

Note: The parts referred to by the numbers in parentheses are shown on page 3 of this instruction manual

INLINE supplies a range of pneumatic 1/4 turn, RACK and PINION TYPE rotary actuators, in double-acting and spring return versions.

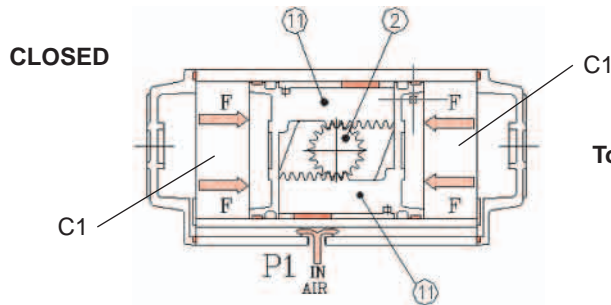
1 Main Characteristics

- 1 **Maximum Air Supply** : 8 bar
- 1 **Supply** : dry air (standard). Special executions with other fluids or gases possible if compatible with actuator materials.
- 1 **Temperature** : from -20°C to 85°C for standard version with NBR seals
from -20°C to 150°C for HIGH TEMP version (Viton seals)
from -40°C to 85°C for LOW TEMP version
- 1 **Rotation** : 90° stroke with regulation +/- 5° for open and closed position (double adjustment). Full stroke regulation 0°/90° available upon request
- 1 **Lubrication** : during assembly, extending actuator life.

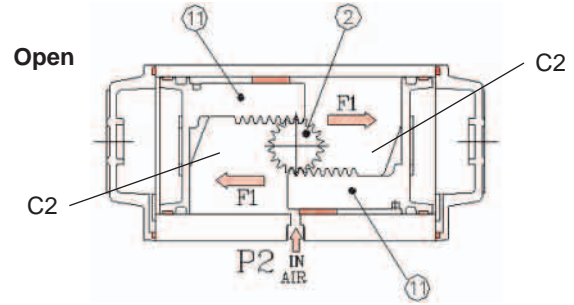
2 Operation Principle

The linear motion of the pistons (11) is the result of force generated from a buildup of pressure in the internal (C2) and external (C1) chambers of the actuator. Rising pressure forces the pistons to open and close, thus turning the pinion (2) in a 90° rotation.

2.1 Double Acting

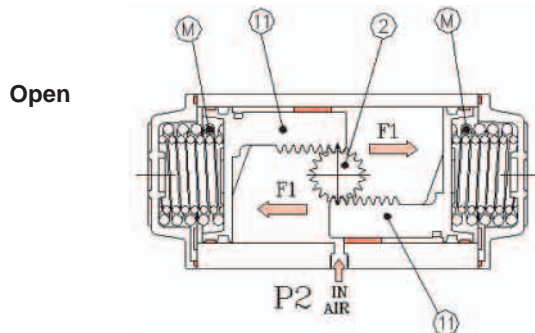


Supply air to port **P1** fills the external chamber (**C1**) and creates a force (**F**) which pushes the pistons (11) inward and generates a torque with a **CLOCKWISE ROTATION** of the pinion (2)

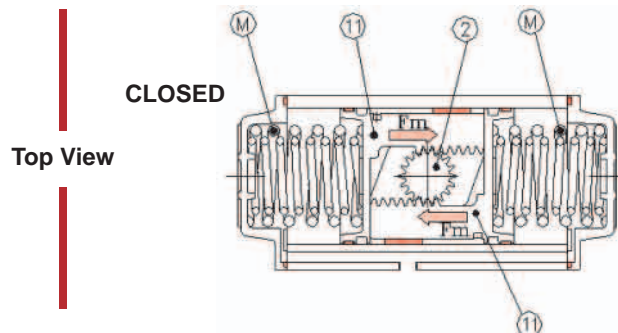


Supplying air to port **P2** fills the internal chamber (**C2**) and creates a force (**F1**) which pushes the pistons (11) outward and generates a torque with a **COUNTERCLOCKWISE ROTATION**

2.2 Spring Return



Pressurizing air port **P2**, the internal chamber fills up and the action of the pressure on the inside surface of the pistons creates a force (**F1**) which causes the opening of the pistons (11). This compresses the springs (**M**) in the external chamber, generating a torque with **COUNTERCLOCKWISE ROTATION** of the pinion (2)



By de-pressurizing air port **P2**, the springs (**M**) unfold creating a force (**Fm**) which causes the closing of the pistons (11), and generates a torque with **CLOCKWISE ROTATION** of the pinion (2)

3 Storage

For applications where the actuator is not put into immediate service, it is recommended that the actuator be kept in a clean and dry place that is well protected from the outside environment. The original packing box supplied by **INLINE** helps in optimizing storage conditions. If longer storage periods are anticipated, we recommend periodically cycling the actuator by pressurizing the chambers. All air ports should be plugged during storage to avoid any dirt intrusion.

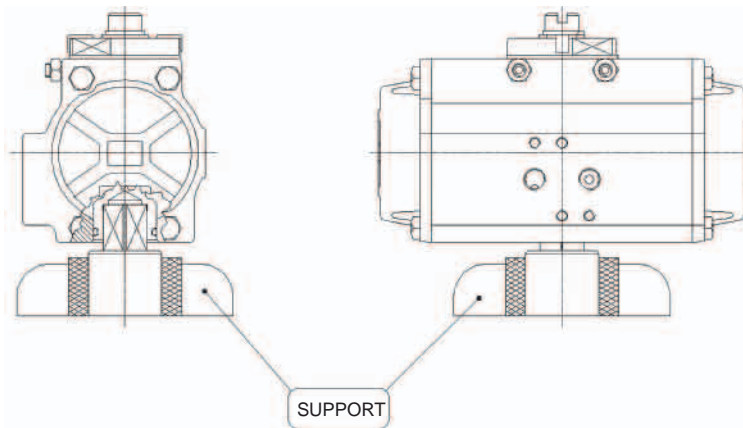
4 Maintenance

INLINE actuators are lubricated during assembly and the guides are made of self-lubricating material. This guarantees a lifetime of at least **1,000,000 cycles** for each **INLINE** actuator under normal working conditions.

Under abnormal working conditions, it may be necessary to replace worn parts (seals). If this is done, we recommend that guides be replaced as well for maximum benefit.

5 Disassembly

1. Disconnect all pneumatic and electric sources from the actuator
2. Remove any accessories which could be damaged
3. Remove the actuator from the valve (note process for correct re-assembly)
4. Place the actuator on a support that holds the pinion drive in place. This will allow you to more easily execute the following steps :



5. Before starting to disassemble the actuator, check the stamp on the body to see whether the actuator is double acting (DA) or spring return (SR).

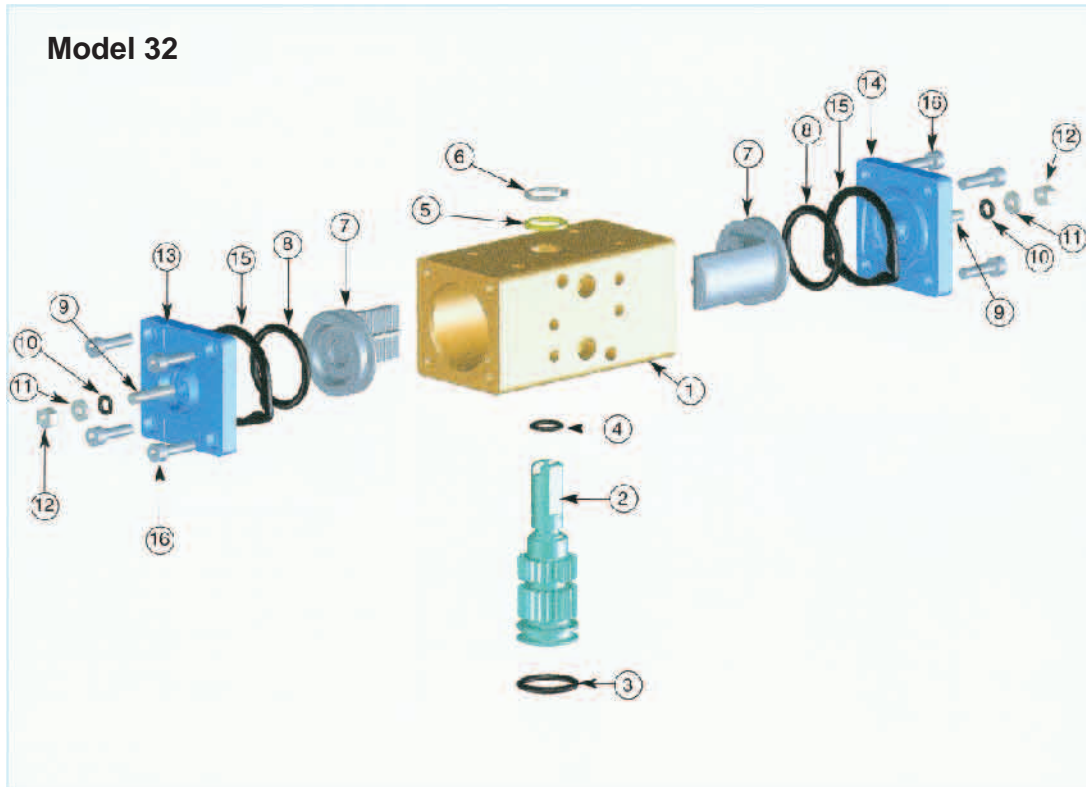
For Double Acting (DA) actuator

6. Remove the end cap screws (**22**) from each end cap (**19-20**) SLOWLY and in a DIAGONAL PATTERN
7. Remove the end caps (**19-20**)
8. Remove snap ring (**10**) from its place on the pinion (**2**)
9. Remove pinion washer (**9**)
10. Remove the cam (**7**) and spacer ring (**6**)
11. Rotate the actuator body (**1**) in a clockwise direction with respect to the pinion (**2**) so that the pistons move towards the body ends.
12. Remove the pistons (**11**) from the body (**1**)
13. Remove the pinion (**2**) carefully from the body (**1**). Be sure that pinion spacer ring (**4**) and top pinion o-ring (**5**) are also removed

For Spring Return (SR) actuator

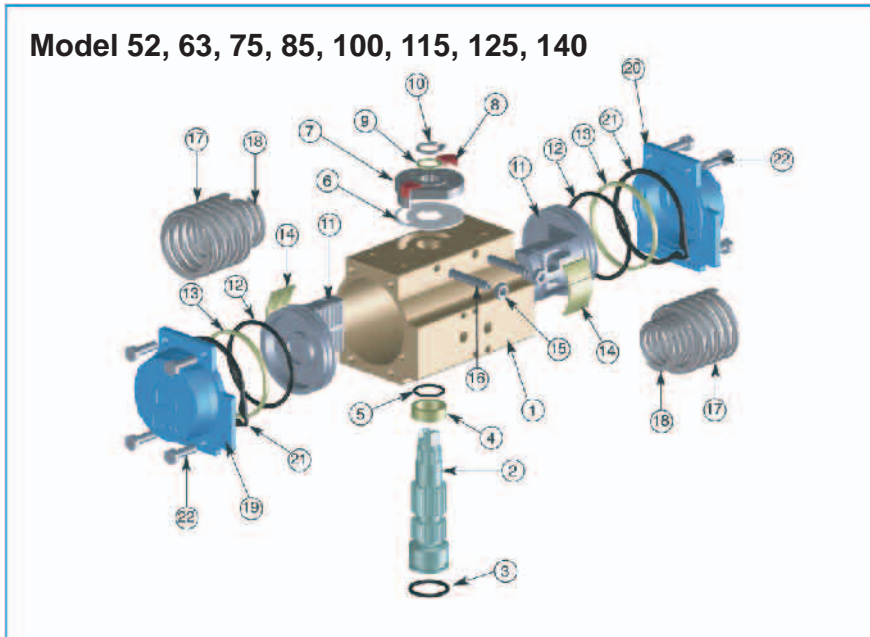
6. CAREFULLY loosen the end cap screws (**22**) from each end cap (**19-20**) in a DIAGONAL PATTERN, rotating each screw no more than 2 full turns before moving to the next screw. For safety, the length of the screws permits the springs to be fully de-compressed without removing the screws.
CAUTION: End caps are under load

6 Actuator Parts



Item	Description	Materials	Treatment	DA / Qty
1	Body	Extruded Aluminum	Hard Anodized	1
2	Anti-blowout Pinion	Steel	Nickel Plated	1
3	Lower Pinion O-Ring	NBR		1
4	Top Pinion O-Ring	NBR		1
5	Spacer Ring	POM		1
6	Pinion Snap Ring	Steel	Nickel Plated	1
7	Piston	Die Cast Aluminum		2
8	Piston O-Ring	NBR		2
9	Stop Bolt	Stainless Steel		2
10	Stop Bolt O-Ring	NBR		2
11	Washer	Stainless Steel		2
12	Stop Bolt Retaining Nut	Stainless Steel		2
13	Left End Cap	Die Cast Aluminum	Painted	1
14	Right End Cap	Die Cast Aluminum	Painted	1
15	End Cap Seats	NBR		2
16	End Cap Fixing Screw	Stainless Steel		8

6 Actuator Parts (cont.)



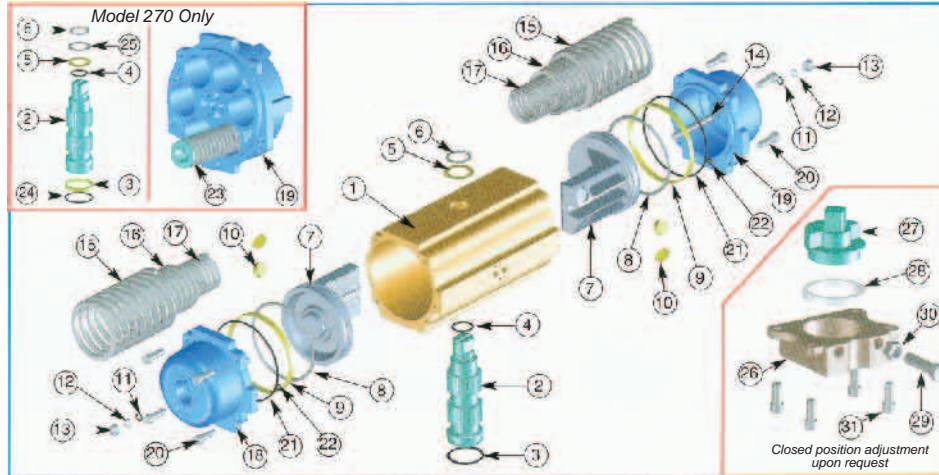
Item	Description	Materials	Treatment	DA / Qty	SR / Qty
1	Body	Extruded Aluminum	Hard Anodized	1	1
2	Anti-blowout Pinion	Steel	Nickel Plated	1	1
3	Lower Pinion O-Ring	NBR		1	1
4	Pinion Spacer Ring	POM		1	1
5	Top Pinion O-Ring	NBR		1	1
6	Cam Spacer Ring	POM		1	1
7	Cam	Stainless Steel		1	1
8	Position Indicator	Nylon		2	2
9	Pinion Washer	Stainless Steel		1	1
10	Pinion Snap Ring	Steel	Nickel Plated	1	1
11	Piston	Die Cast Aluminum		2	2
12	Piston O-Ring	NBR		2	2
13	Anti-friction Ring	POM		2	2
14	Piston Thrust Block	POM		2	2
15	Stop Bolt Retaining Nut	Stainless Steel		2	2
16	Stop Bolt	Stainless Steel		2	2
17	External Spring	Steel	Zinc-Phosphate	0	Based on Spring Setting
18	Internal Spring	Steel	Zinc-Phosphate	0	
19	Left End Cap	Die Cast Aluminum	Powder Coated	1	1
20	Right End Cap	Die Cast Aluminum	Powder Coated	1	1
21	End Cap Seats	NBR		2	2
22	End Cap Fixing Screw	Stainless Steel		8	8

Spring Setting

Set	External Spring	Internal Spring	Air Supply (bar)
01	1	1	2.5 - 3
02	2	-	3 - 4
03	1	2	4 - 5
04	2	1	5 - 5.5
05	2	2	5.5 - 6

6 Actuator Parts (cont.)


Model 160-200-270



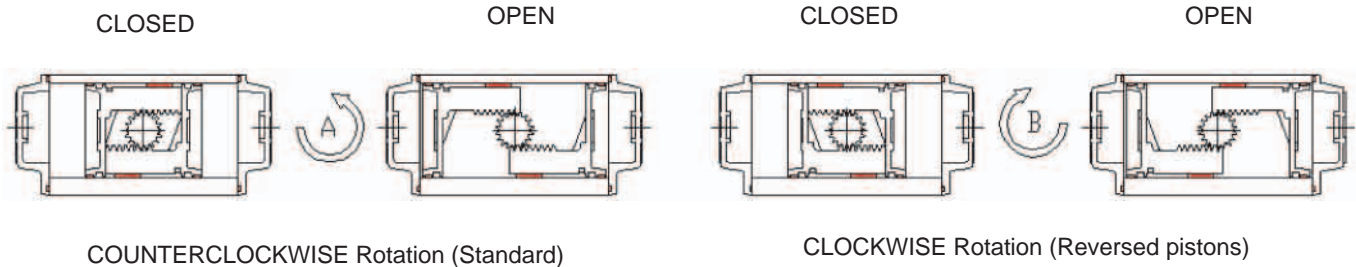
Item	Description	Materials	Treatment	DA / Qty	SR / Qty
1	Body	Extruded Aluminum	Hard Anodized	1	1
2	Anti-blowout Pinion	Steel	Nickel Plated	1	1
3	Lower Pinion O-Ring	NBR		1	1
4	Top Pinion O-Ring	NBR		1	1
5	Pinion Spacer Ring	POM		1	1
6	Pinion Snap Ring	Steel	Nickel Plated	1	1
7	Piston	Die Cast Aluminum		2	2
8	Piston O-Ring	NBR		2	2
9	Anti-friction Ring	PTFE 15% Graphite		2	2
10	Piston Thrust Block	POM		4 (6)*	4 (6)*
11	Stop Bolt O-Ring	NBR		2	2
12	Washer	Stainless Steel		2	2
13	Stop Bolt Retaining Nut	Stainless Steel		2	2
14	Stop Bolt	Stainless Steel		2	2
15	External Spring	Steel	Zinc-Phosphate	0	Based on Spring Setting
16	Central Spring	Steel	Zinc-Phosphate	0	
17	Internal Spring	Steel	Zinc-Phosphate	0	
18	Left End Cap	Die Cast Aluminum	Painted	1	1
19	Right End Cap	Die Cast Aluminum	Painted	1	1
20	End Cap Fixing Screw	Stainless Steel		8 (12)*	8 (12)*
21	End Cap O-Ring	NBR		2	2
22	End Cap Fixing Screw	NBR		2	2
23	Precompressed Spring	Steel	Zinc-Phosphate	0	Based on Spring Setting
24	Anti-friction Ring	PTFE 15% Graphite		1	1
25	Pinion Washer	Stainless Steel		1	1
Closed Position Adjustment Upon Request					
26	Plate	GGG40	Painted	1	1
27	Coupling	Steel	Nickel Plated	1	1
28	Anti-friction Ring	PTFE		1	1
29	Stop Screw	Steel	Zinc Plated	1	1
30	Stop Bolt Retaining Nut	Stainless Steel		1	1
31	Fixing Screws	Stainless Steel		4	4

* (6) and (12) Valid for Model 270 Only

7 Assembly

1. Clean the components before proceeding with the assembly
2. Lightly grease the internal chamber of the body (1) and the seals on the pistons. We suggest using TRIBOSTAR 1 EP (KLUBER) grease
3. Carefully introduce the pinion (2) into the body (1) from the bottom of the actuator. Guide the top of the pinion through the top hole of the actuator so that the Namur notch is at a 30° angle to the short axis of the body (open position) → 
4. Insert the pistons (pre-assembled and greased) into the body as shown below:

Assembly Possibilities - Top View



5. Push the pistons (11) into the body (1) until the teeth of the rack are stopped by the teeth of the pinion (2)
6. Place body on a support and, maintaining light pressure on the pistons (11) with the hands, rotate the body (1) in a counterclockwise rotation with respect to the pinion (2) until the pistons mesh with the pinion. (You should feel the pistons grip the pinion at the same time which avoids unequal pressures.) Reposition the body on the support with the air ports facing the front.
7. Now continue to rotate the body (1) counterclockwise and verify that, at the end of the rotation, the two pinion flat surfaces are about 7° rotated to the axis of the body. (Namur notch will be just slightly past the 12 o'clock position)

N.B. correct assembly gives symmetric stroke of the pistons, verifiable by measuring their equal distance from each end face of the body

8. Assemble the cam spacer ring (6) and the cam (7)
9. Assemble the pinion washer (9) and insert the snap ring (10) in its place on the pinion (2)

NB: use snap rings with reinforced thickness DIN 470 - UNI 7436

10. Adjust the stroke using the adjusting screws (16) and then fixing their position by tightening the nuts (15).

For Double Acting Actuators

11. Mount the end caps (19-20) and secure with screws (22) in a diagonal pattern

12. Repeat the operation on the other side
13. Test the actuator to verify the correct functioning before reinstalling it in its service application

For Spring Return Actuators

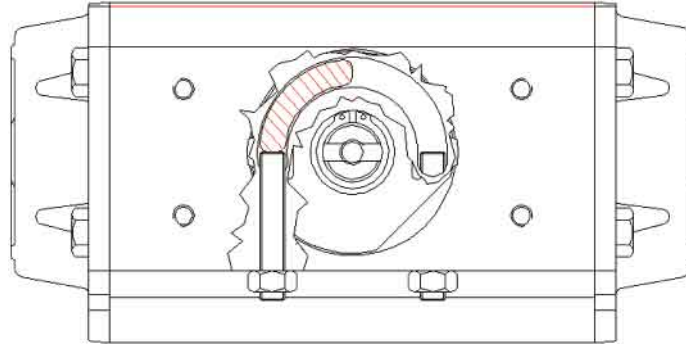
11. Insert the spring set (M) into the body (1), putting it in the seats of the piston (11). Then mount the end caps (19-20) on the springs, centering them in the seats

N.B.: pistons must be in CLOSED position

Partially assemble the screws (22) in a diagonal pattern, compressing the springs uniformly until the end caps (19-20) is completely closed

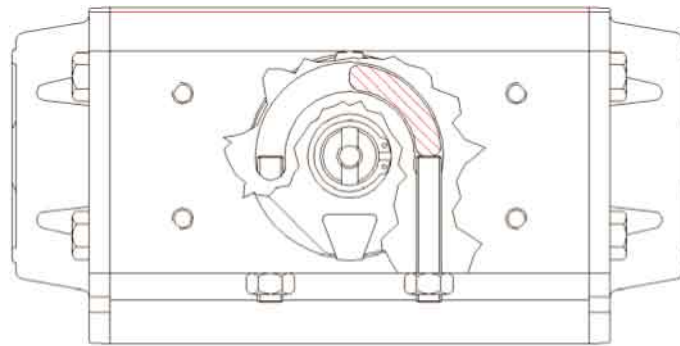
Warning: Do not attempt this on the SR160 or the SR200 without a press and adequate shielding. When springs are under load, accidental release could result in serious injury.

8 Stroke Adjustment



Adjust **LEFT** stop bolt

OPEN position (Standard version)
CLOSED position (Reversed pistons version)



Adjust **RIGHT** stop bolt

CLOSED position (Standard version)
OPEN position (Reversed pistons version)

8.1 Stroke Adjustment Procedure (when pistons are in open position)

- 1 Remove air supply or move the pistons to the closed position
- 1 Adjust the corresponding stop bolt
- 1 Move the pistons to the open position and verify the new adjustment
- 1 Repeat this operation until desired adjustment is achieved

8.2 Stroke Adjustment Procedure (when pistons are in closed position)

- 1 Remove air supply or move the pistons to the open position (necessary for SR models)
- 1 Adjust the corresponding stop bolt
- 1 Move the pistons to the closed position and verify the new adjustment
- 1 Repeat this operation until desired adjustment is achieved