

Bettis RGS Q-Series Double-Acting Actuators

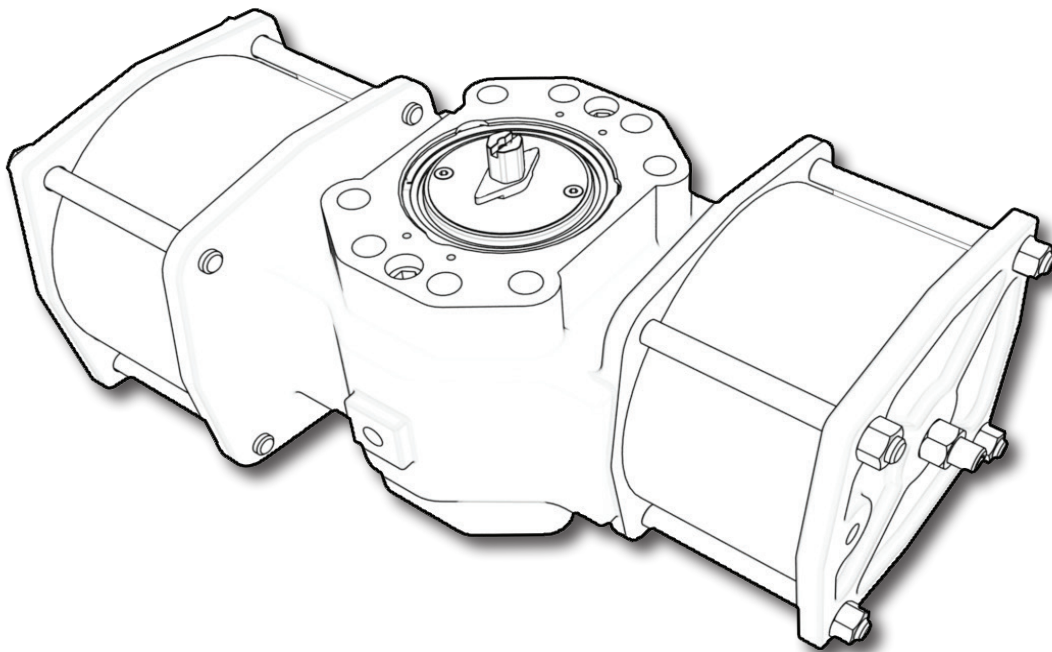


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Section 1: Overview

NOTE:

All activities must be carried out in order to ensure proper actuator operation.
Always read all instructions before beginning maintenance.

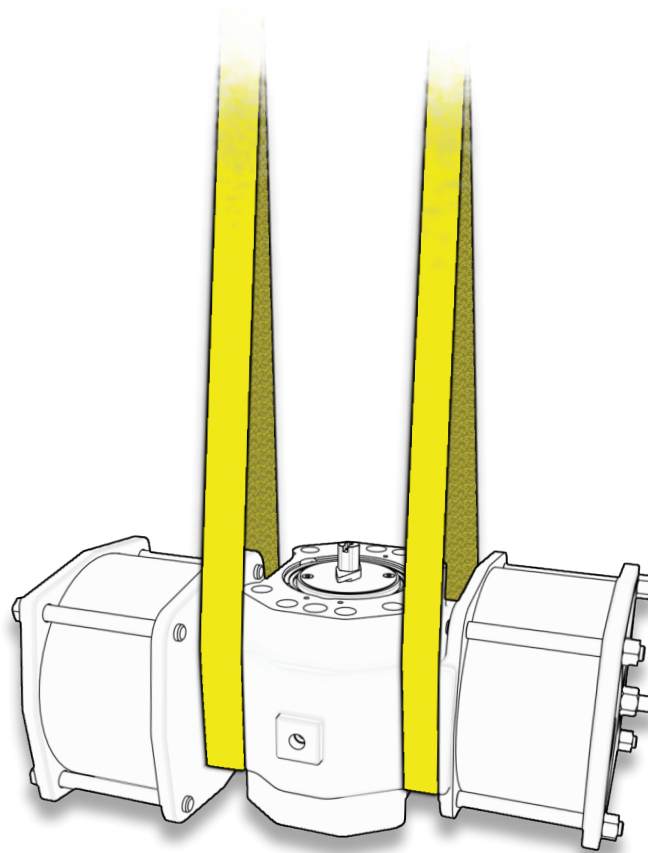
Bettis RGS Q-Series actuators are composed of two or three basic sub-assemblies, one or two force modules and a torque module. The force module contains the piston and rack which provide linear motion. The torque module contains the gear which converts the force modules' linear motion into torque and operates the valve.

Every actuator assembled by Bettis is tested prior to shipment to our customers.
Order specific documentation may be available upon request.

Section 2: Installation

Bettis actuators may be mounted in any position/orientation. If necessary, lift the actuator with straps placed inside the framework of the body. Never lift the actuator by the cylinders, tie rods, or travel stops. Lifting the actuator with the valve attached is not generally recommended.

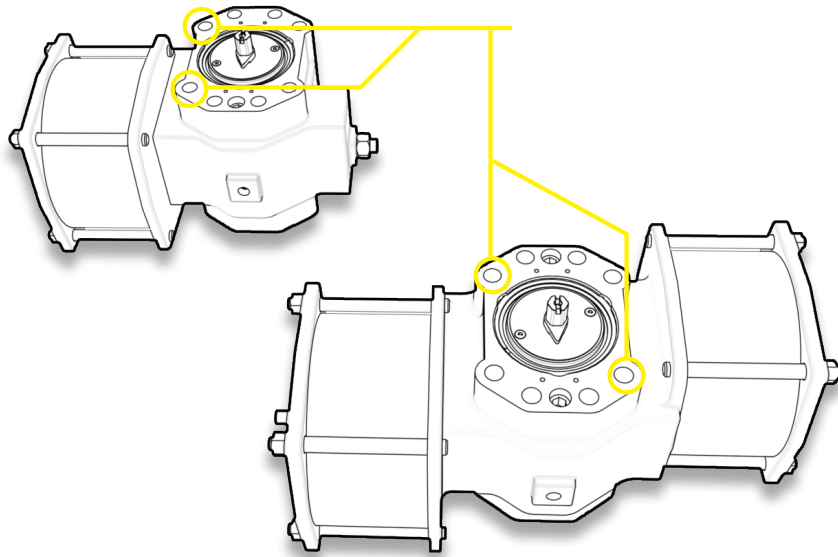
Figure 1



Threaded Lifting Eyes

Lifting eyes may be threaded into the body section and be used to lift the actuator.

Figure 2



2.1 Valve Attachment

NOTE:

Prior to mounting the actuator, verify alignment of coupler and shaft to ensure that the valve will move to correct position.

Ensure the actuator is in the same position as the valve. It may be necessary to stroke the actuator to determine the correct mounting orientation. Attach the actuator to the valve using the proper bracket and coupler, or with a Bettis Universal Mounting Plate (UMP) if provided. Using all mounting holes indicated on Bettis dimensional drawings, tighten all fasteners hand tight, then torque the fasteners to the corresponding value on the table below.

Table 1.

	Thread Pattern	Ft-Lbs	Nm
Q203/204/205	M6	7	9
	M8	16	22
Q207/210	M10	32	43
Q212/214	M20	235	318

2.2 Accessory Mounting

As a standard, Bettis RGS Q-Series actuators are provided with NAMUR slotted accessory mounting geometry. When installing accessories, such as switch boxes or positioners, tighten accessory mounting bolts hand tight, stroke the actuator three times to ensure proper alignment, then tighten the accessory mounting bolts to the proper torque. Check the dimensional drawing or associated product data sheet for exact dimensions.

2.3 Piping and Operation

The operation of a Bettis RGS Q-Series Double-Acting (DA) actuator is comparable to any double-acting rack and pinion actuator.

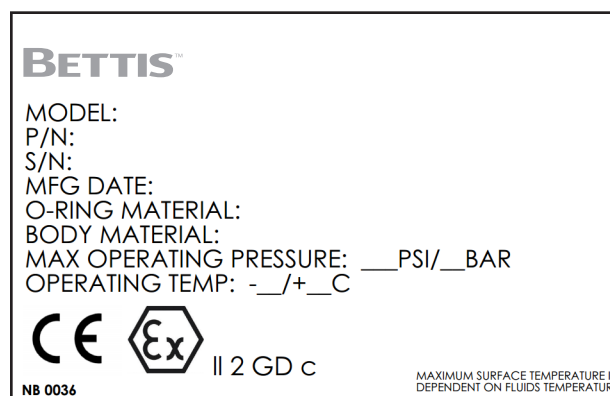
Instrument air, water, and other power gases and fluids may be used to cycle the actuator so long as construction materials were chosen accordingly during assembly and maximum allowable pressure is not exceeded. Air driven stainless-steel actuators with stainless-steel or composite cylinders are not harmed by wet air (so long as freezing does not occur). Aluminum and chrome-plated steel cylinders may be harmed over time by the presence of water.

⚠ WARNING: DO NOT EXCEED PRESSURE RATING

Exceeding the stated maximum pressure may result in damage to equipment and danger to personnel including severe injury or death. Consult the actuator label for operating limits. If an actuator label is missing, contact Bettis to request a replacement.

⚠ WARNING: DO NOT EXCEED TEMPERATURE RATING

Operating outside of the minimum and maximum temperature range may result in damage to equipment and danger to personnel including severe injury or death. Consult the actuator label for operating limits. If an actuator label is missing, contact Bettis to request a replacement. An example of an actuator label is provided below for your reference.



NOTE:

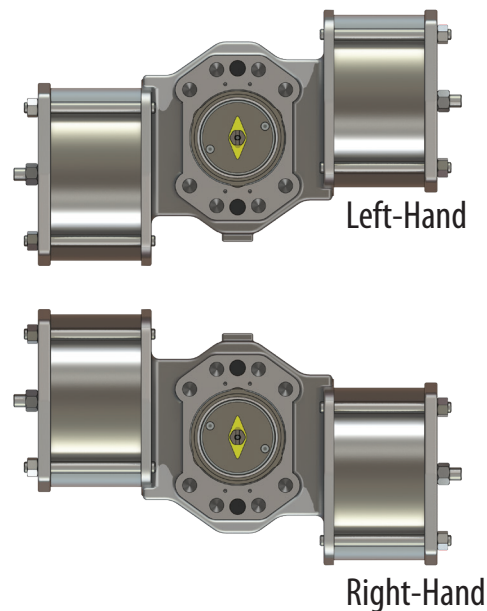
CE marking indicates product conforms to the requirements of applicable directives as listed on the actuator label.

All Bettis actuators are shipped in the fail clockwise (Left-Hand) orientation unless ordered as fail counterclockwise (Right-Hand). The orientation may be reversed in the field by moving all accessories to the opposite side of the shaft and turning the actuator top-side down.

Double-Acting (Left-Hand): pressure on the end cap ports pushes the pistons inward and causes counterclockwise rotation. Pressure to the base plate ports pushes the pistons outward resulting in a clockwise rotation.

Double-Acting (Right-Hand): pressure on the end cap ports pushes the pistons inward and causes clockwise rotation. Pressure to the base plate ports pushes the pistons outward resulting in a counterclockwise rotation.

Figure 3



Piping Guidelines:

- For dual cylinder models (205, 210, and 214), both end cap pressure ports (P1 and P2) must be utilized for proper operation.
- P1 and P2 are typically connected together and powered by a single air pathway.
- For single cylinder models (203, 204, 207, and 212), P2 does not exist.
- P3 is a pressure port on the body.

Figure 4

205DA, 210DA, 214DA

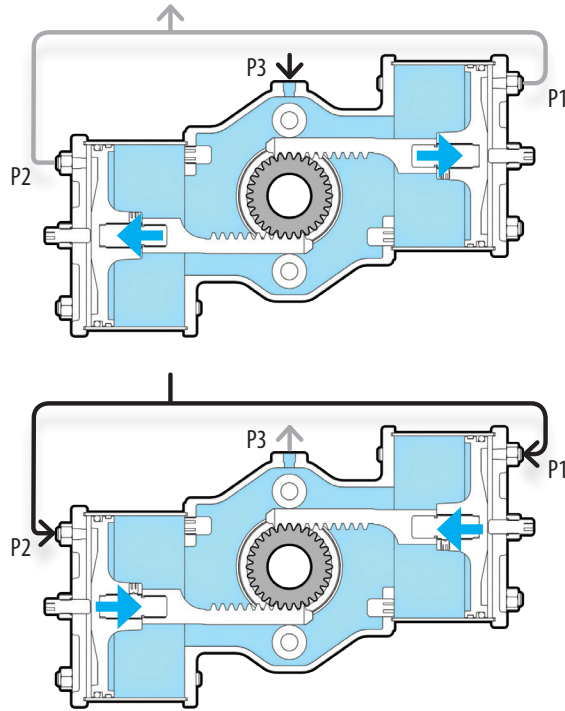
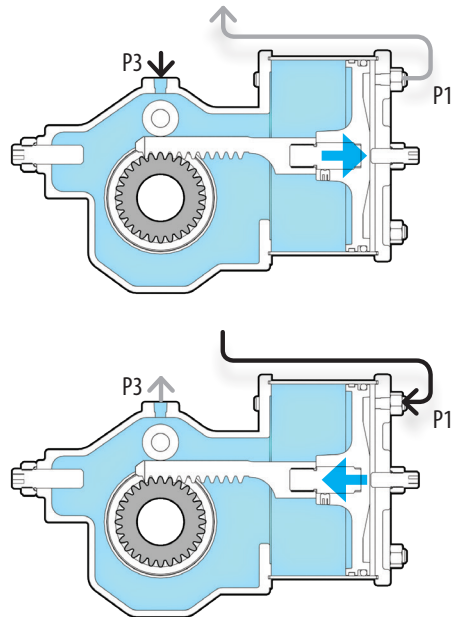


Figure 5

203DA, 204DA, 207DA, 212DA



2.4 Travel Adjustment

The following instructions are for Left-Hand orientated actuators. For non-standard models, clockwise and counterclockwise motion will be the inverse of what is described below. Check the actuator model and orientation before adjusting the Travel Stops.

Figure 6

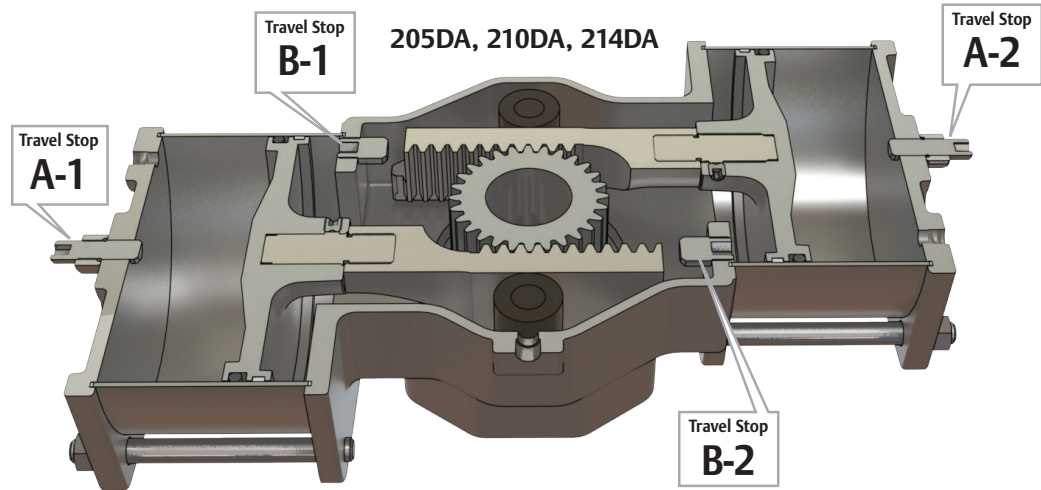
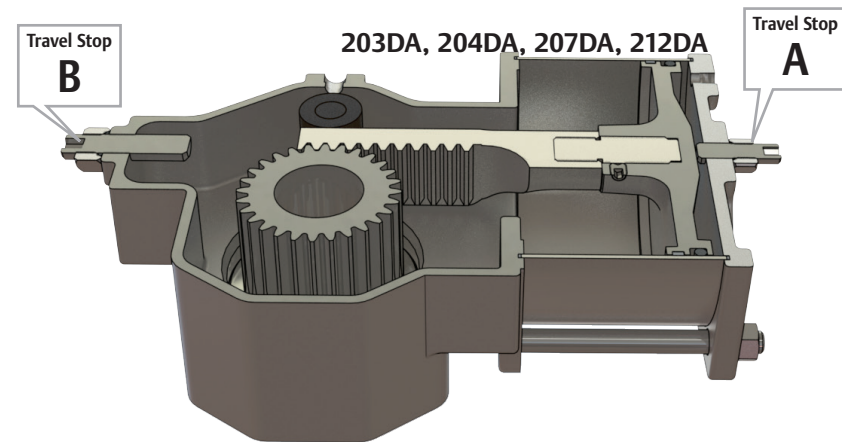


Figure 7



Set Clockwise Rotation (Travel Stop(s) A)

1. Relieve all pressure from the actuator.
2. Loosen Travel Stop Nut(s) on Travel Stop(s) A. Be careful not to misplace the travel stop O-ring(s).
3. Ensure actuator lockout (if provided) is disengaged.*

Single Cylinder Actuators:

- a. Adjust Travel Stop A until set at the desired position. It may be necessary to stroke the actuator in the clockwise direction between each adjustment. This can be accomplished by applying pressure to P3.
- b. With pressure still applied to P3, tighten the travel stop nut until it comes in contact with the end cap, then an additional quarter turn.

Dual Cylinder Actuators:

- a. Unthread Travel Stop A-1 three to four full turns.
- b. Adjust Travel Stop A-2 until the stroke is set to the desired position. It may be necessary to stroke the actuator in the clockwise direction between each adjustment. This can be accomplished by applying pressure to P3.
- c. With pressure applied to P3, thread Travel Stop A-1 in until it is in firm contact with the piston.
- d. With pressure still applied to P3, tighten both travel stop nuts until it comes in contact with the end cap, then an additional quarter turn.

** Clockwise rotation of the travel stop will shorten actuator stroke (stroke < 90°), counterclockwise rotation will lengthen actuator stroke (stroke > 90°).*

Set Counterclockwise Rotation (Travel Stop(s) B)

1. Relieve all pressure from the actuator.
2. Ensure actuator lockout (if provided) is disengaged.*

Single Cylinder Actuators:

- a. Loosen the travel stop nut on Travel Stop B. Be careful not to misplace the travel stop O-ring.
- b. Adjust Travel Stop B until the stroke is set to the desired position. It may be necessary to stroke the actuator in the counterclockwise direction between each adjustment. This can be accomplished by applying pressure to P1.
- c. With pressure applied to P1, tighten the travel stop nut until it comes in contact with the body.

Dual Cylinder Actuators:

If counterclockwise travel adjustment on a dual cylinder actuator is required in the field, it is recommended the user accomplish this via bracket motion followed by resetting Travel Stops A via the directions listed above. If this cannot be accomplished, follow the steps below.

⚠ WARNING: DEPRESSURIZE COMPONENTS PROPERLY

Do not remove/loosen tie rod nuts unless cylinder is fully depressurized. Components may exit the actuator dangerously if disassembly is attempted under pressure.

- a. Follow Section 4.4, Steps 1 to 3.
- b. Adjust each Travel Stop B the appropriate amount. Use the table below as a guide as travel cannot be checked without fully assembling the actuator.#

Table 2.

Model	Degrees of Travel Per 1/4 Turn
Q205	1.4
Q210	1.1
Q214	0.8

- c. Measure the height of both Travel Stops B protruding through the body and ensure that they are equal.
- d. Follow Section 4.5, Steps 16 to 20.

* Clockwise rotation of the travel stop will shorten actuator stroke (stroke < 90°), counterclockwise rotation will lengthen actuator stroke (stroke > 90°).

These travel stops were installed with thread locker and may require an application of heat before they may be adjusted. It is recommended the user reapply thread locker after their adjustment.

Section 3: Troubleshooting

Table 3.

ISSUE	CAUSE	SOLUTION
Irregular or Stuttering Stroke	Supply pressure too low	Verify operating pressure is correct
	Worn internal components	See Section 4.4 to 4.5
	Damaged or valve	Consult valve manufacturer
Leakage	Travel stop nut is not tight	Tighten travel stop nut with pressure relieved from actuator
	Damaged Piston O-ring	See Section 4.4
	Damaged shaft seals	See Section 4.5
	Damaged cylinder seals	See Section 4.4
Improper Travel	Travel stops are not correctly set	See Section 2.4
	Internal cylinder contaminants preventing normal stroke	See Section 4.4 to 4.5
	Damaged valve	Consult valve manufacturer
Operating/Stroking too slowly	Supply pressure too low	Verify operating pressure will supply torque needed to operate valve correctly
	Internal cylinder contaminants preventing normal stroke	See Section 4.4
	Damaged valve	Consult valve manufacturer
	Damaged seals or O-rings causing loss of pressure	See Sections 4.4 to 4.5
	Damaged supply lines	Inspect supply and lines replace as needed
	Limitation of accessories or port size	Upgrade accessories or port size

Section 4: Maintenance

4.1 Periodic Maintenance Schedule

General service actuators do not require periodic maintenance. Severe service actuators may require periodic maintenance based on operating conditions. Severe service may include but is not limited to high speed, high cycle, highly corrosive, explosive atmosphere, and others. Special applications may require individual maintenance schedules. Contact Bettis for help developing a maintenance schedule for your application.

NOTE:

This product is only intended for use in large-scale fixed installations excluded from the scope of Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS 2).

4.2 Lubrication

Bettis actuators are lubricated for life. For special applications, grease fittings may be provided. Use the grease fittings (if applicable) incorporated into the torque module of your actuator to apply additional lubricant. The frequency of this lubrication will depend on the application of the actuator. For any questions regarding the frequency of this operation or appropriate lubrication compounds, contact your Bettis distributor.

⚠ WARNING: DEPRESSURIZE COMPONENTS PROPERLY

Do not remove/loosen tie rod nuts unless cylinder is fully depressurized. Components may exit the actuator dangerously if disassembly is attempted under pressure.

Ensure that all process lines are safe.

Read all maintenance instructions before starting work.

NOTE:

Performing piston seal replacement on one cylinder at a time will allow maintenance while retaining travel stop adjustment. If both cylinders will be removed at the same time, the travel stops must be fully unthreaded prior to removing the end caps. Leaving the travel stops in place will put spring pressure on the end cap when it is removed, which could cause serious injury or death.

4.3 Maintenance Kit

To purchase your actuator maintenance kit, contact your Bettis distributor. Please have the serial number of your actuator available. This number may be found on the actuator label or stamped into the body of the actuator.

4.4 Piston Seal Replacement

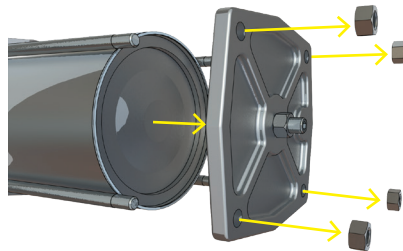
1. Exhaust all pressure and disconnect all supply lines.
2. Loosen all tie rod nuts until they are flush with the ends of the tie rods.
3. Check that there is no pressure against the end cap by verifying that the end cap is not being forced against the tie rod nuts.

⚠ WARNING: EXHAUST ALL PRESSURE AGAINST END CAP

If there is force against the end cap, stop. Do not continue further until it is assured that the unit is safe to disassemble.

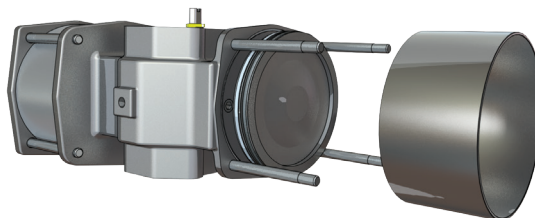
4. Remove the end cap. Be careful not to lose the cylinder seal located on the internal side of the end cap.

Figure 8



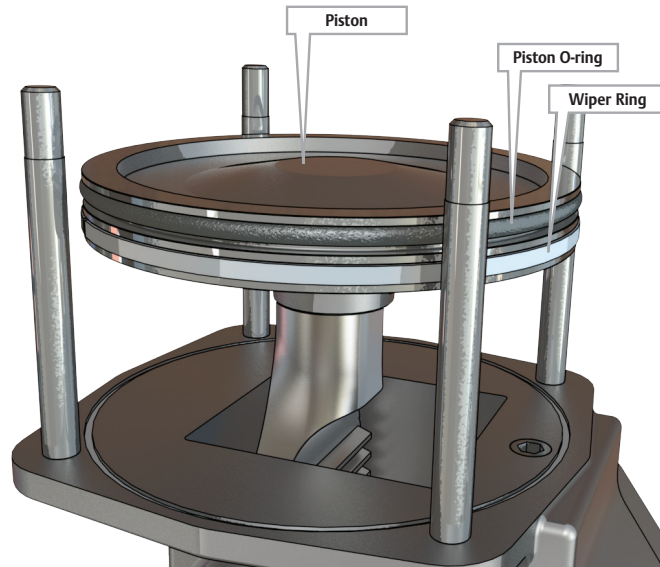
5. Remove the cylinder. Be careful not to damage the internal surface of the cylinder as this will compromise the piston's ability to seal.

Figure 9



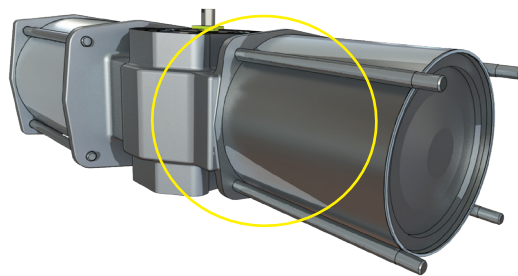
6. Replace the piston O-ring and wiper ring as needed. Be sure to lubricate the new O-ring and wiper ring with the correct Bettis approved lubricant if they are replaced.

Figure 10



7. Inspect the piston bolt for any corrosion or wear (pitting, cracking). If excessive corrosion or wear is apparent, a new actuator or actuator components may be necessary.
8. Lubricate the internal surface of the cylinder with a light coat of the correct Bettis approved lubricant and slide the cylinder back over the piston and into the cylinder seal groove of the base plate, taking care not to pinch the piston O-ring.

Figure 11

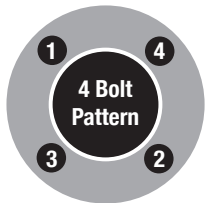


9. Place the end cap back over the tie rods. Be sure that the cylinder is seated in the cylinder seal groove of the end cap with the cylinder seal still in place between the cylinder and the end cap.
10. Secure the end cap with the tie rod hex nuts you removed in step two. Hand tighten, and then torque the hex nuts to half and then full values according to the table below using the pattern designated.

Table 4.

Model	Ft-Lbs	Nm
203	10	14
204/205	10	14
207/210	20	27
212/214	35	48

Figure 12



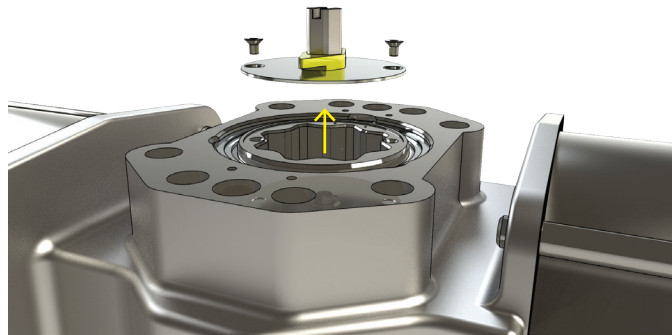
11. Complete Steps 1 to 10 on the second force module of the actuator (dual cylinder models).
12. Leak Test.
13. Reinstate the actuator to service.

4.5 Body Maintenance

To perform this maintenance, the actuator must be removed from the valve.

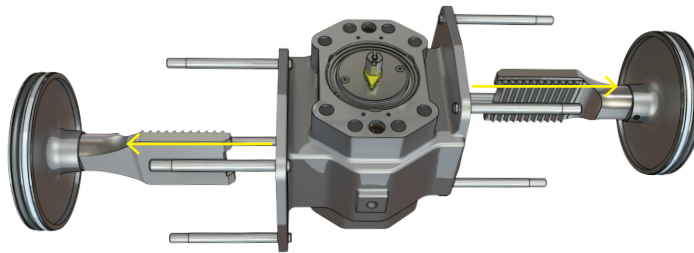
1. Follow Section 4.5, Steps 1 to 5.
2. Remove the top hat assembly by removing the top hat mounting bolts.

Figure 13



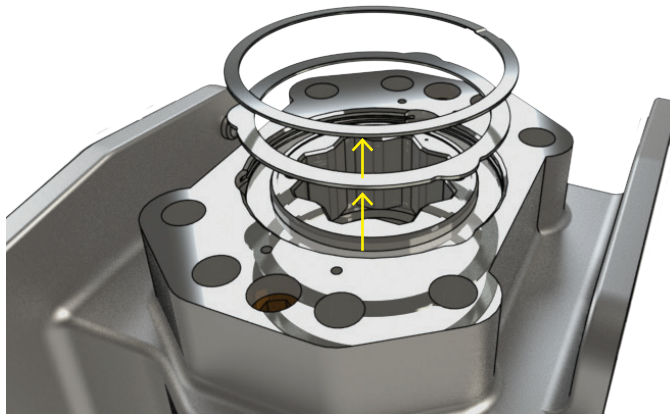
3. Remove the piston assembly(s) by pulling away from body of actuator. If model is a dual cylinder, this may require two people. Rotate the shaft until the teeth of the shaft and rack are no longer engaged.

Figure 14



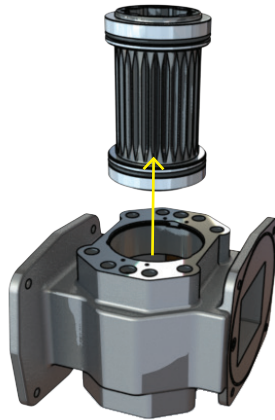
4. Clean and inspect rack teeth for wear. If teeth are excessively worn, a new rack(s) may be necessary for continued reliable/safe operation.
5. Remove retainer ring and thrust washer from top side of shaft.

Figure 15



6. Push shaft through top of shaft hole (shaft will only exit body in one direction). If necessary, a drive key may be inserted into the bottom of the shaft and tapped with a hammer to free the shaft from the body.

Figure 16

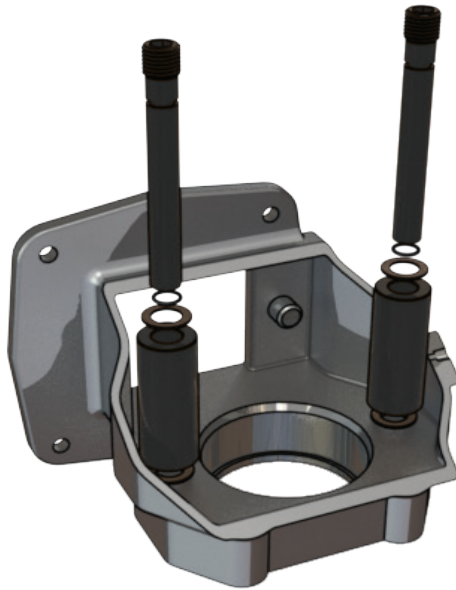


7. Remove bushings and O-rings from shaft and actuator body.
8. Clean and inspect the shaft for wear. If wear is found, a new shaft or actuator may be necessary for further safe/reliable operation.

Reassembly:

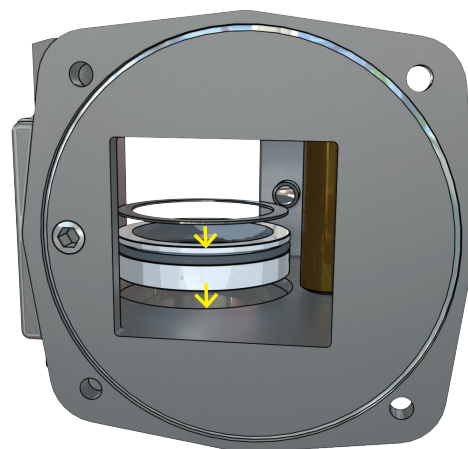
9. Lubricate and install O-ring(s), saddle pin(s), saddle pin thrust washers and roller(s).
10. Lightly coat all O-rings and bushings with lubricant.
11. Install O-rings on internal and external surfaces of bushing(s) in respective O-ring grooves.

Figure 17



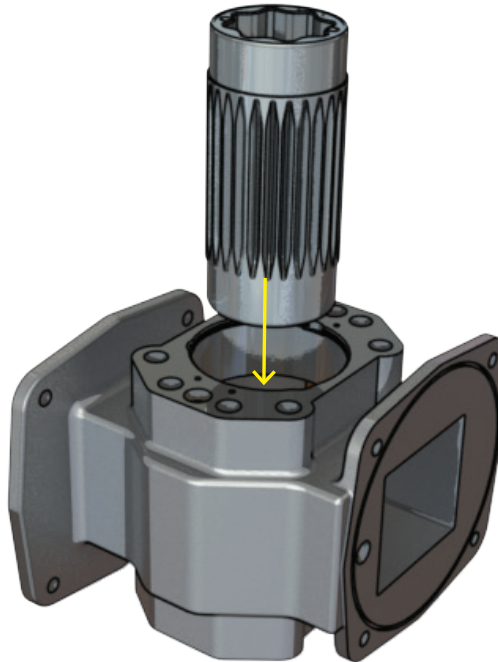
12. Insert one bushing into bottom side of shaft hole (side which contains shoulder to prevent bushing from falling out). The bushing should be placed with external O-ring closer to the center of the body of the actuator.

Figure 18



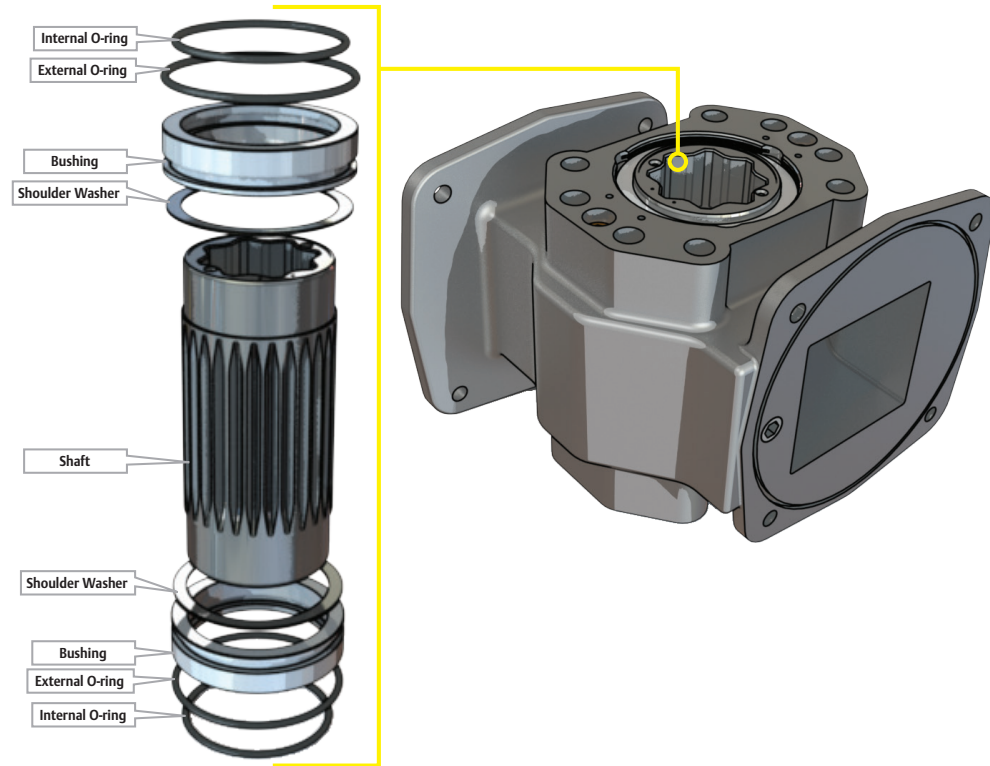
13. Place shaft shoulder washer on top of bushing and insert shaft through top of shaft hole (shaft shoulder washers not applicable for 203, 204, and 205 models).

Figure 19



14. Insert second shaft shoulder washer on top of shaft, followed by bushing (already containing both O-rings) again with external O-ring closer to the center of the body of the actuator (shaft shoulder washers not applicable to 203, 204, and 205 models).

Figure 20



15. Place thrust washer (not applicable on 203, 204, 205) on top of bushing followed by retaining ring. Ensure the retaining ring is seated in groove.
16. Rotate shaft until positioning markers are in the position shown below. Note the orientation of the body NPT port as well as the orientation of the high and low sides of the actuator.

Figure 21

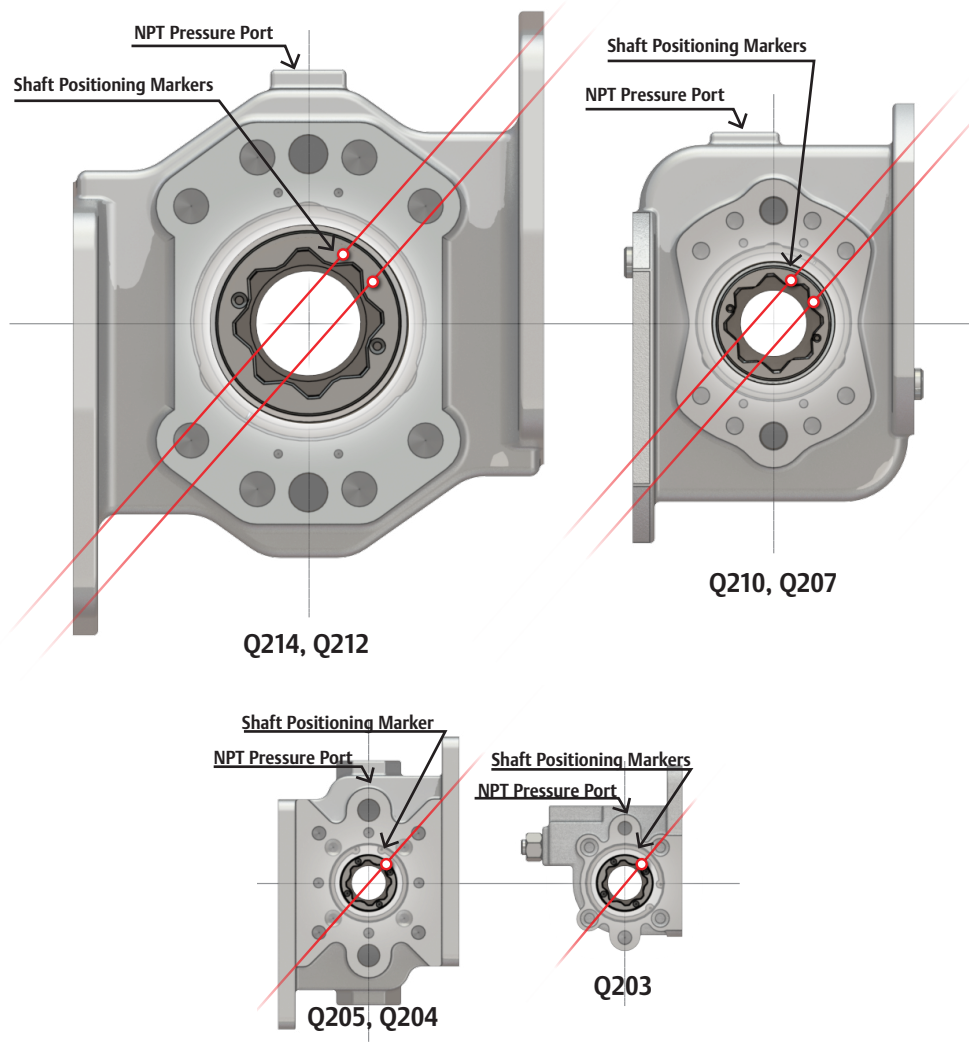
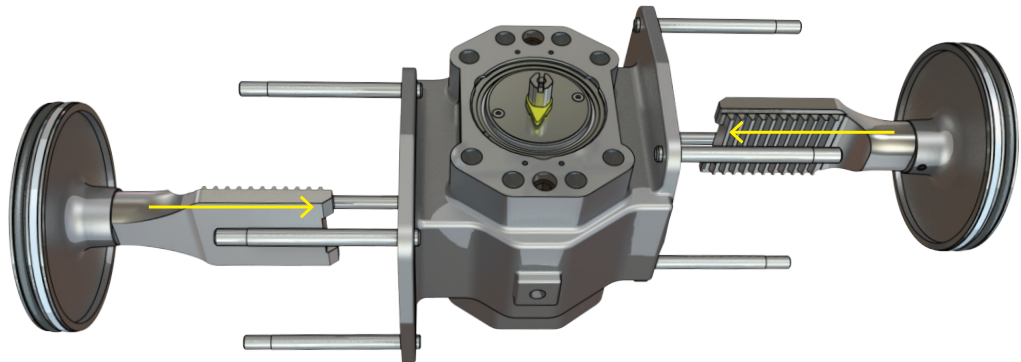


Figure 22



Single Cylinder Models:

- a. Insert the piston and engage rack teeth with shaft teeth after ensuring proper alignment.
- b. Press inward on piston until the point of refusal.

Dual Cylinder Models:

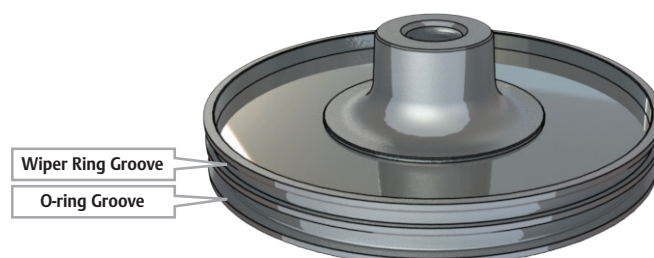
- a. Simultaneously insert the pistons and align teeth on racks and shafts.
- b. Simultaneously press both pistons into the body engaging the rack and shaft teeth until the point of refusal.

** Both pistons should contact the body simultaneously. If they do not, remove piston assemblies, reset shaft into correct position and try again.*

General Reassembly (continued)

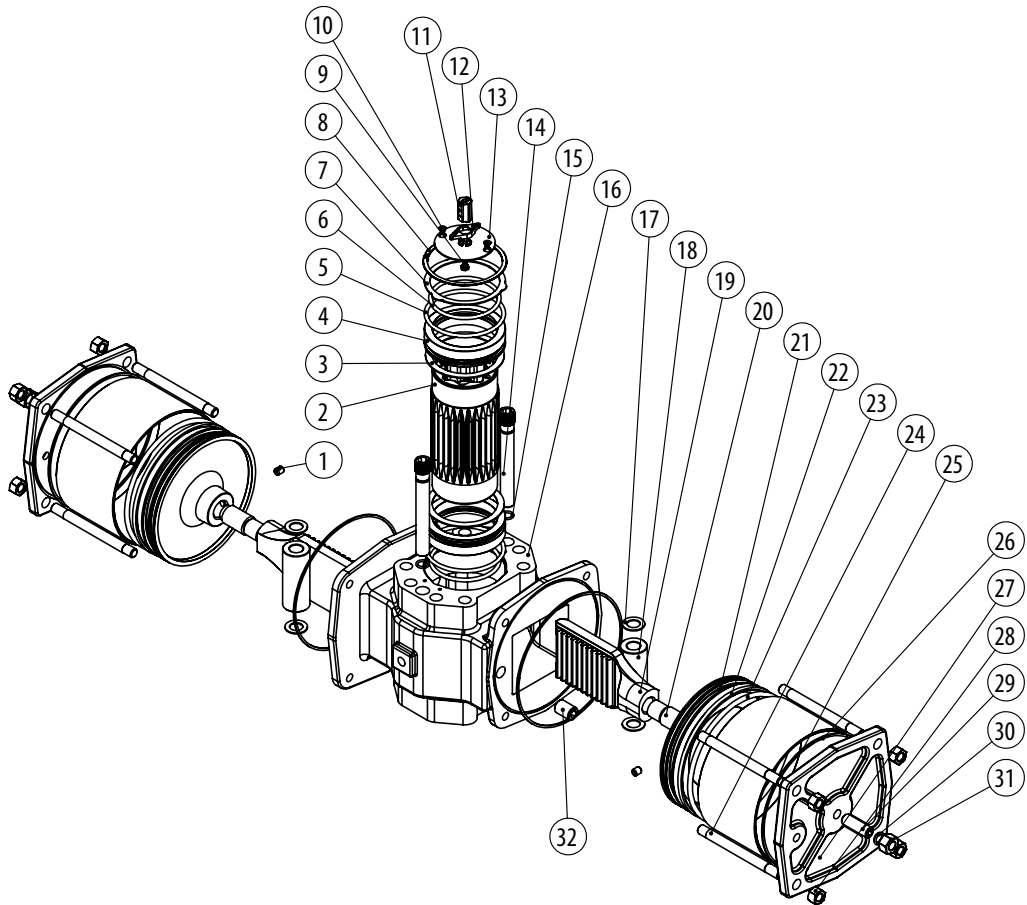
17. Place cylinder seal(s) into cylinder seal groove(s) on body.
18. Lightly lubricate wiper and piston O-ring grooves.
19. Lubricate the wiper and piston O-ring(s) and place them into their respective grooves on piston(s).
20. Follow Section 4.4, Steps 8 to 13.

Figure 23



Appendix A:

A.1 Dual Cylinder Model

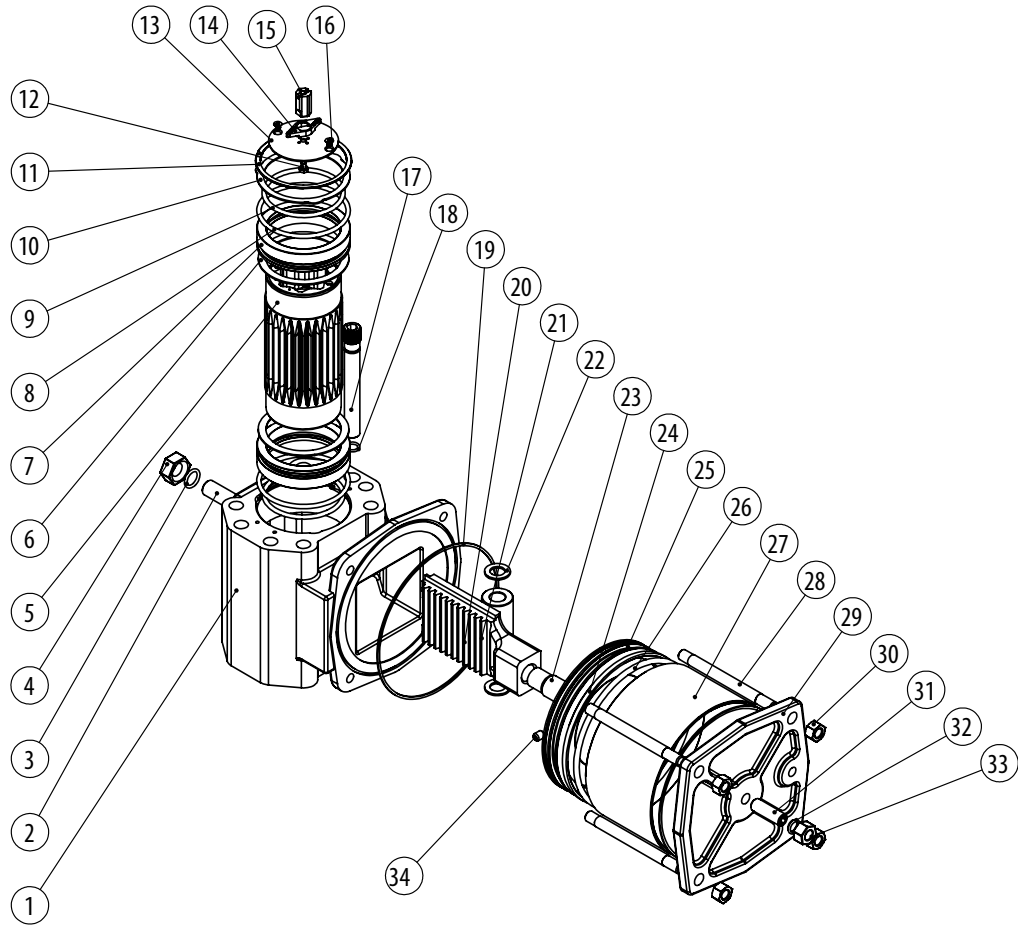


4.5.1 Dual Cylinder Model Part Number

Number	Part
1	Piston Bolt Set Screw
2	Shaft
3	Shaft Shoulder Washer*
4	Shaft Bushing
5	Bushing External O-ring
6	Bushing Internal O-ring
7	Anti Rotate Washer*
8	Retaining Ring
9	Top Hat Bolt
10	Top Hat Mounting Bolt
11	Top Hat
12	Top Hat Indicator
13	Top Hat Base
14	Saddle Pin
15	Saddle Pin
16	Body
17	Roller Thrust Washer
18	Roller
19	Rack
20	Piston Bolt
21	Piston
22	Wiper Ring
23	Piston O-ring
24	Tie Rod
25	Cylinder
26	Cylinder Seal
27	End Cap
28	Hex nut
29	Travel Stop (A)
30	Travel Stop O-ring
31	Travel Stop Nut
32	Travel Stop (B)

*May not be present on all models

A.2 Single Cylinder Model



4.5.2 Single Cylinder Model Part Number

Number	Part
1	Body
2	Travel Stop (B)
3	Travel Stop O-ring (B)
4	Travel Stop Nut (B)
5	Shaft
6	Shaft Shoulder Washer*
7	Shaft Bushing
8	Bushing External O-ring
9	Bushing Internal O-ring
10	Anti Rotate Washer*
11	Retaining Ring
12	Top Hat Bolt
13	Top Hat Base
14	Top Hat Indicator
15	Top Hat
16	Top Hat Mounting Bolt
17	Saddle Pin
18	Saddle Pin O-ring
19	Cylinder Seal
20	Rack
21	Roller
22	Roller Thrust Washer
23	Piston Bolt
24	Wiper Ring
25	Piston
26	Piston O-ring
27	Cylinder Seal
28	Tie Rod
29	End Cap
30	Hex Nut
31	Travel Stop (A)
32	Travel Stop O-ring (A)
33	Travel Stop Nut (A)
34	Piston Bolt Set Screw

*May not be present on all models

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