

# INSTALLATION, OPERATION AND MAINTENANCE MANUAL FOR SERIES-C GENERATION ACTUATORS

For VSI SERIES C ACTUATORS

-Double acting "DA" and Spring Return "SR"  
-90° / 180° Stroke

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### 1) GENERAL

This instruction manual contains important information regarding the installation, operation, maintenance and storage for Series B rack and pinion pneumatic actuators. Please read these instructions carefully and save them for future reference. It is important that only properly trained personnel disassemble/assemble the actuator.

### 2) WARNING

Do not operate the actuator using inflammable, oxidising, corrosive, explosive and unstable gases or liquids. For actuators installed in potentially explosive zones, make sure that the internal parts of the actuator cannot come into contact with the external atmosphere. It is important that the actuator should only be used within pressure limits indicated in these technical specifications.

Operating the actuator over pressure limits will damage internal parts as well as cause damage to the housing.

Operating the actuator over temperature limits will damage internal and external components (disassembly of spring return actuator may become dangerous).

Operating the actuator in corrosive environments with incorrect protection may damage the internal and external parts.

Do not disassemble individual spring cartridges. Disassembly may result in personal injury.

For further information contact Valve Solutions Inc.

Isolate all air lines and make sure that actuator air connection is vented before installation or servicing of the actuator.

Do not remove end caps or disassemble the actuator while the actuator is pressurised.

Before installing onto a valve make sure that the rotation of the valve and the actuator are the same and that the position indicator orientation is also correct.

If the actuator is incorporated in a system or used within safety devices or circuits, the customer shall ensure that the national and local safety laws and regulations are observed.

### 3) WORKING CONDITIONS AND TECHNICAL DATA

#### Operating media:

Dry or lubricated air or inert/non-corrosive gases provided they are compatible with internal actuator parts and lubricant. The operating media must have a dew point equal to -20°C (-4°F) or at least 10°C below the ambient temperature. The maximum particle size must not exceed 30 µm.

#### Supply pressure:

The maximum supply pressure is 8 bar (116 PSI) .  
Generally for Double Acting and Spring Return actuator the supply pressure is: from 2.5 bar (36 PSI) minimum to 8 bar (116 PSI) maximum.

#### Operating Temperature:

Standard product from -20°C (-4°F) to +80°C (+176°F).  
Low temperature LT actuator with silicon "O" rings from -40°C (-40°F) to +80°C (+176°F).  
High temperature HT actuator with FPM "O" rings from -15°C (+5°F) to +150°C (+300°F)

**Caution:** For low and high temperature service, special grease is required. Please contact VSI for each application. High and low temperature will vary the output torque of the actuator.

**Caution:** The operating speeds depend on several factors such as: supply pressure/supply capacity (i.e. pipe diameter/flow capacity or pneumatic accessory), valve type, valve torque and characteristics, what safety factor is to be applied, frequency of operation and temperature. Stroke:

The stroke for Series B actuators is as follows (See technical data):

Standard construction: 90° rotation with stroke adjustment at 0° and 90° + or - 4°

Type 120° stroke: 120° rotation with stroke adjustment at 0° and 120° + or - 4°

Type 180° stroke: 180° rotation with stroke adjustment at 0° and 180° + or - 4°

#### Lubrication:

The actuators are factory lubricated for the life of the actuator in normal working conditions.

The standard lubricant is suitable for use from -20°C (-4°F) to +80°C (+176°F).

For low (LT) and high (HT) temperature service, where special grease is required please contact Valve Solutions Inc.

#### Construction:

Rack and pinion actuator design suitable for both indoor or outdoor installations.

Protection and Corrosion resistance:

Ensure actuators are supplied with corrosion protections for normal environments. For severe duties select the protection required for corrosion protection. See technical data sheet before installing actuators.

Actuator designation and Marking:

The actuator type, size, operating pressure, output torque, direction of rotation, orientation of failure mode, operating temperature and drive type are determined by actuator designation.

Series B actuators are supplied showing all of this information: type, model (including protection and if applicable the LT or HT for operating temperature), stroke, maximum permissible supply pressure, output torque, ancillary attachment, pressure connection, valve actuator attachment and serial number.

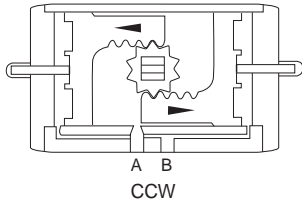
#### 4) OPERATING FUNCTION AND DIRECTION OF ROTATION

The actuator is a pneumatic operator for remote actuation of valves. The operation (90° - 120° or 180° rotation) may be connected by different methods: Direct mounting of solenoid valves (5/2 for double acting, 3/2 for spring return) to pressure connections A and B.

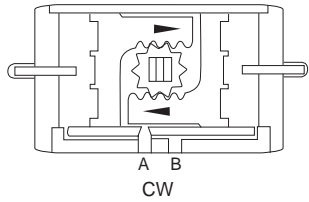
Screwed connection (to pressure connections A and B) with air lines from separate control cabinet.

The standard rotation is clockwise to close, counter-clockwise rotation is obtained when port A is pressurised. For actuator marked LF the rotation is counter-clockwise to close, clockwise rotation is obtained when port A is pressurised.

Double Acting operation function (standard rotation) Top View

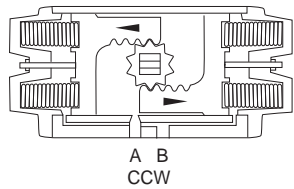


Air supplied to Port A forces the pistons apart and toward end positions, with exhaust air exiting at Port B, a counter-clockwise rotation is obtained.

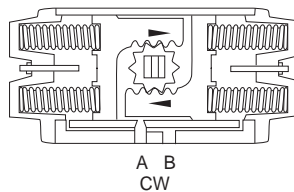


Air supplied to Port B forces the pistons together with exhaust air exiting at port A, a clockwise rotation is obtained

Single acting operation function (standard rotation) top view.



Air supplied to Port A forces the pistons apart and toward end positions, compressing the springs with exhaust air exiting at Port B, a counter clockwise rotation is obtained.



On loss of air pressure (air or electric failure) at Port A allow the springs to force the pistons to the centre position with exhaust air exiting at Port A, a clock-wise rotation is obtained

5) ACTUATOR INSTALLATION INSTRUCTIONS

The Series B actuator is a pneumatic device for the remote operation of industrial valves. The Series B actuator will operate through 90°, the option is available for 120° or 180° of rotation permitting the opening and closing of many types of 1/4 turn valves.

All the necessary technical information to install the actuator correctly and safely onto a valve i.e. (Dimensions, Output torque, Air volume, Stroke Adjustment, Operating time, Operating temperature) is available. Please read this technical information carefully before proceeding with the actuator installation.

5.1 ) Important Safety Notice:

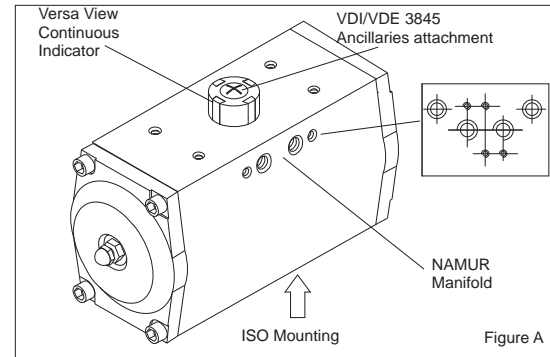
The actuator must not be pressurized at any time during installation as injury may result.

The utmost cleanliness is required during air supply connection to the actuator i.e. the connecting pipe thread, fittings and seals must be clean and dirt-free.

When fitting accessories onto the actuator assemble them in such a way that the top of the drive shaft is easily accessible should manual operation of the actuator be required.

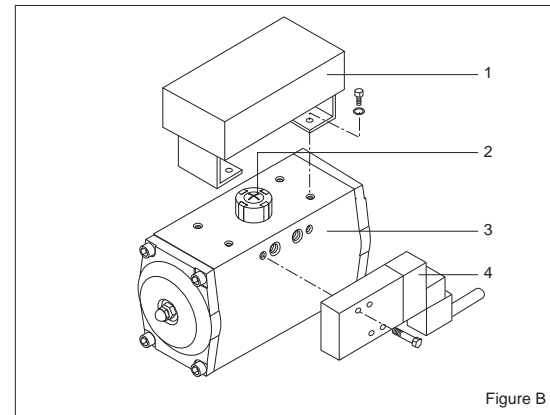
Before fitting onto the valve make sure that the actuator / valve are correctly orientated depending which direction of rotation is required.

5.2) Controls and connections, Figure A



5.3) Assembly of accessories:

Solenoid valves and Switchboxes Figure B



Solenoid valve mounting:

Before mounting a Solenoid valve ensure that the actuator is in its normal position (closed position) pistons together:

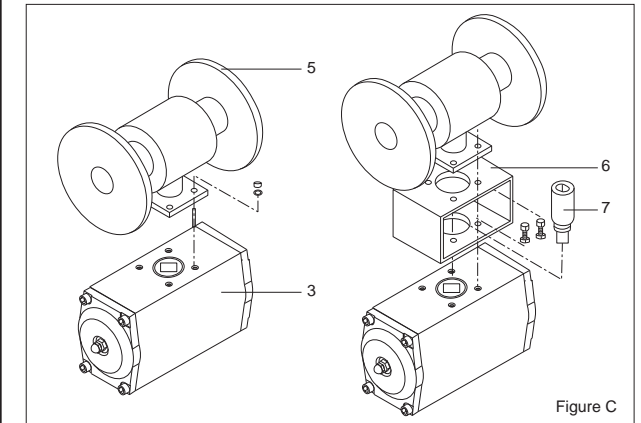
For Standard assembly and rotation (Clockwise to close): the groove on the indicator 2 must be diagonal to the longitudinal axis of the actuator in the closed position.

Fit the solenoid valve 4 onto the actuator 3 using the screws provided (max. tightening torque see the table below).

Switchbox mounting:

Fit the switchbox and bracket 1 onto the actuator 3, using four screws provided (max. tightening torque see the table below).

5.4) Assembly of Valve Figure C:



Before proceeding with the assembly of a valve onto an actuator be sure that the actuator operates in the desired direction of rotation and both actuator/ valve are correctly orientated.

Important: When using a spring return actuator for a fail safe operation, ensure that when air or electricity failure occurs the direction of rotation is correct for your application

Fit the valve 5 onto the actuator 3. Ensure that the actuator is in normal position (closed position).

There are two types of valve assembly onto the actuator:

Direct-mount: Fit the square of the valve 5 directly into the square of the actuator 3 and bolt together through the valve ISO pad .

Bracket-mount: Mounting with a bracket 6 and coupling 7, the bracket is bolted to the actuator / valve to join them together and the coupling is used to connect the actuator output drive to the valve stem.

5.4.1) Mounting alternatives:

5.4.2) Valve mounting with Actuator Type STANDARD (Clockwise to close) FigureD:

5.4.3) Valve mounting with Actuator Type LF (Clockwise to open) Figure E:

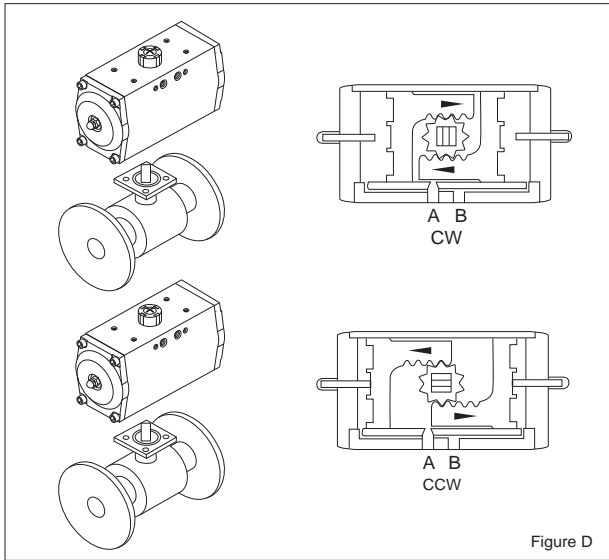


Figure D

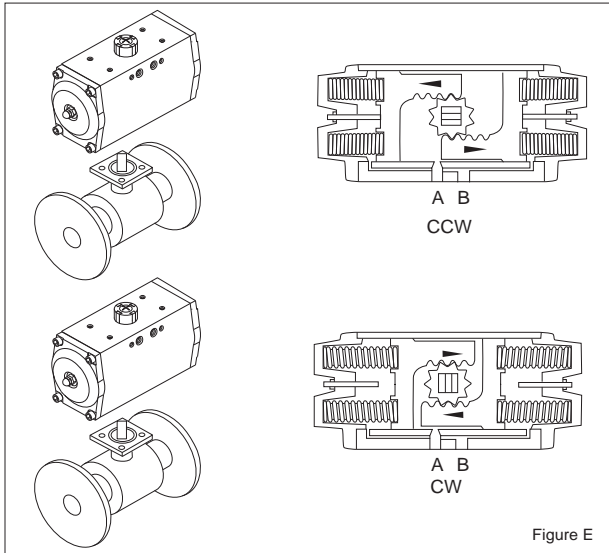


Figure E

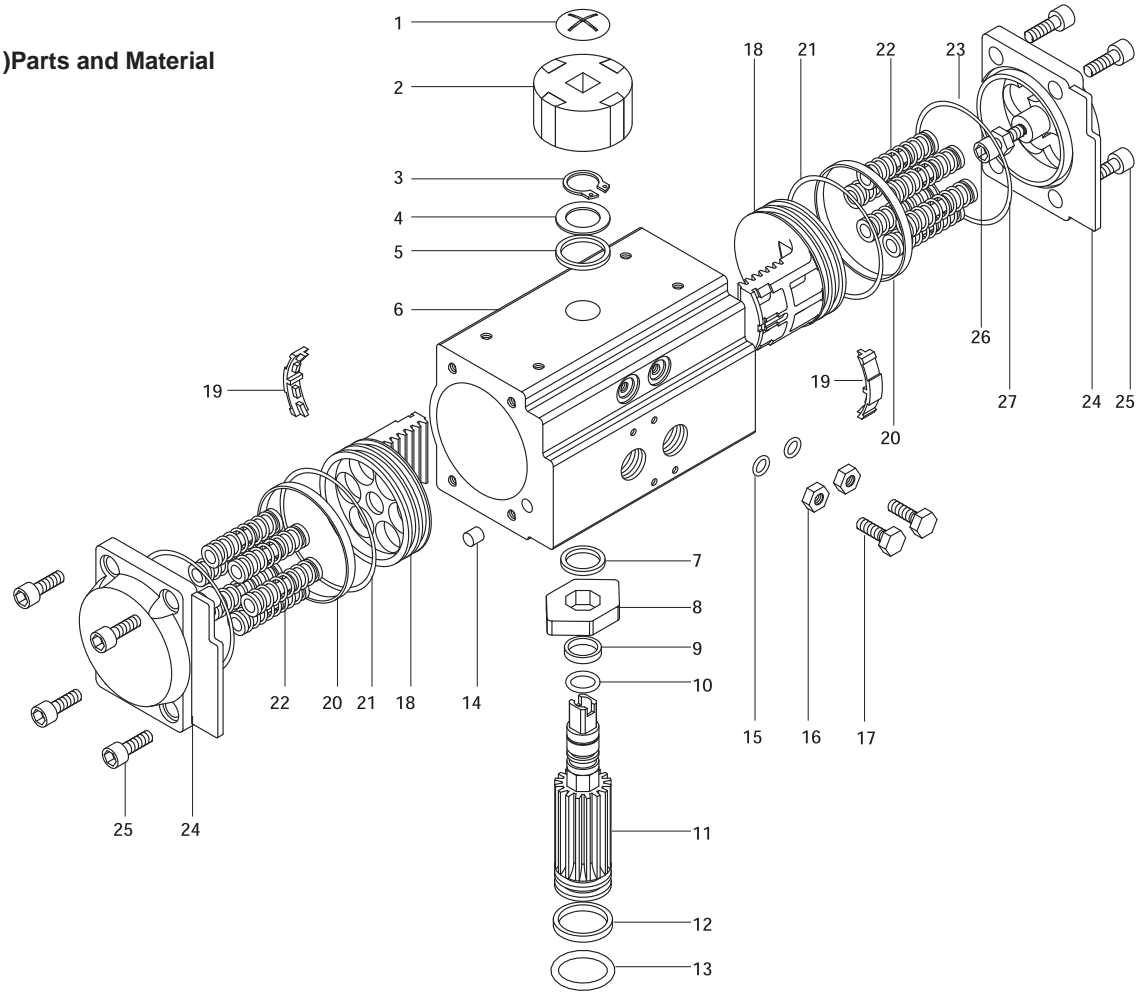
### 6) MAINTENANCE INSTRUCTION

With the Information given below, Valve Solutions provides the end user with all the required information necessary for maintenance. Under normal operating conditions the actuator requires only periodic observation to ensure proper adjustment.

Rebuilding of the Series B actuators is allowed only to the personnel of VSI or to personnel which are properly instructed. By contravention the guarantees expires!

Spare kits for maintenance are available to replace all seals and bearings that may be necessary between 300,000 and 1,000,000 cycles depending on operating and / or environmental conditions and actuator size.

### 6.1) Parts and Material



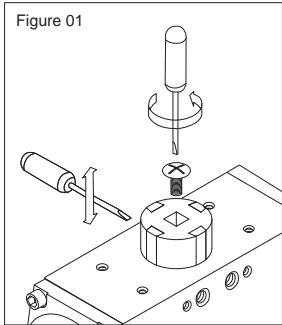
No.	Description	Qty	Standards Material
1	Indicator Screw	1	Plastic
2	Indicator	1	Plastic
3	Snap Ring	1	Stainless Steel
4	Thrust Washer	1	Stainless Steel
5	Outside Washer	1	Engineering Plastics
6	Body	1	Alluminum Alloy (6005-T5)
7	Inside Washer	1	Engineering Plastics
8	Cam	1	Alloy Steel
9	Top O-Ring	1	NBR
10	Top Bearing	1	Engineering Plastics
11	Pinion	1	Alloy Steel
12	Bottom O-Ring	1	NBR
13	Bottom Bearing	1	Engineering Plastics
14	Plug	2	NBR

No.	Description	Qty	Standards Material
15	Adjustment Screw O-Ring	2	NBR
16	Adjustment Screw Nut	2	Stainless Steel
17	Adjustment Screw	2	Stainless Steel
18	Piston	2	Cast Aluminum (101A)
19	Piston Guide	2	Engineering Plastics
20	Piston Bearing	2	Engineering Plastics
21	Piston O-Ring	0-12	NBR
22	Spring	2	Spring Steel
23	End Cap O-Ring	2	NBR
24	End Cap	8	Cast Aluminum (ADC12)
25	Cap Screw	2	Stainless steel
26	Stop Screw	2	Stainless steel
27	Stop Screw Nut	2	Stainless steel

## 6.2) Disassembly

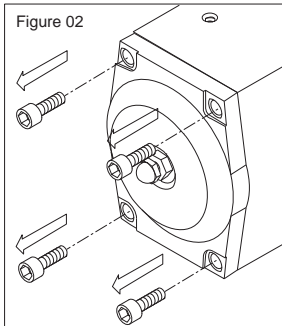
When disassembly of actuator is required for maintenance, firstly remove the actuator from the valve. Before performing any disassembly operations it is important to verify that the actuator is not pressurised. When the actuator is a spring return unit, make sure that the actuator is in the failed position before disassembling.

### A) Removal of position indicator (Part No. 2), figure 01:



Remove indicator screw (1) if fitted  
Lift position indicator (2) off shaft, it may be necessary to pry gently with a screwdriver.

### B) End Caps disassembly (Part No 23), figure 02:



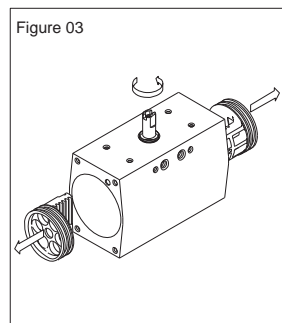
Remove cap screw (End cap 23) in the sequence shown in the figure 02. Caution: when disassembling a spring return actuator, the end cap (23) should be loose after unscrewing end cap bolts (24) 4-5 turns. If there is still force on the end cap after 4-5 turns of the end cap bolts, this may indicate a damaged spring cartridge and any further disassembly should be discontinued. Further disassembly of the end caps may result in injury. Return actuator to

Valve Solutions for further maintenance.

For spring return actuators, always remove spring cartridge.

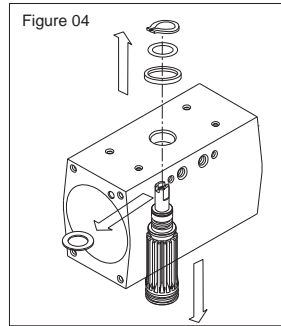
Remove end cap O-rings (22) and discard if replacing all soft components.

### C) Pistons disassembly (Part No. 14), figure 03:



Holding the body (6) in a vice or similar device, rotate the drive shaft (10) until the pistons (14) are released.  
Caution: Air pressure should not be used to remove the pistons from the body.  
Remove piston 'O' rings (22) using a small screwdriver; remove the piston guide (17) and piston bearings (16). Discard bearings when replacing all soft components.

### D) Pinion shaft disassembling (Part No 11), figure 04:



Remove snap ring (3) carefully, using snap-ring pliers, remove external snap washer (5) and thrust washer (4). Apply downward force to top of drive shaft (10) until it is partially out of the bottom of the body when it is possible to remove the inside washer (9), then push the pinion (10) completely out of the bottom of the body. If pinion does not remove freely gently top the shaft with a plastic mallet.

Remove top and bottom pinion bearings (8) and (11) and top and

bottom pinion O-rings (7) and (12).

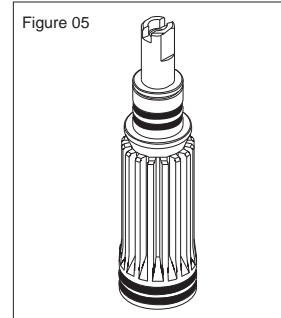
Discard bearings (8) and (11), internal and external thrust washer (5) and O-rings (12) and (7) if replacing all soft components.

When all components are disassembled, those not being replaced should be properly cleaned and inspected for wear prior to being greased and re-assembled.

## 6.3) Assembly:

Prior to assembly, ensure all components are perfectly clean and free from damage.

### A) Drive shaft assembly (Part No. 10), figures 05:



Install top and bottom pinion bearings (8) and (11) and top and bottom pinion O-rings (12) and (7) onto the shaft.

Grease the outside surface of the drive shaft on top and bottom as shown in figure 06.

Insert partially the drive shaft (10) in the body (6), install inside washer (9). Insert completely the drive shaft in the body.

Fit external inside washer (9), thrust washer (4) and then snap ring (3)

using snap ring pliers.

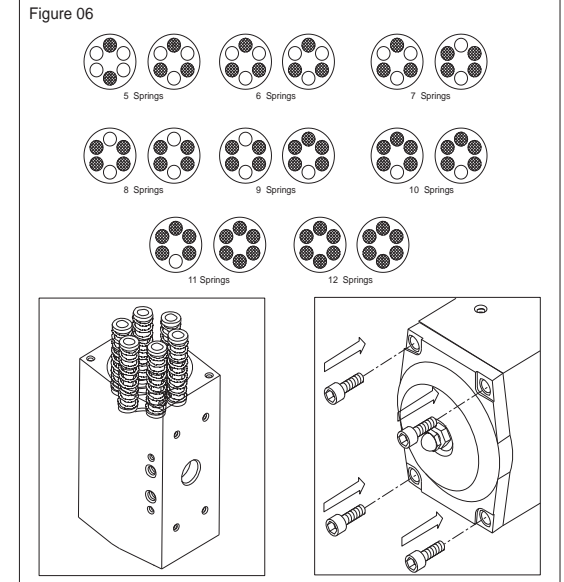
### B) Pistons assembly (Part No. 14):

Install piston O-rings (22), the Piston guide (17) and piston bearings (16). Grease the internal surface of the body (6) and the piston (14) rack teeth. Hold the body (6) in a horizontal position by inserting the top of the shaft into a vice or the bottom of the shaft connection into a male drive fitted in a vice.

For standard rotation assembly (clockwise to close) rotate the body (6) about 40-45° counter-clockwise from bottom view or clockwise from top view depending on which way the shaft has been linked.

Press the two pistons (14) simultaneously inside the body (6) until the pistons are engaged and rotate the body clockwise from bottom view or counter clockwise from top view until the stroke is completed. Ensure that when the pistons are inserted that they both mesh at the same time. Check fully closed and open positions.

### C) End cap (part 23) and spring cartridge (21) assembly, figures 06:



Lubricate the body.

For spring return actuator insert the proper quantity of spring cartridge according to the pattern shown in figure 6 (referring to the total number of springs), insert spring cartridge (21) as shown in figure 6.

Fit end cap O-ring seal (22) into the groove in the end cap, on both end caps.

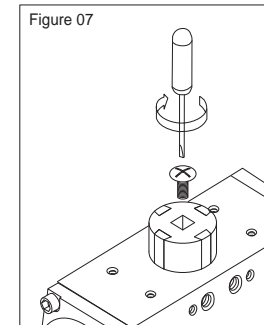
Fit end caps onto the body (6), verifying that the O-ring remains in the groove.

Insert all the cap screws (24) and tighten each only partially. Complete tightening by following the sequence indicated in figure 6.

### D) Stroke adjustment for standard rotation actuator (Clockwise to close):

90°(open)position stroke adjustment with actuator in open position, screw or unscrew the right (from top view) stop screw (27) until the desired stop position is achieved.

### E) Assembly of position indicator (Parts No 1 and 2), figure 07:



Fit position indicator (2) on the shaft verifying that it indicates the correct actuator position.

Then fit cap screw (1) where fitted.

7) STORAGE INSTRUCTIONS  
If the actuators are not for immediate use, the following precaution must be taken for storage:

Store in a dry environment at ambient temperature.

It is recommended that the actuator be stored in its original box.

Do not remove the plastic plugs on air supply ports.