

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.

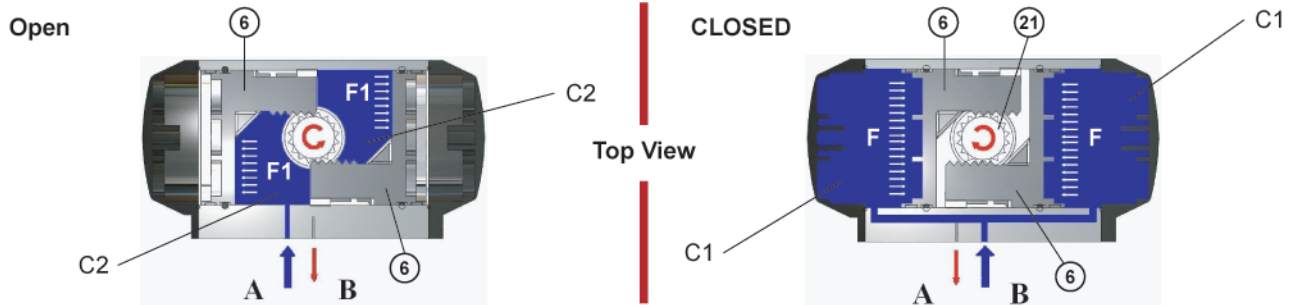
1 Main Characteristics

- **Maximum Air Supply :** 8 bar
- **Supply :** dry air (standard). Special executions with other fluids or gases possible if compatible with actuator materials.
- **Temperature :** from -20°C to 80°C for standard version with NBR seals
from -15°C to 150°C for HIGH TEMP version (Viton seals)
from -40°C to 80°C for LOW TEMP version
- **Rotation :** 90° stroke with regulation +/- 5° for open and closed position (double adjustment). Full stroke regulation 0°/90° available upon request
- **Lubrication :** during assembly, extending actuator life.

2 Operation Principle

The linear motion of the pistons (6) 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 (21) in a 90° rotation.

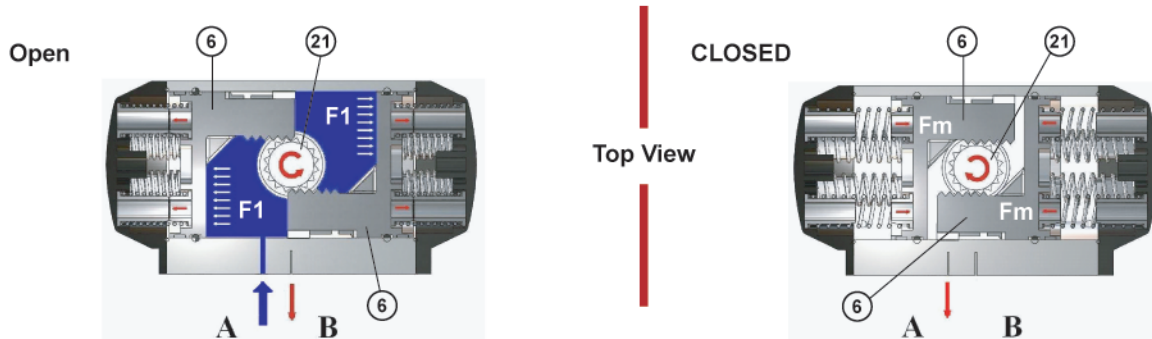
2.1 Double Acting



Supplying air to port **A** fills the internal chamber (**C2**) and creates a force (**F1**) which pushes the pistons (**6**) outward and generates a torque with a **COUNTERCLOCKWISE ROTATION**

Supply air to port **B** fills the external chamber (**C1**) and creates a force (**F**) which pushes the pistons (**6**) inward and generates a torque with a **CLOCKWISE ROTATION** of the pinion (**21**)

2.2 Spring Return



Pressurizing air port **A**, 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 (**6**). This compresses the springs in the external chamber, generating a torque with **COUNTERCLOCKWISE ROTATION** of the pinion (**21**)

By de-pressurizing air port **P2**, the springs unfold creating a force (**Fm**) which causes the closing of the pistons (**6**), and generates a torque with **CLOCKWISE ROTATION** of the pinion (**21**)

3 Storage

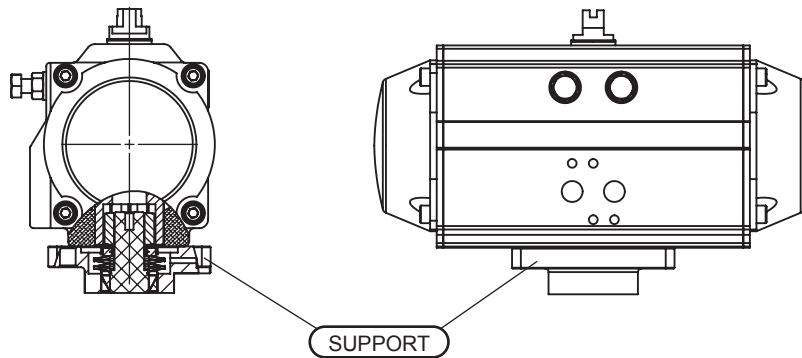
For applications where the actuator is not put into immediate service, it is recommended that the actuator be kept in a clean and dry place that is well protected from the outside environment. The original packing box supplied by **INLINE** helps in optimizing storage conditions. If longer storage periods 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 materials. Under normal operating conditions, **INLINE** actuators should provide over 1 million cycles of trouble-free performance without any need for maintenance. Under abnormal working conditions, or after 1 million cycles, it may be necessary to replace worn parts. When this is done, **INLINE** recommends replacement of all seals (SO) or all seals and guides (SG), available as repair kits from your authorized **INLINE** distributor.

5 Disassembly

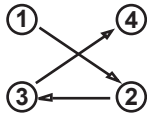
1. Disconnect all pneumatic and electric sources from the actuator
2. Remove any accessories which could be damaged
3. Remove the actuator from the valve (note process for correct re-assembly)
4. Place the actuator on a support that holds the pinion drive in place. This will allow you to more easily 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 (1) from each end cap (3, 12) SLOWLY and in a DIAGONAL PATTERN

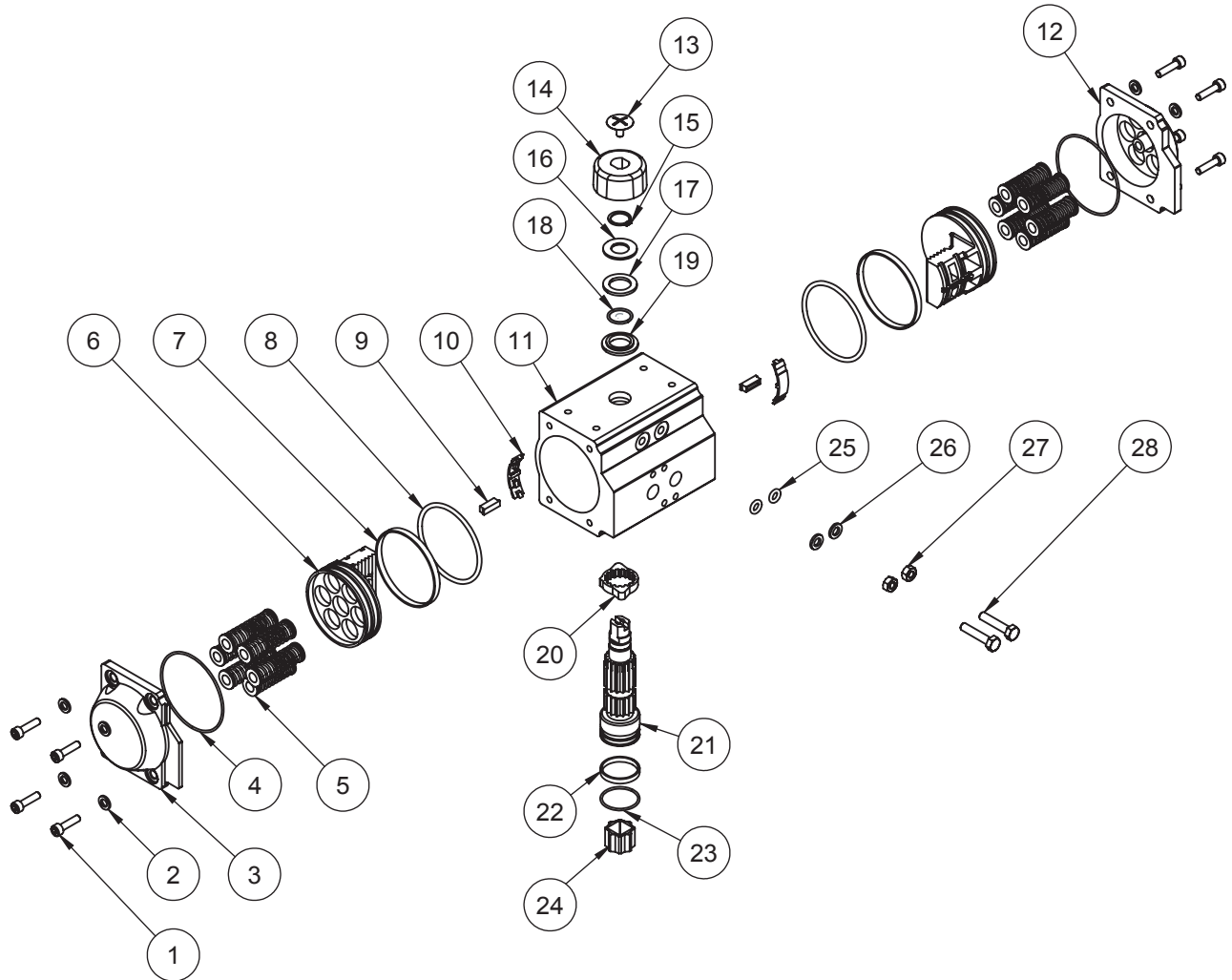


7. Remove end caps (3, 12)
8. Remove snap ring (15) from its place on the pinion (21)
9. Remove pinion washer (16) and top pinion bearing (17)
10. Rotate the actuator body (11) in a clockwise direction with respect to the pinion (21) so that the pistons move towards the body ends
11. Remove the pistons (6) from the body (11)
12. Remove the pinion (21) carefully from the body (11) by pressing down firmly on top of the pinion (21) while securing the bottom of the pinion (21) with other hand
13. Before removing pinion (21) completely, mark the pinion (21) and stroke adjustment stop (20) for correct positioning during reassembly
14. Remove stroke adjustment stop (20) from top of pinion (21) inside body so that pinion can be removed from bottom

For Spring Return (SR) actuator

6. CAREFULLY loosen the end cap screws (1) from each end cap (3, 12) 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.
7. Remove end caps (3, 12) and springs (5) and continue steps 8 - 14 to the left


6 Actuator Parts



No.	Part Description	Qty.	Material
1	Socket Head Screw	8	SUS 304
2	Split Washer	8	301 SS
3	End Cap (Left)	1	Alum. A380
4	Cylinder Head O-Ring	2	NBR (Buna) Rubber
5	Spring	12	Spring Steel
6	Piston	2	Alum. A380
7	Piston Ring Bearing	2	POM
8	Piston O-Ring	2	NBR (Buna) Rubber
9	Piston Guide Block	2	PA6
10	Piston Rack Bearing	2	PA6
11	Body	1	6063-T6
12	End Cap (Right)	1	Alum. A380
13	Indicator Screw	1	ABS
14	Position Indicator	1	ABS

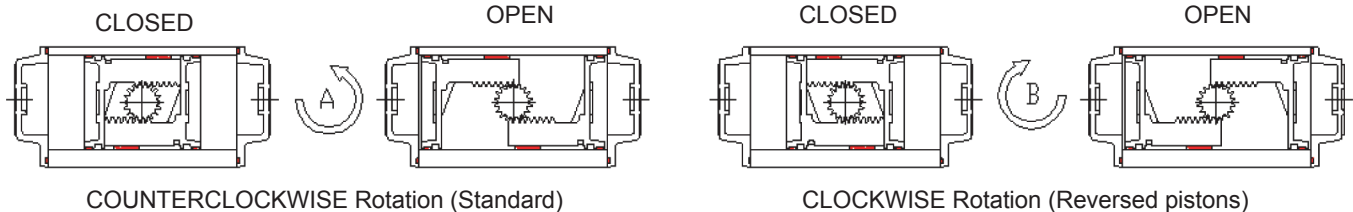
No.	Description	Qty.	Material
15	Snap Ring	1	304 SS
16	Washer	1	SUS 304
17	Top Pinion Bearing	1	POM
18	Top Pinion O-Ring	1	NBR (Buna) Rubber
19	Disc Bearing	1	POM
20	Stroke Adjustment Stop	1	SAE 1020
21	Pinion	1	SAE 1045
22	Bottom Pinion Bearing	1	POM
23	Bottom Pinion O-Ring	1	NBR (Buna) Rubber
24	Actuator Insert	1	Nickel Plated Carbon Steel
25	Adjusting Bolt O-Ring	2	NBR (Buna) Rubber
26	Metal Washer	2	SUS 304
27	Nut	2	SUS 304
28	Adjusting Bolt	2	SUS 304

7 Assembly

1. Clean the components and replace all needed seals and/or bearings provided before proceeding with the assembly
2. Lightly grease the internal chamber of the body (11) and the seals on the pistons. We suggest using TRIBOSTAR 1 EP (KLUBER) grease
3. Lubricate new top pinion o-ring (18) and insert into the countersink inside the top of body (11) where pinion (21) is inserted
4. Carefully insert the pinion (21) into the body (11) from the bottom of the actuator, with top of pinion (21) halfway into the body, return stroke adjustment stop (20) to previous position by lowering over pinion top and onto gear. Place the disc bearing (19) flat side down, on top of the stroke adjustment stop (20). Guide the top of the pinion through the top pinion o-ring (18) and through top hole of the actuator body until bottom of pinion (21) is flush with bottom of body and position the Namur notch at a 30° angle to the short axis of the body (open position) → 

5. Replace the top pinion bearing (17) and the pinion washer (16) and insert the snap ring (15) in place to retain the pinion (21)
6. Insert the pistons (pre-assembled and greased) into the body as shown below:

Assembly Possibilities - Top View



7. Push the pistons (6) into the body (11) until the teeth of the rack are stopped by the teeth of the pinion (21)
8. Place body on a support and, maintaining light pressure on the pistons (6) with the hands, rotate the body (11) in a counterclockwise rotation with respect to the pinion (21) 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.
9. Now continue to rotate the body (11) 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)
10. Verify that pistons (6) have been inserted symmetrically by measuring the depth of each piston (6) face from each end of the body (11). If depths are the same, pistons (6) are positioned correctly

For Double Acting Actuators

11. Mount the end caps (3, 12) and secure with screws (1) in a diagonal pattern

For Spring Return Actuators

11. With pistons (6) fully inserted, turn actuator body on end and insert the spring set (5) into the body (11), putting each spring into a spring pocket of the piston (6). Then mount the end cap (3 or 12) on the spring set, carefully aligning spring pockets on cap with springs. When aligned and level, hand tighten screws (1). Begin wrench tightening screws no more than 2 turns at a time, rotating until the end cap (3 or 12) is secure

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.

12. Repeat the operation on the other side
13. Adjust the actuator stroke using the adjusting bolts (28) and then fixing their position by tightening the nuts (27). Namur slot should be parallel to long axis in open position and perpendicular in closed
14. Test the actuator to verify the correct functioning before reinstalling it in its service application