

Apollo® Rack & Pinion Pneumatic Actuators

Installation, Operation and Maintenance Manual

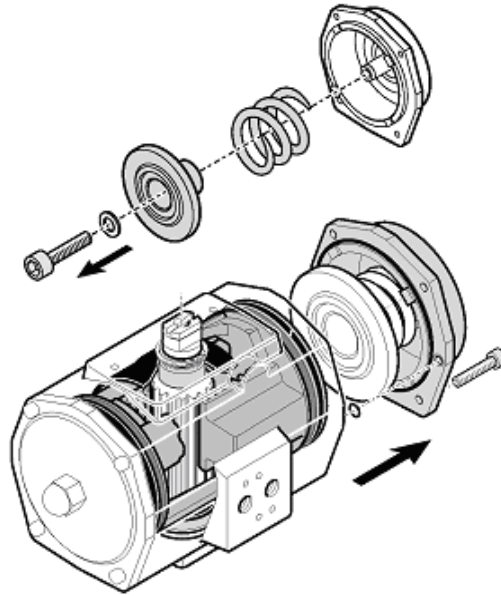
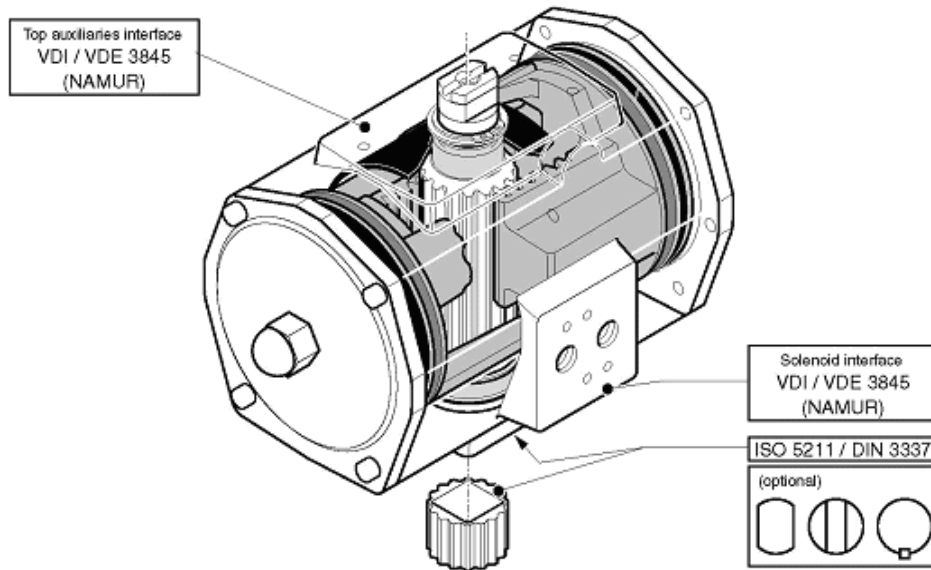


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1 INTRODUCTION

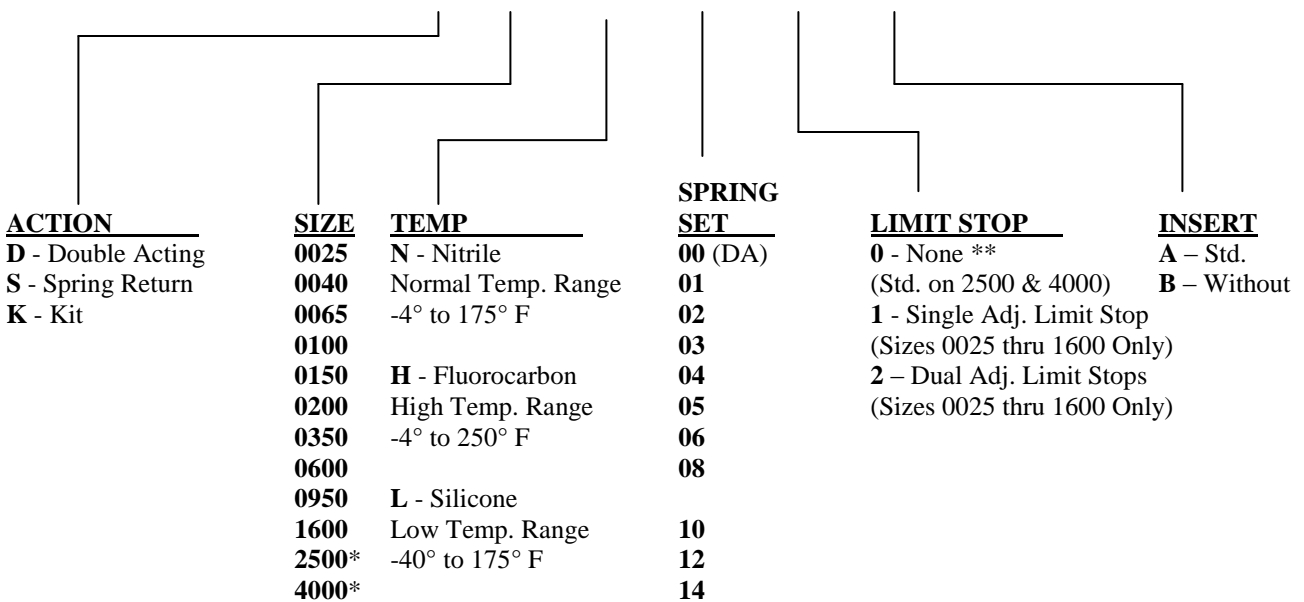
1.1 Feature Identification



1.2 Assembly Part Numbering System

EXAMPLE:

A S 0350 N 05 2 A



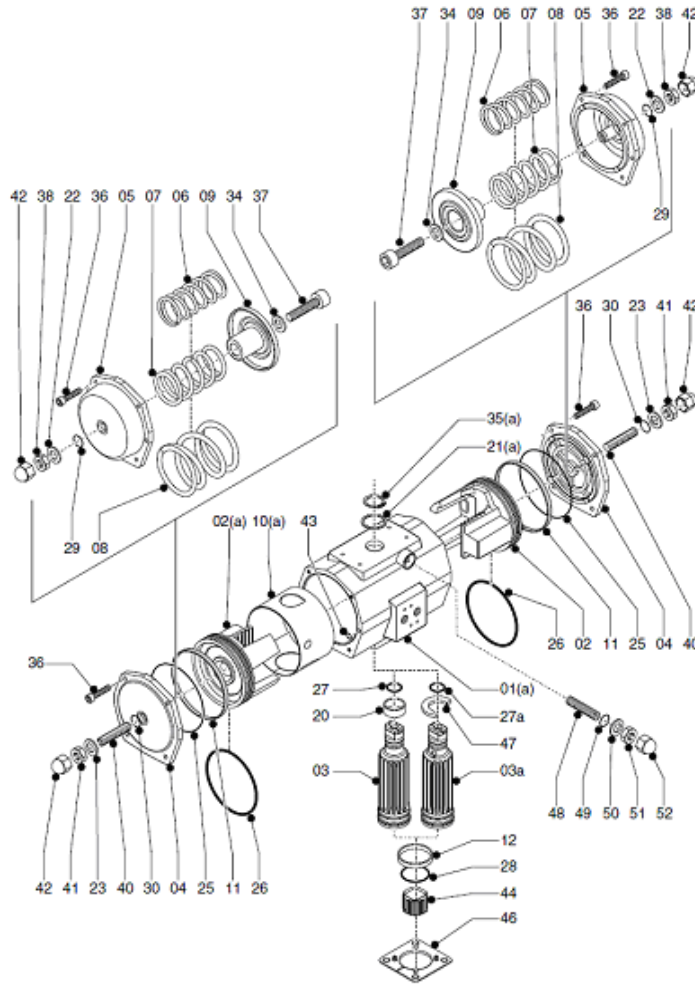
* Units have no adapter options

**Optional double stroke adjustment plate is available for 2500 & 4000 (see price list)

Note: Add suffix "F" for fail open units

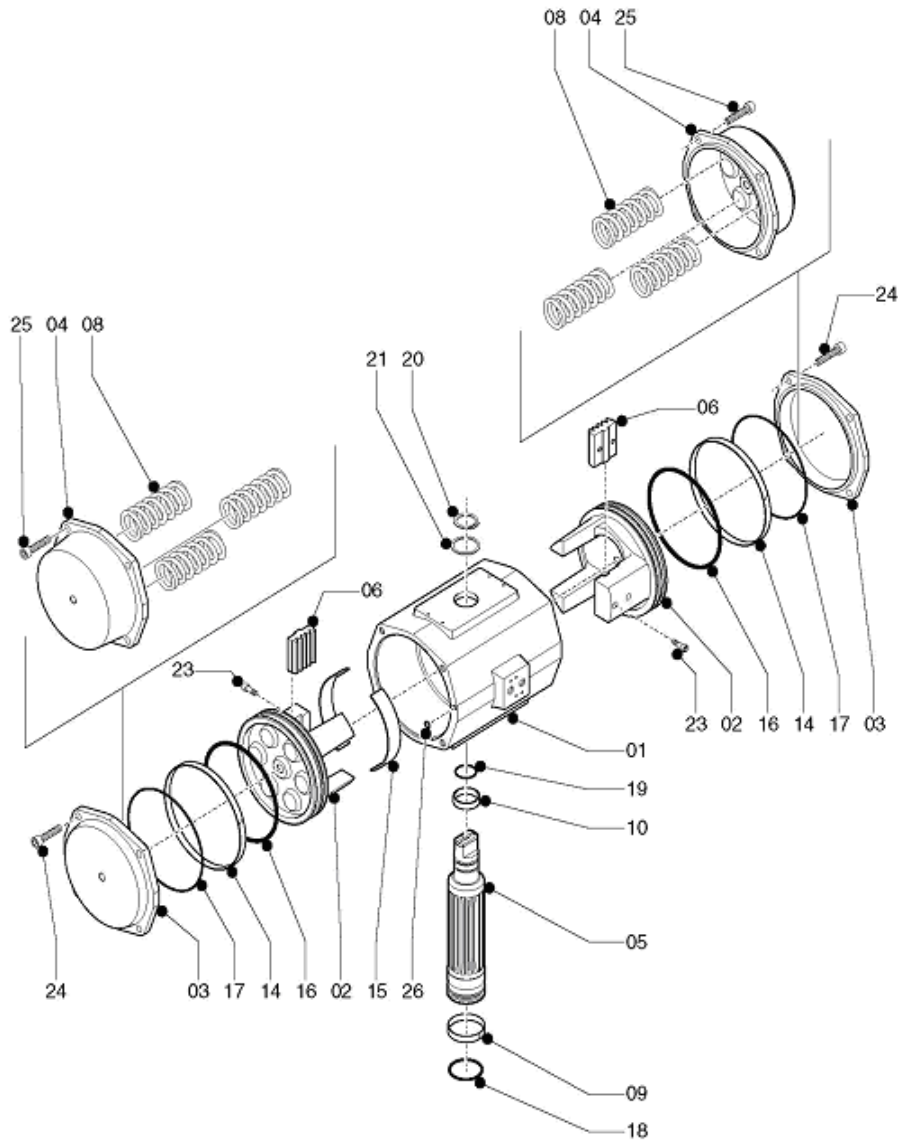
2 EXPLODED VIEW & PARTS LIST

2.1 A0025 to A1600 Actuators



01	(1) Body	21*	(1) Thrust Washer	38	(2) Stop Adjustment Nut
02	(2) Piston	22*	(2) Stop Screw Washer	40	(2) Limit Stop Bolt
03	(1) Pinion	23*	(2) Stop Screw Washer	41	(2) Stop Adjustment Nut
04	(2) D-A End Cap	25*	(2) End Cap O-ring	42	(2) Nut Cover
05	(2) S-R End Cap	26*	(2) Piston O-ring	43	(2) Port O-ring
06	(0 to 2) Inner Spring	27*	(1) Upper Pinion O-ring	44	(1) Insert/Adapter
07	(0 to 2) Middle Spring	28*	(1) Lower Pinion O-ring	47	(1) Stroke Cam
08	(0 to 2) Outer Spring	29*	(2) Stop Screw O-ring	48	(1) Dual Stop Bolt
09	(2) Spring Holder	30*	(2) Stop Screw O-ring	49*	(1) Dual Stop O-ring
10*	(1) Guide Band	34	(2) Stop Screw Washer	50*	(1) Dual Stop Washer
11*	(2) Piston Guide	35	(1) Spring Clip	51	(1) Dual Stop Lock Nut
12	(1) Lower Bearing	36	(8) End Cap Bolt	52	(1) Dual Stop Nut Cover
20*	(1) Upper Bearing	37	(2) Limit Stop Bolt	*	Contained in Repair Kit

2.2 A2500 and A4000 Actuators



- | | | | | | |
|-----|-----------------------|-----|-------------------------|-----|---------------------------|
| 01 | (1) Body | 10* | (1) Upper Bearing | 21* | (1) Thrust Washer |
| 02 | (2) Piston | 14* | (2) Piston Guide | 23 | (2 or 4) Rack Capscrew |
| 03 | (2) D-A End Cap | 15* | (2) Heel Guide | 24 | (8 or 20) DA End Cap Bolt |
| 04 | (2) S-R End Cap | 16* | (2) Piston O-ring | 25 | (8 or 20) SR End Cap Bolt |
| 05 | (1) Pinion | 17* | (2) End Cap O-ring | 26 | (2) Port O-ring |
| 06 | (2) Gear Rack | 18* | (1) Lower Pinion O-ring | * | Contained in Repair Kit |
| 08 | (0 to 14) Coil Spring | 19* | (1) Upper Pinion O-ring | | |
| 09* | (1) Lower Bearing | 20* | (1) Spring Clip | | |

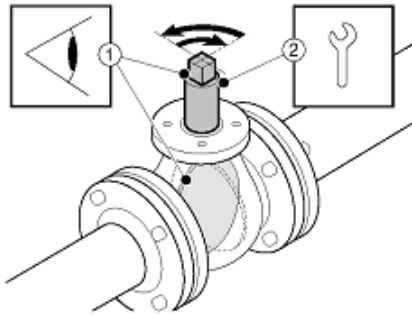
3 INSTALLATION

Caution: Do not attempt work on valves or actuators that are under pressure.

Caution: Ball valves and plug valves can trap pressure in the body cavity. Isolate the piping system in which the valve/actuator assembly is installed and relieve any pressure on or in the valve.

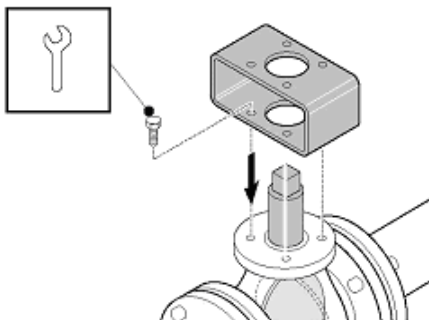
3.1 Double Acting Installation

3.1.1 Note the position of the valve. If at all possible, place the valve in the fully open position.



3.1.2 Remove the handle and stops to clear the top-works of the valve. Do not remove features that control packing adjustment with the valve under pressure.

3.1.3 If a standoff bracket is required, mount it to the valve first with the provided hardware, oriented to provide the most convenient access to the valve packing adjustment if applicable. Install fasteners hand tight at this time.



3.1.4 Ball valves, butterfly valves and plug valves are designed to operate in 90 degrees of

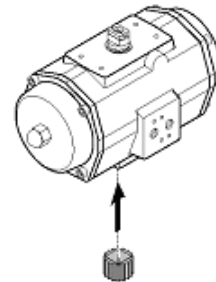
rotation. Convention requires that the operator be installed to provide “clockwise (CW) to close” operation.

3.1.5 Normal installation of the actuator is in-line with the piping system. Installation perpendicular to the pipeline can be used to address space limitations but, the clockwise to close rotation should be maintained if at all possible.

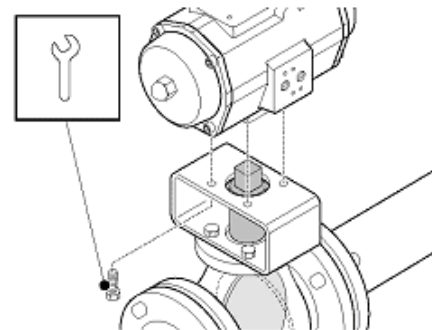
3.1.6 Pressure applied to the port labeled “A” will verify that the actuator is in the full CCW position or to port “B” to confirm full CW position.

3.1.5 If a coupling was supplied with the mounting kit, verify its smooth fitment in the adapter/insert provided with the actuator.

3.1.6 If the insert was supplied loose, install it in the actuator. Install the coupling on the valve stem.



3.1.7 Slide the actuator over the coupling in the proper orientation.



3.1.8 The upper bracket fasteners should start with little or no effort. Tighten finger tight. If they do not align properly, do not disturb the

valve's position, instead refer to the section 3.3.1 "Single Stop Adjustment" and adjust the actuators position after backing off the stops in each end cap.

3.1.9 Tighten all fasteners and temporarily connect a pressure source to "B" port and stroke the valve open observing the coupling and/or actuator for smooth operation. Jerky motion suggests binding in the assembly. Loosen all mounting hardware fasteners, allow the package to self-align and re-tighten. Stroke the assembly again and repeat if necessary to achieve smooth operation.

3.1.10 Verify full 90 degrees of actuator rotation. If adjustments were made in step 3.1.8, closed position adjustment may be necessary on dual stop units.

3.2 Spring Return Installation

3.2.1 Spring-return actuator installation follows the same process as installing a double acting actuator with some extra considerations. Actuators intended for fail open service require special factory preparation. Verify that the model number order ends in the letter "F". If not, contact the factory for the proper actuator.

3.2.1 Fail Closed In-line (CW): This procedure is exactly as described for the double action actuator, see section 3.1.

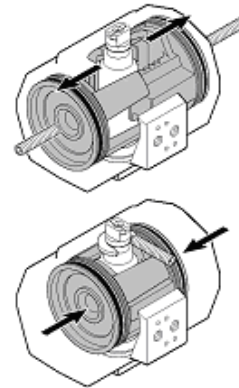
3.2.3 Fail Closed Perpendicular (CW): If the actuator output is a square drive, with the actuator in the full CCW position, slide it on the stem or coupling crossways of the pipeline. If the actuator output is a double-d style, it will be necessary to remove the adapter insert, turn it 90 degrees and reinstall it before sliding it onto the valve stem or coupling. Install the balance of the hardware as described in paragraphs 3.1.8 through 3.1.10.

3.2.4 Fail Open In-line (CCW): After verifying presences of "F" suffix, the procedure is the same as described for the double action actuator, see section 3.1.

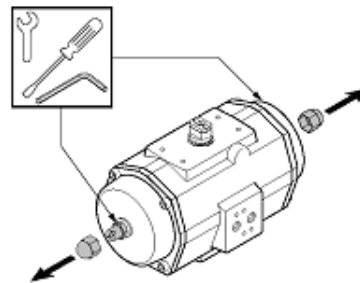
3.2.5 Fail Open Perpendicular (CCW): After verifying presences of "F" suffix and the actuator output is a square drive, with the actuator in the full CCW position, slide it on the stem or coupling crossways of the pipeline. If the actuator output is a double-d style, it will be

necessary to remove the adapter insert, turn it 90 degrees and reinstall it before sliding it onto the valve stem or coupling. Install the balance of the hardware as described in paragraphs 3.1.8 through 3.1.10.

3.3 Stroke Adjustment



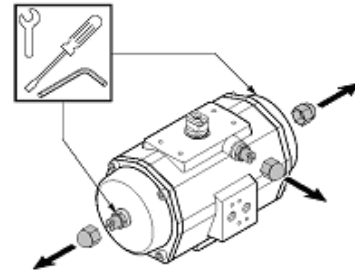
3.3.1 Single Stop Adjustment: Single stop adjustments are located on the end caps only and limit the piston's outward motion. In most cases, this provides fine adjustment to the valve's open position. All styles of actuators have this feature.



3.3.1.1 Remove both nut covers. Loosen both lock nuts. Back out both limit stop bolts 4 turns. Using a wrench applied to the top portion of the pinion turn the actuator shaft until the valve is in the desired position. For spring return actuators it may be necessary to use air pressure applied at port A to position the valve and actuator.

3.3.1.2 Turn in both limit stop bolts until an obstruction is felt (do not force), lock the lock nuts and reinstall the nut covers.

Caution: Failure to adjust both outbound limit stops may result in damage to the actuator pistons.



3.3.2 **Dual Stop Adjustment:** On dual stop models, the outbound stops are adjusted in the same manner described in 3.3.1. Dual stop models have inward stop adjustment as well. The bolt above the air connection interface limits the inward movement of the pistons, most commonly the closed position.

3.3.2.1 Remove the nut cover and back off the adjustment screw 4 turns. Turn the actuator shaft either by wrench or air pressure to the desired position.

3.3.2.2 Turn in the limit stop bolt until it meets obstruction (do not force), lock the lock nut and reinstall the nut cover. The inward stroke is now set.

3.4 Tool Chart

Actuator Size	End Cap Socket-head Cap screws size, wrench	End Cap Fastener Torque (max.) N-m (ft-lb)	End Cap Limit Stop Hex Nut	End Cap Limit Stop Screw	Dual Limit Stop Hex Nut	Dual Limit Stop Screw
AD/AS0025	M5, 4mm AK	()	10mm W	3mm AK	10mm W	SD
AD/AS0040	M5, 4mm AK	()	13mm W	4mm AK	13mm W	SD
AD/AS0065	M6, 5mm AK	5 (4)	13mm W	4mm AK	13mm W	SD
AD/AS0100	M6, 5mm AK	5 (4)	17mm W	5mm AK	17mm W	SD
AD/AS0150			17mm W	5mm AK	17mm W	SD
AD/AS0200	M8, 6mm AK	18 (13)	17mm W	5mm AK	17mm W	SD
AD/AS0350	M10, 8mm AK	30 (22)	19mm W	6mm AK	19mm W	SD
AD/AS0600	M12, 10mm AK	54 (40)	24mm W	11mm W	24mm W	11mm W
AD/AS0950	M12, 10mm AK	54 (40)	24mm W	11mm W	24mm W	11mm W
AD/AS1600	M14, 12mm AK	88 (65)	30mm W	11mm W	30mm W	11mm W
AD/AS2500	M10, 8mm AK	30 (22)	46mm W	17mm W	n/a	n/a
AD/AS4000	M10, 8mm AK	30 (22)	46mm W	17mm W	n/a	n/a

Note: W = wrench, AK = allen key, SD = screwdriver

3.5 Recommended Tubing Size

Tubing Run	Actuator Size		
	A0025 to A0065	A0100 to A0950	A1600 to A4000
Less than 4ft.	1/4" all sizes		
More than 4 ft	1/4"	5/16"	3/8"

4 DISASSEMBLY

Caution: Do not attempt to disassembly valves or actuators that are under pressure.

Caution: Ball valves and plug valves can trap pressure in the body cavity. Isolate the piping system in which the valve/actuator assembly is installed and relieve any pressure on or in the valve.

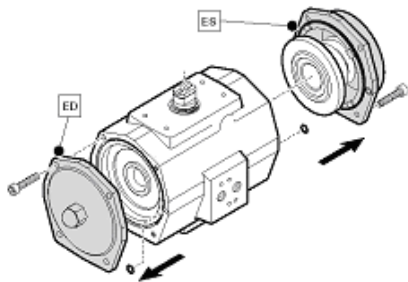
Caution: If the actuator is a “spring-return” model, in a criss-cross pattern loosen all the end cap fasteners uniformly, two to three turns at a time until the pre-load on the springs has been relieved.

4.1 Before Starting

Procure the appropriate repair kit. Part numbers appear like “AK0350N” for the kit containing buna-n (Nitrile) seals. Kits will contain (1) lower bearing, (1) upper bearing, (2) piston guides, (2) heel guides, (2) piston o-rings, (2) end cap o-rings, (1) lower pinion o-ring, (1) upper pinion o-ring, (1) spring clip, and (1) thrust washer.

4.2 Removing End Caps.

4.2.1 Using the appropriate allen key, remove the end cap capscrews. (See caution above for spring-return actuators.) Discard the end cap o-rings but be careful not to damage the very small port o-rings and retain them for reuse.

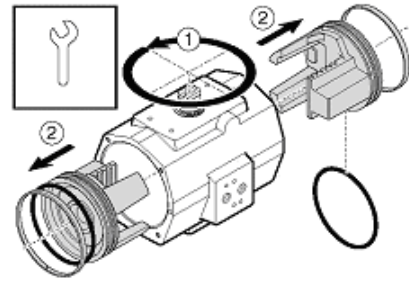


4.2.2 If disassembly of the spring packs is required, note the arrangement of the springs as they are removed.

4.3 Removing Pistons.

4.3.1 Pay close attention to the orientation of the gear racks on the pistons as they are removed.

4.3.2 On single stop units, using a wrench on the top of the pinion, turn the shaft counter-clockwise and drive the pistons out of the bore.



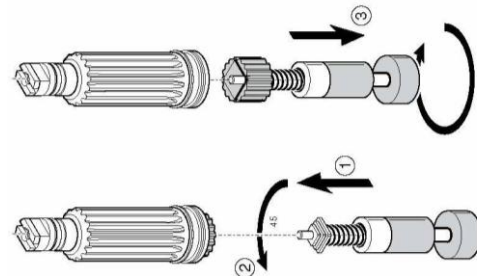
4.3.3 On dual-stop units, it will be necessary to remove the stop adjusting screw located above the air connection interface. Then, using a wrench on the top of the pinion, turn the shaft counter-clockwise and drive the pistons out of the bore.

4.4 Removing the Pinion.

Remove the snap ring from the top of the pinion, remove the thrust washer and push the pinion downward and out of the housing.

4.5 Removing the Insert.

Special tools are available for removing the insert from the pinion, however a slide hammer with a hook to catch the backside of the insert can also be used for the same purpose.

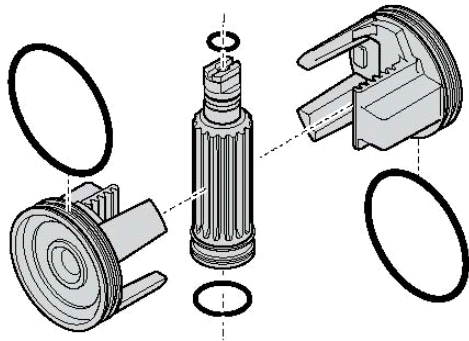


5 REASSEMBLY

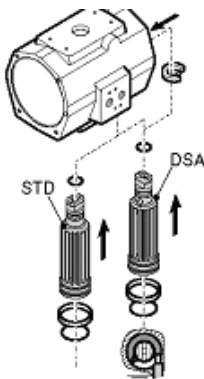
Proper assembly lubricant is included with each kit.

5.1 Heel Guide and Shaft Installation

5.1.2 Apply a light film of Dow 111 grease (suitable for all seals and temperature ranges) to the upper and lower o-rings, bearings, heel guides and the pinion gear teeth. Install the o-rings on the pinion along with the bearings.



5.1.3 On dual stop units, verify that the stop cam is installed in the recess in the top of the body with the flat facing the stop adjustment screw hole.



5.1.4 Align the heel guides inside the body.
 5.1.5 Note the orientation of the detent pin on the pinion of dual stop units and slide the pinion into position in the body.

5.2 Piston Installation.

5.2.1 Apply a thin film of lubricant to the o-rings and piston guides. Install them on each piston.

5.2.2 Align the pinion gear so that its teeth will pick-up the piston's rack teeth when turning the shaft clockwise. (For fail-open actuators, align the piston rack teeth to engage when turning the shaft counter-clockwise.)

5.2.3 Cycle to assure smooth movement and 90 degrees of operation. It may take a couple of attempts to achieve perfect alignment: pistons fully inward, pinion NAMUR flats 90 degrees to the body centerline or pistons fully extended, but not disengaged and pinion flats aligned with body centerline.

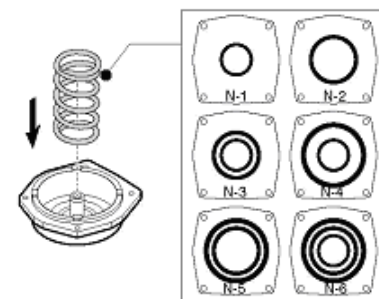
5.3 Double Acting End Cap Reassembly

5.3.1 Apply a thin film of lubricant on the end cap o-rings and port o-rings.
 5.3.2 Install the port o-rings on each end of the body and the end cap o-rings on both end caps.

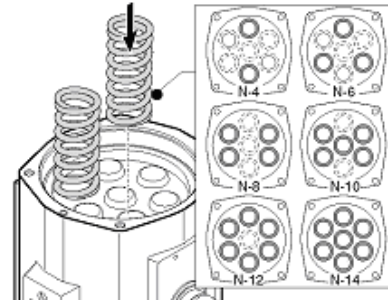
5.4 Spring Return End Cap Assembly

5.4.1 Place the springs in the same positions as they were originally removed.

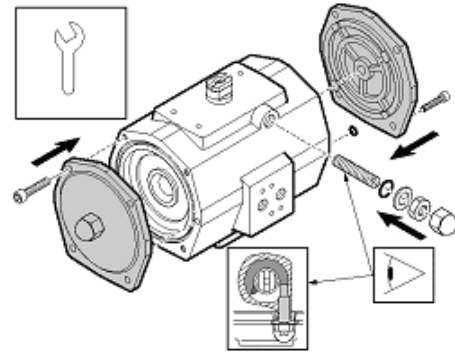
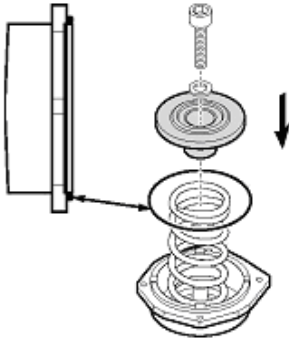
(AS0025 to AS0350)



(AS0600 to AS4000)



5.4.2 On A1600 and smaller units, reinstall the spring holder using the new o-rings, new washers, limit stop bolts and nuts.



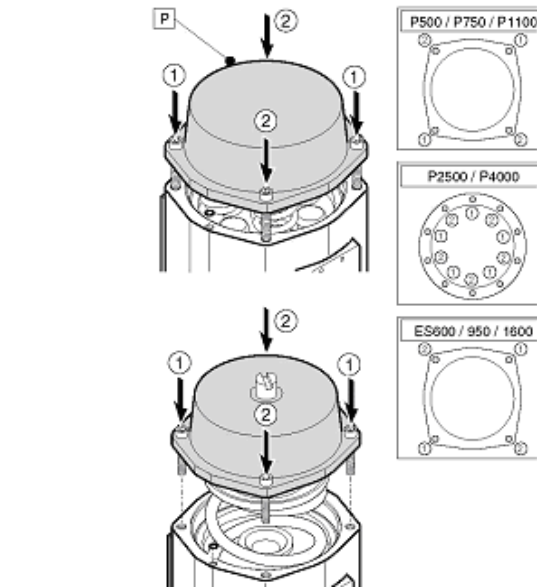
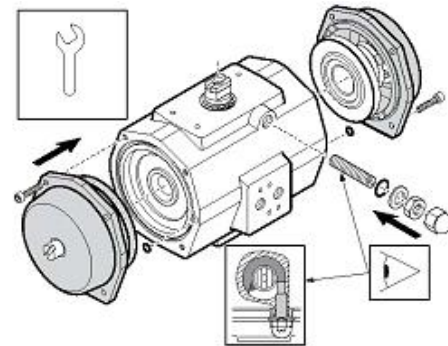
(AS0025 to AS0350)

5.4.3 Make certain the pistons are fully retracted into the body.

5.4.4 Apply a thin film of lubricant on the end cap o-rings and port o-rings. Install the port o-rings on each end of the body and the end cap o-rings on both end caps.

5.5 Final Assembly

5.5.1 Using the original fasteners, install the end caps on the body. Tighten fasteners in a criss-cross pattern.



5.5.2 On dual stop units, install the stop bolt, o-ring, washer and lock nut. Turn the bolt in until it meets resistance, then back it off 4 turns as an initial adjustment.

5.5.3 Install the new shaft spring clip onto its mating groove on the top shaft extension. Check proper functioning by applying pressure to the A-port or B-port.

5.5.4 Install the insert/adaptor into the pinion in the proper orientation for the application.

5.5.5 Temporarily install all the nut covers.

5.5.6 Inspect the assembled unit for air leaks. Apply pressure to the A-port and use some soapsuds around shaft top and shaft bottom to check for air leakage. Apply pressure to the B-port and use some soapsuds around the end caps to check for air leakage.

5.5.7 See Section 3.3 for guidance in adjusting and setting the unit stops.

5.5.8 For touch-up paint, use Rust-oleum® “Sunburst Yellow” Gloss Protective Enamel, available in spray (#7747830), ½ pint (#7747730) or quart (#7747502) size containers.

(Typical Double Acting Unit)