—a new cylinder assembly with the opposite action is required. The spring action of a spring-return actuator may be reversed from spring-to-open to spring-to-close— or vice versa—as described below:

1. If the actuator is on a valve, remove the actuator from the valve as described in the *Removing Actuator* section.
2. Disassemble the actuator as described in *Actuator Disassembly* section.
3. Assemble the actuator as described in *Spring-Return Actuator Reassembly* section, except:
 - a. Reverse the locations of the two cylinder assemblies, and
 - b. Use the appropriate (spring-to-open or spring-to-close) spring assembly.
4. Replace the actuator on the valve as described in the *Mounting Actuator* section.

Changing Mounting Position

The actuator may be mounted in any of four positions on the valve. The mounting position may be changed as follows:

1. Remove the actuator from the valve as described in the Removing Actuator From Valve section.
2. Replace the actuator on the valve as described in the Mounting Actuator On Valve section.

Lockable Model

The double-acting and spring-return R1 PowerRac® Actuators are each available as a lockable model that allows the actuator to be locked in either the open or closed position. The lockable model is identified by PRL in the catalog characteristic.

As shown in Figure 5, the lockable model has a notched gear (B8) and an enlarged housing (B1) that includes two lock screws (B64) and two jam nuts (B65). A lockout cover assembly (B60) is also included.



CAUTION!

The two lock screws (B64) must be in either the unlocked or the locked position as described in the following sections. The gear (B8) will be damaged if either of the stop screws is placed in an intermediate position between the unlocked and locked positions.

Unlocked Condition

Under normal unlocked running conditions, both of the lock screws are backed out of the housing to allow the gear to rotate freely in either direction. To be fully disengaged, the distance from the housing to the end of each lock screw must be at least 2¼" (57 mm). To hold the lock screws in position, the jam nuts are tightened to 38 ± 5 foot pounds (52 ± 7 Nm).

Locked Closed Position

Follow the steps below to change the unit from the unlocked condition to the locked closed position. Refer to Figure 5 for component identification. Before proceeding, the open and closed position stops must be correctly adjusted as described in the Open and Closed Stops section.

1. Operate the actuator to the fully closed (clockwise) position.



WARNING!

Adjust only the left-side lock screw to lock the actuator in the closed position. Adjusting the wrong screw does not lock the actuator, and can result in personal injury or equipment damage.

2. Loosen the jam nut (B65) on the **left** side lock screw (B64), as viewed when facing the top of the heads of the lock screws. Hold the lock screw from turning, and turn the jam nut several turns counterclockwise, to the head of the lock screw.
3. Turn the **left** side lock screw clockwise several turns until resistance is felt from the lock screw contacting the notch in the gear (B8). Tighten the lock screw to 5 to 10 foot pounds (7 to 14 Nm) to ensure that the lock screw is contacting the gear.
4. Turn the **left** side jam nut clockwise against the actuator housing. While holding the lock screw from turning, tighten the jam nut to 38 ± 5 foot pounds (52 ± 7 Nm).
5. Place and lock the lockout cover assembly (B60) on the head of the **left** side lock screw.

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Lockable Model (continued)

Locked Open Position

Follow the steps below to change the unit from the unlocked condition to the locked open position. Refer to Figure 6 for component identification. Before proceeding, the open and closed position stops must be correctly adjusted as described in the Open and Closed Stops section.

1. Operate the actuator to the fully open (counterclockwise) position.



WARNING!

Adjust only the right-side lock screw to lock the actuator in the open position. Adjusting the wrong screw does not lock the actuator, and can result in personal injury or equipment damage.

2. Loosen the jam nut (B65) on the **right** side lock screw (B64), as viewed when facing the top of the heads of the lock screws. Hold the lock screw from turning, and turn the jam nut several turns counterclockwise, to the head of the lock screw.
3. Turn the **right** side lock screw clockwise several turns until resistance is felt from the lock screw contacting the notch in the gear (B8). Tighten the lock screw to 5 to 10 foot pounds to ensure that the lock screw is contacting the gear.
4. Turn the **right** side jam nut clockwise against the actuator housing. Hold the lock screw from turning and tighten the jam nut to 38 ± 5 foot pounds (52 ± 7 Nm).
5. Place and lock the lockout cover assembly (B60) on the head of the right side lock screw.

Lockable Model (continued)

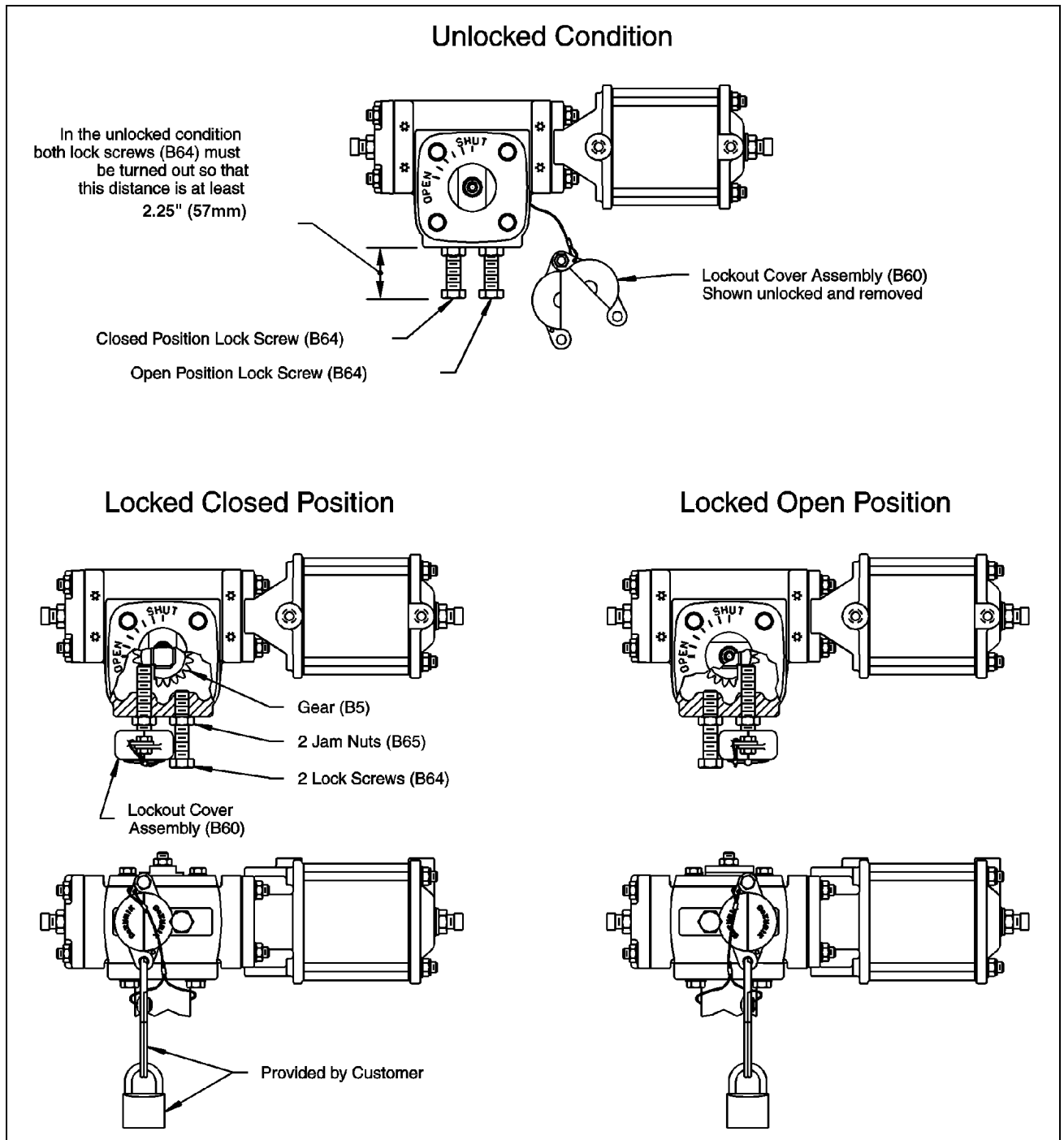


Figure 5—Lockable Model

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Troubleshooting

Condition	Possible Cause	Corrective Action
Actuator closes to wrong position	Closed position stop is set incorrectly	Adjust closed position stop. See <i>Position Stops</i> section.
Actuator opens to wrong position	Open position stop is set incorrectly	Adjust open position stop. See <i>Position Stops</i> section.
Actuator will not fully operate valve	Cylinder pressure is low	Increase cylinder pressure. Do not exceed 100 PSI
	Actuator is sized incorrectly	Use larger actuator
	Piston seal in cylinder is leaking	Replace piston seal(s)
	Cylinder has wrong spring assembly	Use spring assembly with opposite action
	Pipeline obstruction is preventing closure	Remove obstruction
	Lockable Model is locked	Place in unlocked condition. See <i>Lockable Model</i> section
Double-acting actuator rotates in wrong position	Air connections to cylinder are incorrect	Reverse air connections to cylinder
Valve fails in wrong direction with spring-return actuator	Actuator is assembled incorrectly	Exchange locations of spring-return and double-acting cylinders

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