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1) GENERAL

This instruction manual contains important information regarding the installation, operation, maintenance and storage for AIR TORQUE 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) SAFETY NOTICE

- It is important that the actuator should only be used within pressure limits indicated in our 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 Air Torque.
- 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 $30\ \mu\text{m}$.

• 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.

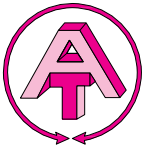
• Operating Temperature:

Standard product from -20°C (-4°F) to $+80^{\circ}\text{C}$ ($+176^{\circ}\text{F}$).

Low temperature LT actuator with silicon "O" rings from -40°C (-40°F) to $+80^{\circ}\text{C}$ ($+176^{\circ}\text{F}$).

High temperature HT actuator with FPM "O" rings from -15°C ($+5^{\circ}\text{F}$) to $+150^{\circ}\text{C}$ ($+300^{\circ}\text{F}$)

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



- Operating Time:

See Technical Data Sheet.

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 AIR TORQUE actuators are as follows (See technical data):

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

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

Type X 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 AIR TORQUE.

Recommended Air Torque actuator lubricants for standard working conditions:

- Kluber Unigear LA02
- Esso (Exxon) Beacon EP2
- Fina Marson EP L2
- Shell Alvania EP2
- Mobilux EP2

- 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.

AIR TORQUE actuators are supplied with a label showing all of this information: type, model (including protection and if applicable the LT or HT for operating temperature), stroke, maximum permissible supply pressure, direction of rotation, 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:

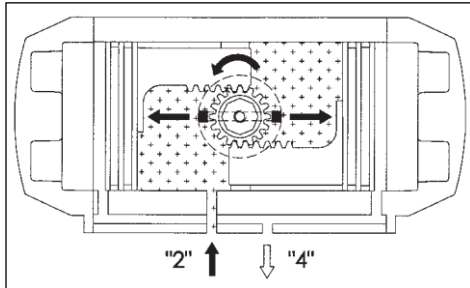
- Direct mounting of solenoid valves (5/2 for double acting, 3/2 for spring return) to pressure connections 2 and 4.
- Screwed connection (to pressure connections 2 and 4) with air lines from separate control cabinet.

The standard rotation is clockwise to close, counter-clockwise rotation is obtained when port 2 is pressurised. For actuator marked LF the rotation is counter-clockwise to close, clockwise rotation is obtained when port 2 is pressurised.

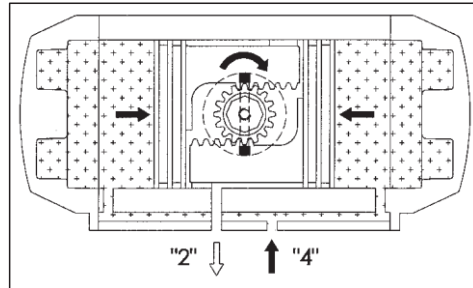


• Double Acting operation function (standard rotation) Top View

Air supplied to Port 2 forces the pistons apart and toward end positions, with exhaust air exiting at Port 4, a counter clockwise rotation is obtained.

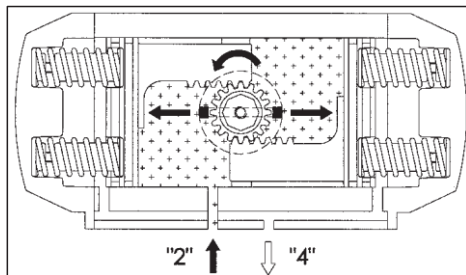


Air supplied to Port 4 forces the pistons together with exhaust air exiting at port 2, a clockwise rotation is obtained.

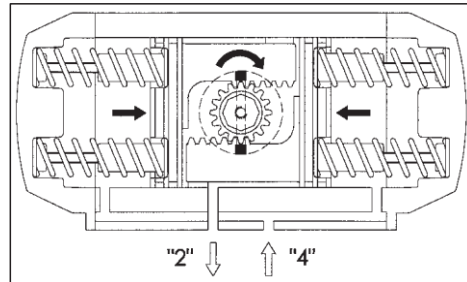


• Single Acting operation function (standard rotation) Top View

Air supplied to Port 2 forces the pistons apart and toward end positions, compressing the springs with exhaust air exiting at Port 4, a counter clockwise rotation is obtained.



On loss of air pressure (air or electric failure) at Port 2 allow the springs to force the pistons to the centre position with exhaust air exiting at Port 2, a clockwise rotation is obtained.



5) ACTUATOR INSTALLATION INSTRUCTIONS

The AT actuator is a pneumatic device for the remote operation of industrial valves. The AT 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.

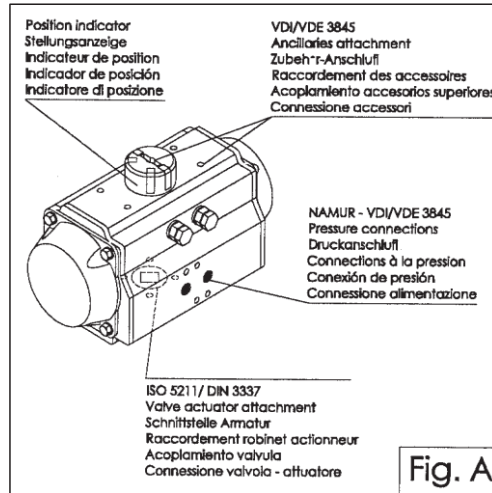
All the necessary technical information to install the actuator correctly and safely onto a valve i.e. Dimensions, Output torque, Air volume, Stroke Adjustment, Operating time, Operating temperature, Direction of rotation and Weight is stated clearly on the Actuator label, in the catalogue and technical data sheets. 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 upon 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:

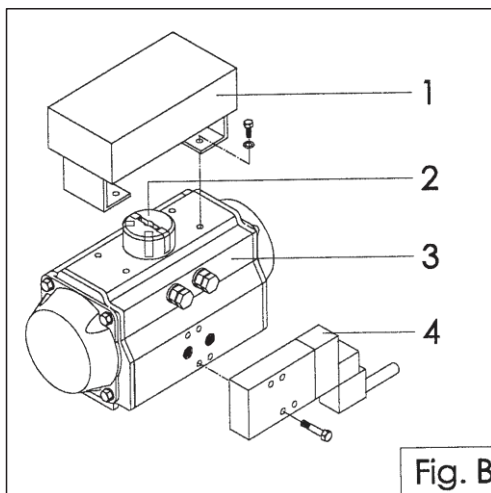
Before mounting a Solenoid valve ensure that the actuator is in its normal position (closed position) pistons together :

- 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).



Tightening torque table:

M..	Nm
M5	5 -> 6
M6	10 -> 11
M8	23 -> 25
M10	48 -> 52
M12	82 -> 86
M14	132 -> 138
M16	200 -> 210
M20	390 -> 410
M24	675 -> 705



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 (max. tightening torque see table above).

-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 (max. tightening torque see table).

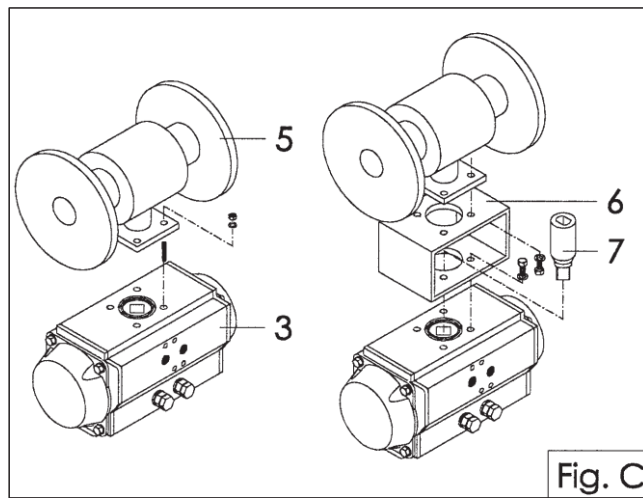
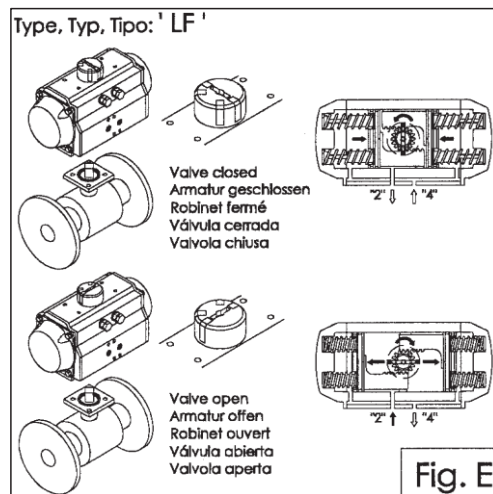
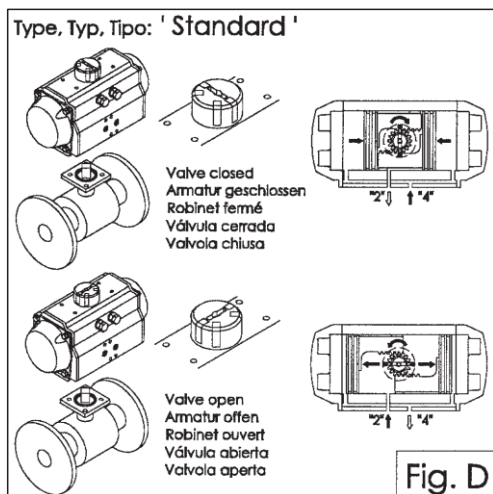


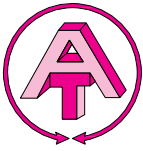
Fig. C

1) Mounting alternatives :

2) Valve mounting with Actuator Type STANDARD (Clockwise to close) Figure D :

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





6) MAINTENANCE INSTRUCTION

With the information given below, AIR TORQUE 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 AIR TORQUE actuators is allowed only to the personnel of AIR TORQUE or to personnel which are properly instructed. By contravention the guarantees expires!

Spare kits for maintenance are available to replace all seals and bearings (Soft components listed in table) that may be necessary between 500,000 and 1,000,000 cycles depending on operating and/or environmental conditions.

6.1) Drawing with itemised component and recommended spare parts

Pos.	Pcs	Part Description	Material	Specification	Protection
01	1	Oct1-Cam (Stop Arrangement)	1.4021/GS400-15 ⁽¹⁾	EN 10088-3/ISO 1083 ⁽¹⁾	
02	2	Stop Cap Screw	B8 Cl.2	ASTMA193	
03	2	Washer (Stop CapScrew)	A2	ISO 3506	
04	2	Nut(Stop Cap Screw)	A2-70	ISO 3506	
05*	2	Bearing (Piston Back)	PPA	Amodel ET1001HS	
06*	1	Bearing (Pinion Top)	PA46	StanylTW300	
07*	1	Bearing (Pinion Bottom)	PA46	StanylTW300	
08*	2	Thrust Bearing (Pinion)	PPA	Amodel ET1001HS	
09*	2	Plug (Transfer Part)	NBR	NBR 70Shore	
10	1	Thrust Washer (Pinion)	1.4301	EN 10088-3	
11*	2	O' Ring (Stop Cap Screw Seal)	NBR	NBR 70Shore	
12	2	Piston Guide	PPA+45%GF	Amodel AS1145	
13	8/12/16 ⁽²⁾	Cap Screw (EndCap)	A ² -70	ISO 3506	
14*	2	O' Ring (End Cap)	NBR	NBR 70Shore	
15*	2	Bearing (Piston Head)	PPA	Amodel ET1001HS	
16*	2	O' Ring (Piston)	NBR	NBR 70Shore	
17	min.4/max.12	Spring (Cartridge)	SiCr Spring Alloy Steel	DIN 17223Part2	Epoxy coated
18	1	Spring Clip (Pinion)	C75	DIN 17223	ENP
19	1	Position Indicator	PP+30%GF	Hostalen PPN VP7790 GV2/30	
20*	1	O' Ring (Pinion Bottom)	NBR	NBR 70Shore	
21*	1	O' Ring (Pinion Top)	NBR	NBR 70Shore	
30	1 ⁽³⁾	Right End Cap	GD-AISI8.5Cu3.5Fe	UNI 5075	A, B, C, D, E, P
31	1 ⁽³⁾	Left End Cap	GD-AISI8.5Cu3.5Fe	UNI 5075	A, B, C, D, E, P
39	1	Cap Screw (Indicator)	A2-70	ISO 3506	
40	2	Pistons	GD-AISI8.5Cu3.5Fe	UNI 5075	anodized
41	1	Identification Label	Polyester Aluminium		
42	2	Label (EndCap)	Polyester Aluminium		
43	1	Spigot	Alloy 6082	ASTM B221	Alodur
50	1	Body	Alloy 6083	ASTM B221	A, B, C, D, E, P
60	1	Drive Shaft	Al105	ASTMA105	ENP

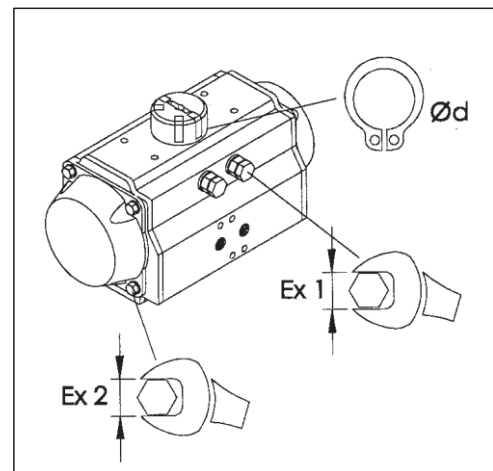
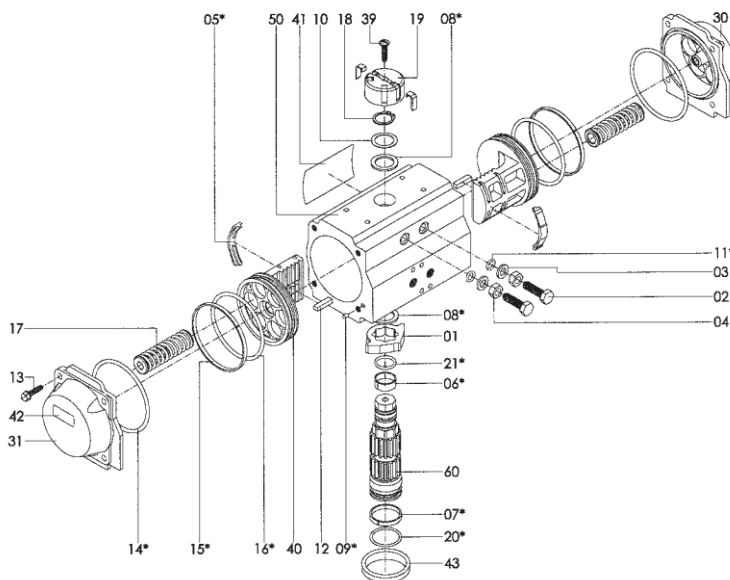
*Spare Part

⁽¹⁾ AISI420 Type DR/DL, SC/SO 15-150; GS400-15 Type DR/DL, SC/SO 220-4000

⁽²⁾ 8 pcs. Type DR/DL, SC/SO 15-1200; 12 pcs. Typ DR/DL, SC/SO 3000

⁽³⁾ Type DR/DL, SC/SO 600-3000 End Caps are symmetric

	EX1 mm	EX2 mm	ø d mm
AT 051/054	10	8	14
AT 101/104	10	10	16
AT 201/204	13	10	22
AT 251/254	13	10	25
AT 301/304	17	13	26
AT 351/354	19	13	36
AT 401/404	19	17	38
AT 451/454	22	17	45
AT 501/504	22	19	48
AT 551/554	24	19	52
AT 601/604	30	22	58
AT 651/654	30	24	68
AT 701/704	36	22	80
AT 801/804			





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. Always use caution and double check that the ports 2 and 4 are vented and are free from any accessory and/or device. 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. 19), figure 01:

- Remove cap screw (39) if fitted
- Lift position indicator (19) off shaft, it may be necessary to try gently with a screwdriver.

B) Removal of stop cap screws (Part No. 02), figure 02:

- Remove both stop cap screws together with nut (04) and washer (03)
- Remove stop screw O-rings (11) and discard if replacing all soft parts.

C) End Caps disassembly (Part No 30 right and 31 left) For model AT 551 to AT 701 the 2 end caps (30) are symmetric, figure 03:

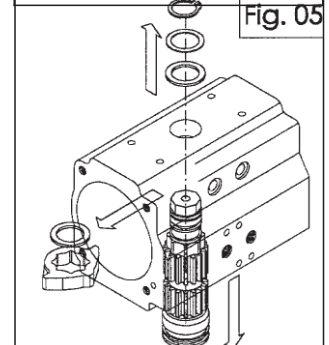
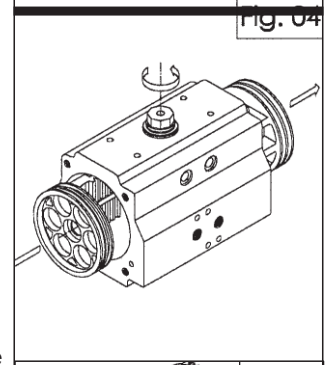
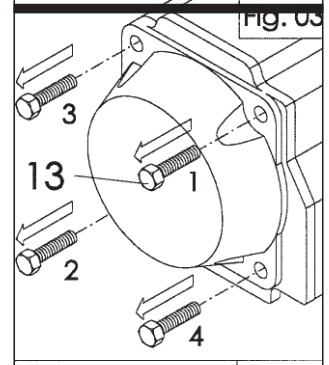
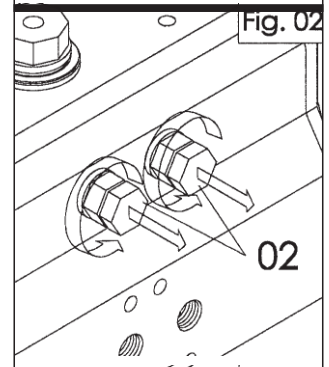
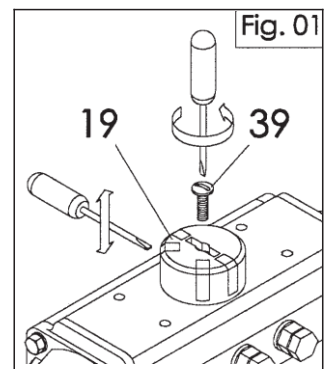
- Remove cap screw (End cap 13) in the sequence shown in the figure 03. Caution: when disassembling a spring return actuator, the end cap (30 and 31) should be loose after unscrewing end cap bolts (13) 4-5 turns. If there is still force on the end cap after 4-5 turns of the end cap bolts, this may indicate a damaged spring cartridge and any further disassembly should be discontinued. Further disassembly of the end caps may result in injury. Return actuator to AIR TORQUE for further maintenance.
- For spring return actuators, always remove spring cartridge.
- Remove end cap O-rings (14) and discard if replacing all soft components.

D) Pistons disassembly (Part No. 40), figure 04:

- Holding the body (50) in a vice or similar device, rotate the drive shaft (60) until the pistons (40) are released.
- Caution: Air pressure should not be used to remove the pistons from the body.
- Remove piston 'O' rings (16) using a small screwdriver; remove the piston back (05) and piston head (15) bearings. Discard bearings when replacing all soft components.

E) Pinion shaft disassembling (Part No 60), figure 05:

- Remove spring clip (18) carefully, using nap-ring pliers, remove external thrust bearing (08) and thrust washer (10).
- Apply downward force to top of drive shaft (60) until it is partially out of the bottom of the body when it is possible to remove the octi-cam (01) and internal thrust bearing (08), then push the pinion (60) completely out of the bottom of the body. If pinion does not remove freely gently tap the top of the shaft with a plastic mallet.
- Remove top and bottom pinion bearings (06) and (07) and top and bottom pinion O-rings (21) and (22).
- Discard bearings (06) and (07), internal and external thrust washer (08) and O-rings (21) and (22) if replacing all soft components.





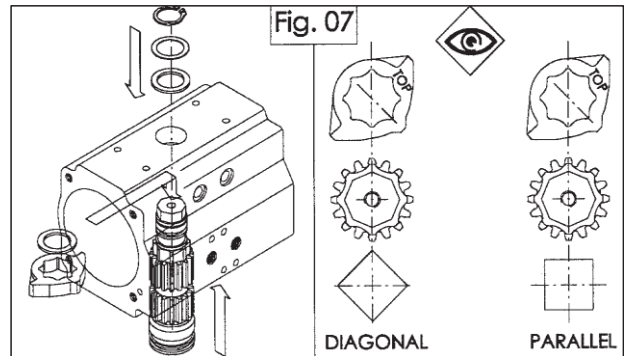
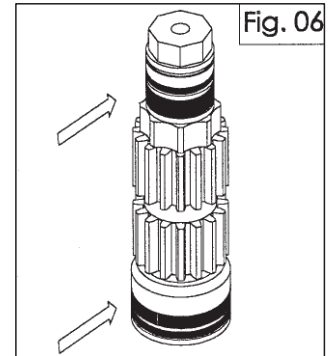
When all component are disassembled, those not being replaced should be properly cleaned and inspected for wear prior to being greased and reassembled.

6.3) Assembly :

Prior to assembly, ensure all components are perfectly clean and free from damage. Please see point 3 for recommended lubricants.

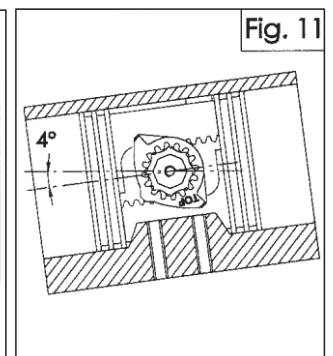
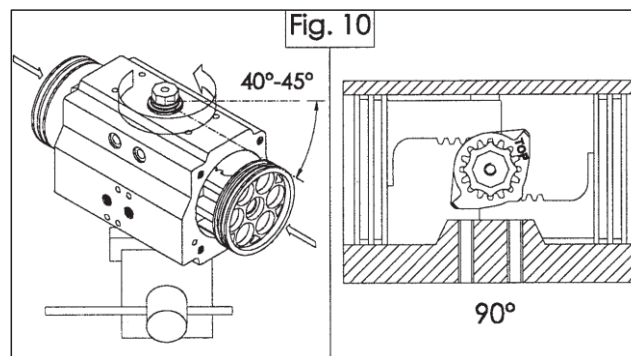
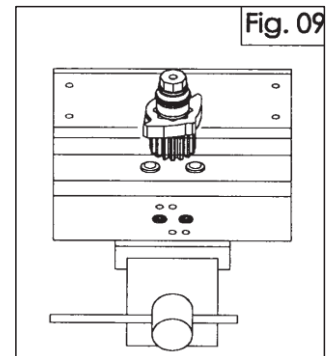
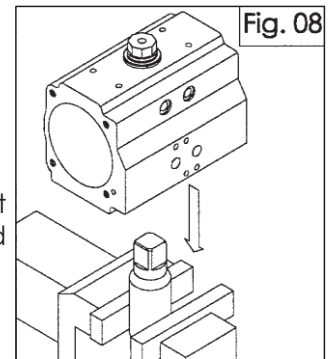
A) Drive shaft assembly (Part No. 60), figures 06 and 07:

- Install top and bottom pinion bearings (06) and (07) and top and bottom pinion O-rings (21) and (22) 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 (60) in the body (50), install octi-cam (01) in the correct position as shown in figure 07 related to the bottom and top of the drive shaft and the rotation of the actuator when energised and install internal thrust bearing (08). Insert completely the drive shaft in the body.
- Fit external thrust bearing (08), thrust washer (10) and then external circlip (18) using snap ring pliers.



B) Pistons assembly (Part No. 40), figures 08, 09, 10 and 11:

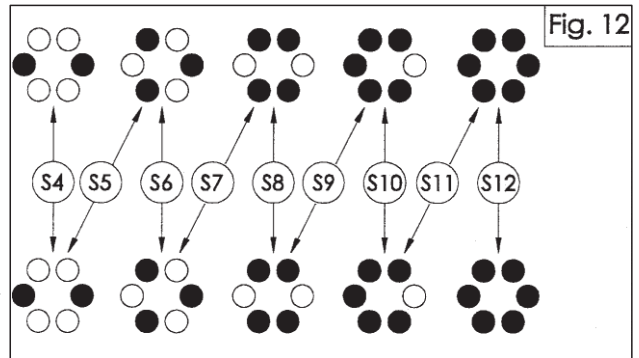
- Install piston O-rings (16), the Piston skirt (05) and piston head (15) bearings.
- Grease the internal surface of the body (50) and the piston (40) rack teeth.
- Hold the body (50) in a horizontal position by inserting the top of the shaft into a vice or the bottom of the shaft connection into a male drive fitted in a vice as shown in figure 08.
- Ensure that the octi-cam is in the right position as shown in figure 09.
- For standard rotation assembly (clockwise to close) rotate the body (50) about 40-45° counter-clockwise from bottom view or clockwise from top view depending on which way the shaft has been linked as shown in figure 10.
- Press the two pistons (40) simultaneously inside the body (50) 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 as shown in figure 11.



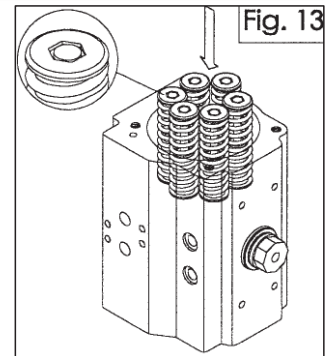


C) End cap (part 30 right and 31 left) and spring cartridge (17) assembly (For model AT 651 to AT 701 the 2 end caps 30 are symmetric), figures 12, 13 and 14:

- Lubricate the body.
- For spring return actuator insert the proper quantity of spring cartridge according to the pattern shown in figure 12 (referring to the total number of springs). Insert spring cartridge (17) as shown in figure 13.

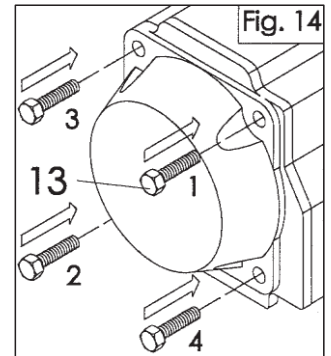


- Fit end cap O-ring seal (14) into the groove in the end cap, on both end caps.
- Fit end caps onto the body (50), verifying that the O-ring remains in the groove.
- Insert all the cap screws (13) and tighten each only partially. Complete tightening by following the sequence indicated in figure 14.



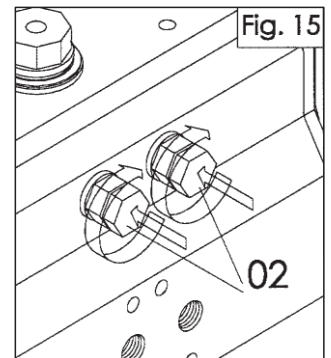
D) Assembly of stop cap screws (Parts 02), and stroke adjustment figure 15:

- Insert on both the stop cap screw (02), the nut (04), the washer (03), and the O-ring in (11)
- Fit the stop cap screw (02) in the body.



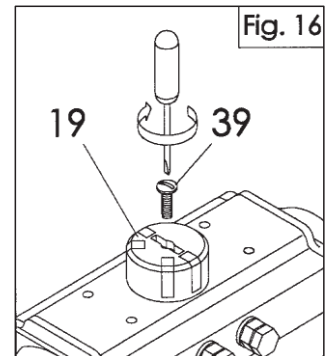
Stroke adjustment for standard rotation actuator (Clockwise to close):

- 0° (Close) position stroke adjustment with actuator in close position, screw or unscrew the right (from top view) stop cap screw (02) until the desired stop position is achieved. Then tighten the stop adjustment nut (04) to lock it in place
- 90° (open) position stroke adjustment with actuator in open position, screw or unscrew the left (from top view) stop cap screw (02) until the desired stop position is achieved, then tighten the stop adjustment nut (04) and lock it in place.



E) Assembly of position indicator (Parts No 19 and 39), figure 16:

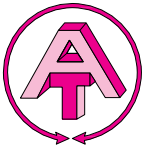
- Fit position indicator (19) on the shaft verifying that it indicates the correct actuator position.
- Then fit cap screw (39) where fitted.



7) STORAGE INSTRUCTIONS

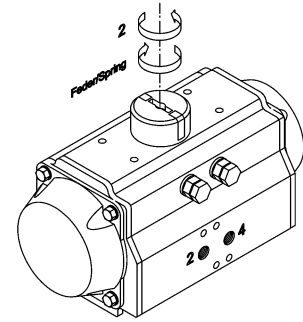
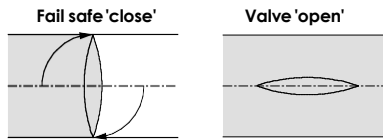
If the actuators are not for immediate use, the following precaution must be taken for storage :

- 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.



Fail safe to close (Valve type)

Spring to close (only S) (clockwise)



The standard model of the AT-actuators will be mounted in direction of the media flow from the valve.

Way of turning:

By pressure on port '2' the drive shaft of the actuator turns 'anti-clockwise' from basic position of the actuator 'close' into the end position 'open', an opening of the valve is obtained.

In case of pressure fail on port '2' the drive shaft of the actuator turns 'clockwise' into the basic position of the actuator 'close' (only S), a closing of the valve is obtained.

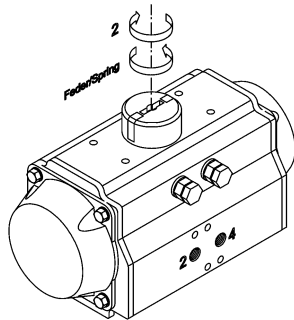
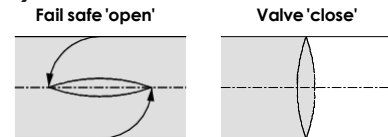
The delivery will be in basic position. By assembling actuator in basic position and valve in close position.

The order no. is: **ST**

Important: By mounting diagonal to the flow from the valve, pay attention for the correct position of the indicator (Must be turned about 90°, see manual)!

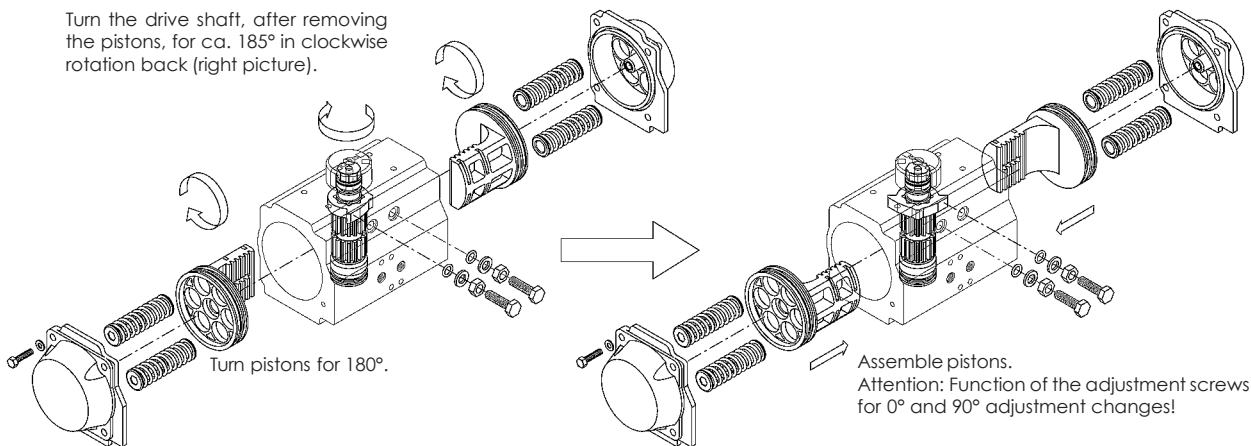
Fail safe to open (Valve type)

Spring to open (only S) (anticlockwise)



If the drive shaft of the actuator has to turn during the opening of the valve anticlockwise (fail safe to open by spring return), the pistons and the cam (turning of the drive shaft) must be assembled as shown in figure (bottom).

Turn the drive shaft, after removing the pistons, for ca. 185° in clockwise rotation back (right picture).



Turn pistons for 180°.

Assemble pistons.
Attention: Function of the adjustment screws for 0° and 90° adjustment changes!

Way of turning:

The drive shaft of the actuator turns 'anticlockwise' from end position of the actuator 'open' (pressure fail on port '2') into the basic position 'close', an opening of the valve is obtained.

The delivery will be in basic position. By assembling actuator in basic position and valve in open position.

The order no. is: **LF**



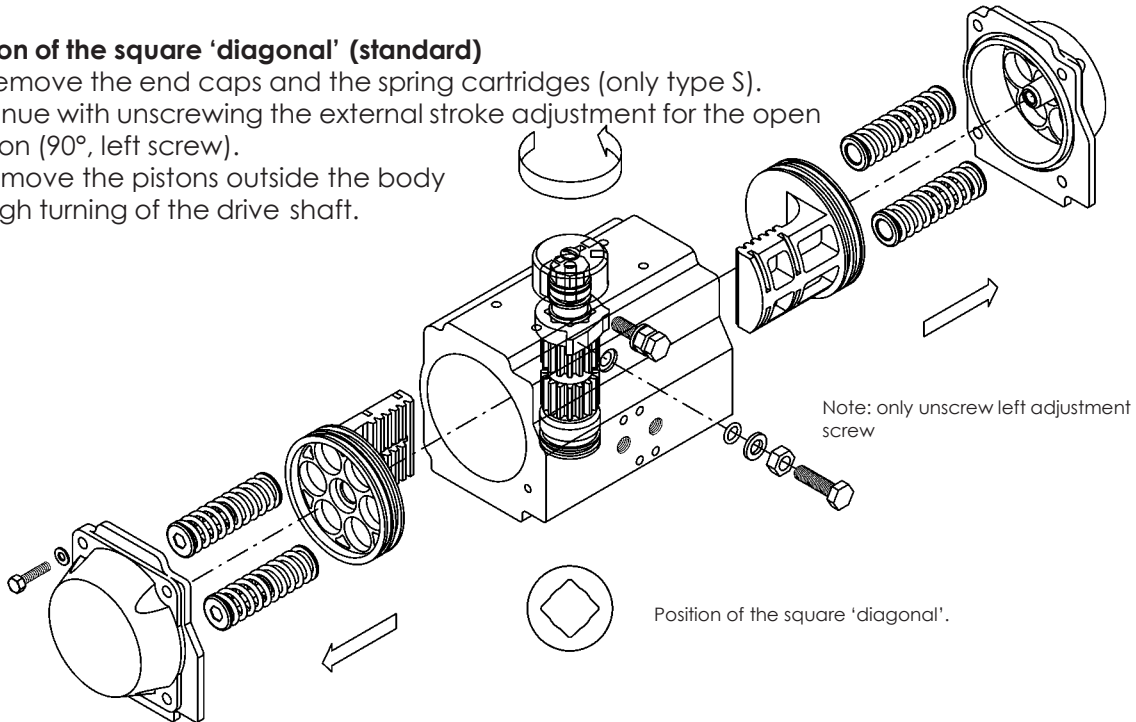
Manual for assembly of square position 'diagonal' in 'parallel'

The standard versions of the AT-actuators have the square position 'diagonal'.

Note: Pay attention to the maintenance informations for all assemblings.

Position of the square 'diagonal' (standard)

First remove the end caps and the spring cartridges (only type S).
Continue with unscrewing the external stroke adjustment for the open position (90°, left screw).
Then move the pistons outside the body through turning of the drive shaft.



Position of the square 'parallel'

Turn back the drive shaft into the basic position (until the end position of the right adjustment screw is touched, closed position). Remove the indicator and the spring clip. Then push down the drive shaft a little, while fixing the cam in it's position.
Turn the drive shaft for one tooth (connection cam drive shaft), until the square is parallel.
Now fit the drive shaft again.
After that turn the drive shaft in the open position (see above) and assemble the actuator.

