

MANUAL

Pneumatic actuator - AL 77-200

Type and design

DA = Double Acting. Actuator with pneumatic operation in both directions.

SR = Spring Return. Actuator with spring return.

Size 210, 230, 250 and 270 have 1 piston.

Size 220, 240, 260, 265 and 280 have 2 pistons.

Operating medium

If the operating medium is instrument air, it shall be dust and oil-free. Accepted operating medium: Non-dangerous fluids (group 2 according to directive 97/23/EC). The dew point shall be equal to -20°C or, at least, 10°C below the ambient temperature. The maximum particle size must not exceed $40\ \mu\text{m}$. The exhaust air must pass through a filter silencer before it is let out into the workshop.

The application of the Scotch Yoke construction

The Scotch Yoke of the AL 77-200 actuators has canted slots. Thus the actuator can be given different function depending on how the pistons are mounted in the actuator. The pistons are mounted according to Fig. 1, page 2, or Fig. 1a, in order to achieve the following functions.

According to Fig. 1:

DA-Actuator with adjustable closed valve position (clockwise end of travel).

SRF-Actuator with spring opening (counter clockwise direction), adjustable "closed" valve position (clockwise end of travel).

According to Fig. 1a:

DAAO-Actuator with adjustable open valve position (counter clockwise end of travel).

SR-Actuator with spring closing (clockwise direction), adjustable "open" valve position (counter clockwise end of travel).

The possibility to turn the pistons can be used in several ways in order to suit the actuators to the customer's requirements.

WARNING!

AL 77-200 actuators must only be used as actuators on valves. Levers, racks and similar cannot be used to transmit movement without protective equipment. Pinch risk in the valve opening when test trimming non-installed valves.

Manual operation

WARNING!

It is very risky to try to operate the actuator manually by using the key grip on the driving shaft. The accumulated energy inside the actuator may instantaneously be set free.

The actuator can be equipped with handwheel for manual operation, AL 77-M1. Other methods on request.



WARNING!

All manual operations must be carried out with a vented actuator.

Installation and adjustment

All types of actuators can be mounted in various positions, e.g. vertical or horizontal. When mounting on a valve, ensure that the actuator shaft and the valve stem are centered, and that a play of 0,5-1 mm exists between shaft and driving bush depending on actuator size. Ensure especially that actuator and driving bush are mounted correctly in relation to each other, considering that the actuator shaft has an octagonal hole and that a faulty mounting of 45° is possible. This naturally also applies to direct mounting on a valve. The guide ring (37) can be dismantled when not in use. After mounting, it may be necessary to adjust the turning angle of the actuator.

Tightening torques for lock nuts on page 6.

As mentioned previously, the DA actuators can, as standard, be adjusted in "closed" valve position and the SR actuators in "open" position. The adjustment occurs by loosening the lock nut on the end plate, after which the set screw is turned clockwise for reduced and anti-clockwise for increased rotary motion. The adjustment degree is $\pm 3^{\circ}$. AL77-220, -240, -260 and -280 have two adjustment screws.

It is important that both screws are in contact with the piston in question.

The actuator is supplied with an indicator on the driving shaft. The indicator can be mounted in 2 optional positions for different valve functions, mounting directions, etc.

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Specific condition of use

Actuators intended to be used in hazardous areas are limited in accordance with the Ex marking on actuator sticker. Avoid placing actuator in direct sunlight, due to the risk of increased temperature. Especially for actuator in hazardous areas.

The temperature of the actuator control medium shall be the same as the ambient temperature in hazardous areas.

If actuator is used on equipment with heavy dynamic parts without built in mechanical stop, the energy transmitted to the actuator has to be considered. If used in hazardous areas the system must be in consideration with respect to the limitations for impact energy according to valid Ex standards.

Mechanical generated spark, avoid any accidental impact on the equipment or friction in the equipment parts containing light metals.

The actuator shall not have any dust layers during its normal operation and expected malfunction

Operating medium, see page 1.

For SR actuators, filter-dust excluder IP6X must be mounted for the venting side of the actuator, either in the venting port or in the direct mounted solenoid valves venting port.

Note

Dust and debris accumulated on the actuator will slow down its cooling and contribute to increase of its external temperature.

Prevent electrostatic discharge

Do not polish/rub nonmetallic surface with a dry cloth. The tools and the cleaning procedures must not produce sparks or create adverse condition in the environment during maintenance operations, so as to prevent potential explosion hazards. Prevent electrostatic charges in potentially explosive areas.

Electrostatic risk

There is a potential electrostatic charging hazard associated with nonconductive paint and therefore actuator must only be cleaned with a damp cloth.

Prevent electrostatic charges in potentially explosive areas – do not polish/rub nonconductive surfaces with a dry cloth, the operator's clothes must not be electrostatically charged. The tools and cleaning procedures must not produce sparks or create adverse conditions in the environment during maintenance operations, so as to prevent potential explosion hazards. The user must ensure that the operating environment and any materials surrounding the actuator cannot lead to a reduction in the safe use of, or the protection afforded by, the actuator.

Where appropriate the user must ensure the actuator is suitably protected against its operating environment.

The user must plan a regular equipment surface cleaning maintenance for example with a damp cloth every 6 month as minimum, recommended due to the dustiness of the environment, if possible decrease the cleaning frequency.

Actuator type

Standard -20°C - +75°C		Viton -15°C - +75°C		High temp 0°C - + 150°C		Low temp -40°C - +55°C		Low temp arctic -47°C - + 55°C	
T amb (°C)	T Class	T amb (°C)	T Class	T amb (°C)	T Class	T amb (°C)	T Class	T amb (°C)	T Class
55	T6	55	T6	55	T6	55	T6	55	T6
75	T5	75	T5	70	T5				
				105	T4				
				150	T3				
Actuator with manual override MI max ambient temperature 70° C									

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IECEX DNV 21.0039X / DNV 21 ATEX 94I78X

Standard	II 2 G Ex h IIC Gb T6/T5 -20°C to +55°C/+75°C II 2 D Ex h IIIC Db T79 / T99
Viton	II 2 G Ex h IIC Gb T6/T5 -15°C to +55°C/+75°C II 2 D Ex h IIIC Db T68 / T88
High temp	II 2 G Ex h IIC Gb T6/T5/T4/T3 0°C to +55°C/+70°C/+105°C/+175°C II 2 D Ex h IIIC Db T68 / T88 / T118 / T163
Low temp	II 2 G Ex h IIC Gb T6 -40°C to +55°C II 2 D Ex h IIIC Db T79
Low temp arctic	II 2 G Ex h IIC Gb T6 -47°C to +55°C II 2 D Ex h IIIC Db T79

Note!

When actuator is equipped with manual override MI max ambient temperature 70°C is allowed.

Lubrication

AL 77 actuators are permanently lubricated, and additional lubrication is normally not required. However, during frequent operation and heavy load it's recommended to use oil mist lubrication or regrease once every year / or 100 000 cycles whatever appears first.

For oil mist lubrication is a mineral oil type ISO VG32 according to DIN 51524HLP recommended. Oil mist lubricator should be set at lowest possible value that allows effective lubrication of the actuator. Commenced oil mist lubrication must continue.

To regrease actuator, follow the instruction "Service of RC210-280" page 4.

Note! If external accessories like pneumatic or electropneumatic positioner etc. is mounted to the actuator, check the accessories data sheet if oil mist is allowed.

Recommended Lubrication Grease

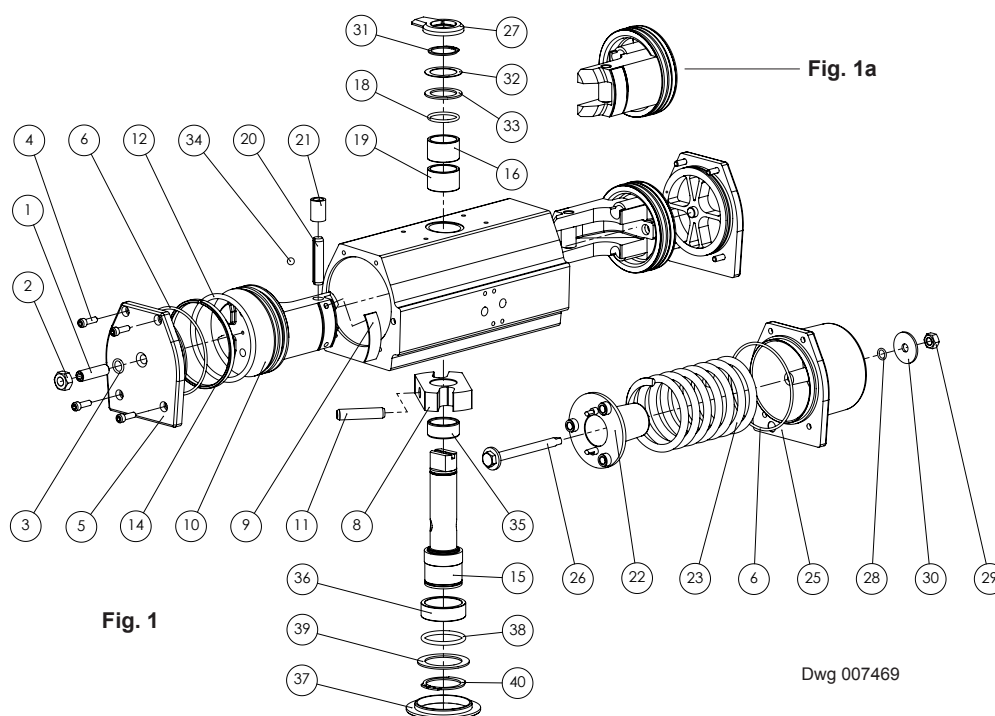
Cylinder bore and drive shaft with shaft sealings	Grease
200 standard	Klübersynth AR 34-402
200 high temperature	Klübertemp HM 83-402
200 low temperature	Klüber Isoflex Topas NCA 52

Piston roller (21) + bearing	Grease
All AL 77-210	Cargo Red Grease

Oil mist lubrication and grease containing polyglycole, ester or other aggressive additives shall be avoided.

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Service of size 210-280

⚠ WARNING!

Before dismantling, check that the compressed air and possible power supply are disconnected. Dismantling of SR unit, see instruction on page 5. Dismantling of SR unit with manual operation unit type MI, see instruction on page 4.

Exchange of piston sealings and support elements

1. Please read the warning above!
2. Dismantle the actuator from the console.
3. Dismantle the end plates (5) or the spring houses (25).
4. Fasten the actuator shaft between soft jaws in a vice and turn the actuator until the pistons reach the cylinder end. Then place a few rods in the holes on the outside of one piston. By pressing together and pulling these rods simultaneously, the piston is dismantled from the cylinder.
5. If the piston O-ring (12) is worn, it must be replaced.
6. Replace the support band (14) if it is worn.
7. Replace the support element (9) if it is worn.
8. Grease the cylinder surface with a grease according to the lubrication list on page 6.
9. Fit piston/s correctly positioned, see "The Application of the Scotch Yoke construction".
10. Fit the end plate/s or spring pack/s and adjust the shaft turning angle.

Exchange of shaft sealings and support washers

The O-rings (18) and (38) and the support washers (33) and (39) can easily be replaced as below.

1. Please read the warning on the left!
2. Dismantle the actuator from the console.
3. Dismantle the retaining rings (31) and (40) around the shaft.
4. Dismantle the worn details.
5. Fit the new O-rings (18) and (38).
6. Fit new washers under the retaining rings.
7. Use a grease according to the lubrication list on page 6 when mounting.
8. Fit the new retaining rings.
9. Check that the retaining rings are tightly fitted without play in their grooves.

Exchange of shaft bearings

The bearings (16) and (36) and also the support ring (19) on the AL 77-210-240 can easily be replaced when the pistons and shaft sealings are dismantled as above. For larger actuators, please contact the supplier.


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Material specification for size 210-280

Part no	Description	No DA	No SR	Material	Surface treatment
1	Adjusting screw ¹	1	-	Size 210–260: Stainless steel Others: Steel	- Zinc plated
2	Lock nut ¹	1	-	Size 210–260: Stainless steel Others: Steel	- Zinc plated
3	O-ring ¹	1	-	Nitrile	-
4	Screw	8-16	8-16	Size 210–260: Stainless steel Others: Steel	- Zinc plated
5	End plate with centre hole ¹	1	-	Aluminium	Anodized
6	O-ring	2	2	Nitrile	-
7	Cylinder	1	1	Aluminium	Powder coated
8	Scotch Yoke	1	1	Steel	-
9	Support element ¹	1	1	POM	-
10	Piston	1	1	Aluminium	-
11	Roll pin, double ^{2,3}	1	1	Spring steel	-
12	O-ring	1	1	Nitrile	-
14	Support band ¹	1	1	Polymer material	-
15	Driving shaft	1	1	Size 210–260: Stainless steel Others: Steel	- Zinc plated, yellow chromated
16	Bearing, upper	1	1	Polymer material	-
17	End plate with centre hole	1	1	Aluminium	Powder coated
18	O-ring, upper	1	1	Nitrile	-
19	Support ring, upper	1	1	Polymer material	-
20	Piston pin ¹	1	1	Steel	-
21	Piston roller ¹	1	1	Steel	-
22	Spring guide ¹	-	1	Aluminium	-
23	Spring, external ¹	-	1	Alloyed spring steel	Corrosion protected
24	Spring, internal ^{1,5}	-	1	Alloyed spring steel	Corrosion protected
25	Spring housing ¹	-	1	Aluminium	Powder coated
26	Pre-tensioning screw ¹	-	1	Size 210–260: Stainless steel Others: Steel	- Zinc plated
27	Indicator	1	1	Polymer material	-
28	O-ring ¹	-	1	Nitrile	-
29	Lock nut ¹	-	1	Size 210–260: Stainless steel Others: Steel	- Zinc plated
30	Marking washer ¹	-	1	Aluminium	Anodized
31	Retaining ring, upper	1	1	Spring steel	Corrosion protected
32	Middle washer	1	1	Stainless steel	-
33	Support washer, upper	1	1	Polymer material, chemically resistant	-
34	Sealing ¹	1	1	Size 210–260: Stainless steel Others: Nitrile	- -
35	Support ring, lower	1	1	Polymer material	-
36	Bearing, lower	1	1	Polymer material	-
37	Guide ring	1	1	Polymer material	-
38	O-ring lower	1	1	Nitrile	-
39	Support washer, lower	1	1	Polymer material, chemically resistant	-
40	Retaining ring, lower	1	1	Spring steel	Corrosion protected

1) For actuator sizes 220, 240, 260 and 280: The double amount of details. 2) Size 240 has triple roll pins. 3) Size 270–280 have a slotted pin in steel. 4) Not in the picture! Do not exist for sizes 220, 240, 260 and 280. 5) Only for sizes 270 and 280, not in the picture.

 = Included in repair kit / seal kit

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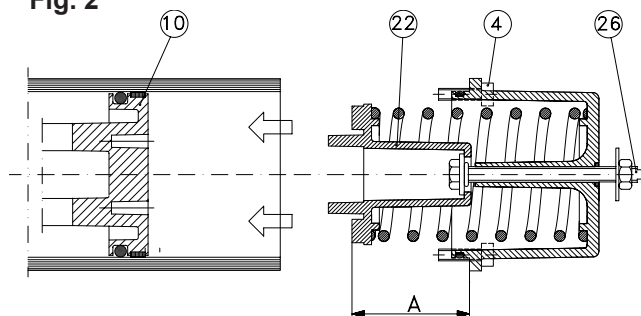
Pneumatic actuator - AL 77-200

Converting to SR Actuators

All DA actuators can be changed into SR actuators by adding spring conversion kits according to the following instruction:

1. Please read the warning on page 2!
 2. Dismantle the end plates. (The description is for size 220, 240, 260 and 280 which have two pistons).
 3. Dismantle the pistons. See text under "Exchange of piston sealings and support elements".
 4. Mount the pistons according to figure 1 on page 2.
 5. Check that the spring is correctly pre-tensioned according to table 1 and figure 2.
 6. The spring guide (22) is centered towards the piston with the aid of 2 pins.
 7. The SR units on sizes 230–280 must be turned so that one of the three support points lies between the bosses on the piston (10).
 8. Mount the SR unit when the pistons are in their innermost position.
 9. Put the screws (4) in place. When tightening the screws, the spring force is transmitted from the tensioning screw (26) to these screws.
- Tightening torques according to table on page 6.**
10. The turning angle of the actuator is adjusted with the tensioning screw (26).

Fig. 2



Adjustment is made with screw (26).

Table I

AL 77-200 SR	A
210-220	41
230-240	62
250-260	87
270-280	137

Instructions for dismantling of AL 77 200-SR actuators with manual operation unit type M1

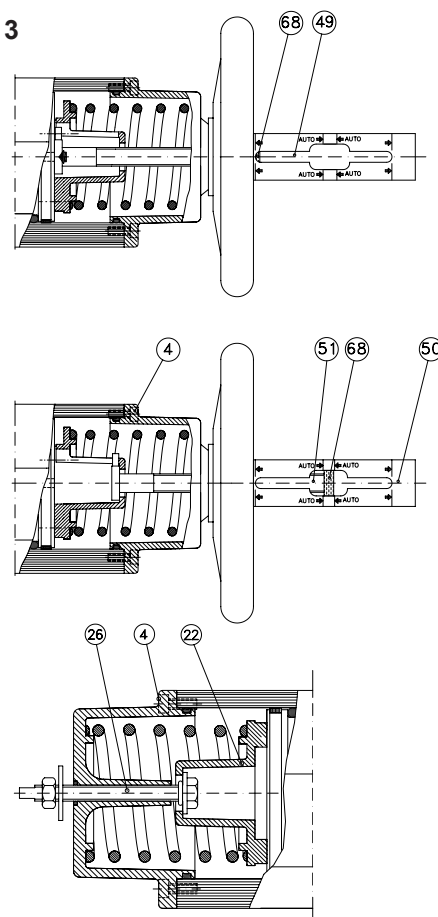
WARNING!

Do not remove the protective tube (50) and handwheel from the spring housing as long as the springs are tensioned. This procedure must be followed for safe dismantling of pre-tensioned spring housings.

1. The actuator must be pressureless.
2. Check that the springs can press the piston back into its starting position according to figure 3. The upper shaft journal must not be oblique.
3. Disconnect possible power supply.
4. Turn the handwheel so that the threaded stem (51) moves toward the actuator until it stops and the yellow marker (68) can just barely be seen in the plastic tube (49).
5. For sizes 220, 240, 260 and 280 (i.e. actuators with two pistons): adjust the tensioning screw (26) in the opposite spring housing anti-clockwise until it lies against the spring guide (22). Dismantle the spring housing by loosening the screws (4).
6. For all sizes: then turn the handwheel until there is resistance and the yellow marker (68) can be seen within the "AUTO" position.
7. Dismantle the spring housing of the manual override by loosening the retaining screws (4) and turning the handwheel several turns in the direction which gives the least resistance.

Dismantling must be carried out in the above order with the utmost care. In the case of the slightest uncertainty - contact Axel Larsson.

Fig. 3



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WARNING!

The procedures below must be followed for safe dismantling of pretensioned spring housings.

Instructions for dismantling of AL 77-200 SR actuators

Size 210, 230, 250 and 270

1. The actuator must be pressureless.
2. Check that the springs can press the piston into starting position according to figure 4.
3. Disconnect all possible power supply.
4. Loosen the lock nut (29).
5. Turn the tensioning screw (26) anti-clockwise until it lies lightly against the spring guide (22).
6. Dismantle the spring housing by loosening the screws (4).
7. Dismantling must be carried out with the utmost care. In the case of the slightest uncertainty - contact the supplier.

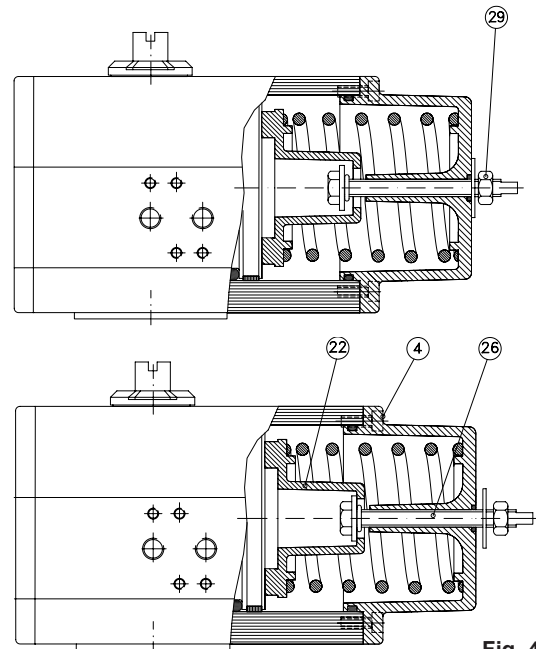


Fig. 4

Size 220, 240, 260 and 280

1. The actuator must be pressureless.
2. Check that the springs can press the piston into starting position according to figure 5.
3. Disconnect all possible power supply.
4. Loosen the lock nuts (29).
5. Turn both spring tensioning screws (26) clockwise until they lie lightly against the spring guides (22).
6. Turn the left spring tensioning screw (26) anti-clockwise until it lies lightly against the spring guide (22) and dismantle the left spring housing by loosening the screws (4).
7. Dismantle the right spring housing in the same manner as the left one.
8. Dismantling must be carried out with the utmost care. In the case of the slightest uncertainty - contact the supplier.

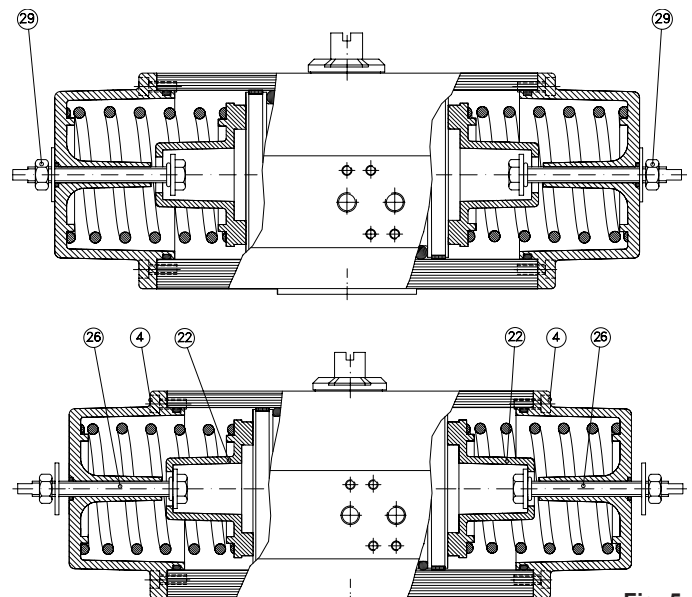


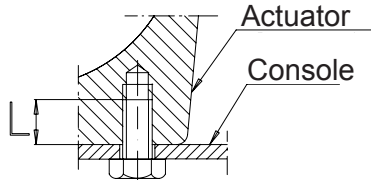
Fig. 5

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Tightening torques for screws and lock nuts

The actuators must be screwed onto the console with the correct tightening torque in order to remain stable during operation. Please use as long screws as possible without the threads grounding.



"L" is the screw length according to drawing.

Tightening torques

Actuator	Screw (4)	Lock nut DA (2)	Lock nut SR (29)
210-220	4	17	7
230-240	4	33	17
250-260	17	90	33
265	23 (17)	55	55
270-280	76 (55)	120	120

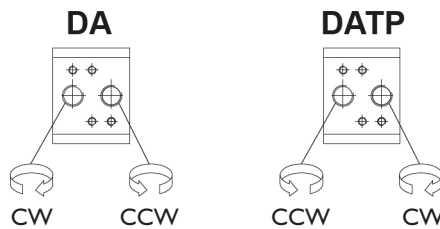
Within brackets: Tightening torque with Stainless steel screw, A2 70 quality.

Tightening torques

Actuator	DIN flange	Thread	L max (inch)	Screw length (mm)										
				8	10	12	14	16	18	20	24	28	32	
210-220	F06	M6	11	8,8	9,2	-	-	-	-	-	-	-	-	-
210-220	F07	M8	14	-	21	23	23	-	-	-	-	-	-	-
230-240	F07	M8	14	-	21	23	23	-	-	-	-	-	-	-
230-240	F10	M10	17	-	-	40	45	45	-	-	-	-	-	-
250-260	F10	M10	17	-	-	40	45	45	-	-	-	-	-	-
250-260	F12	M12	21	-	-	-	60	70	75	75	-	-	-	-
265	F12	M12	21	-	-	-	60	70	75	75	-	-	-	-
270	F14	M16	25	-	-	-	-	125	140	155	185	-	-	-
270	170x110	M16	25	-	-	-	-	125	140	155	185	-	-	-
280	F12	M12	25	-	-	-	-	70	75	75	75	-	-	-
280	F16	M20	32	-	-	-	-	-	-	-	280	330	360	-
280	F25	M16	25	-	-	-	-	125	140	155	185	-	-	-

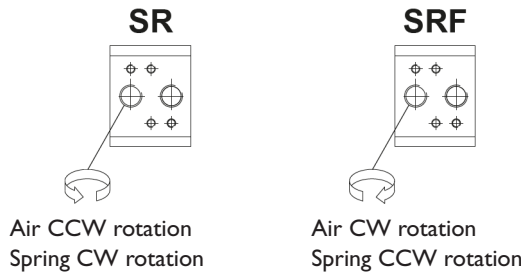
Air connections

Double acting

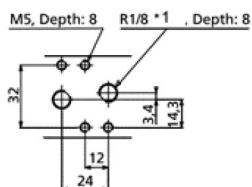


Reversed direction of rotation

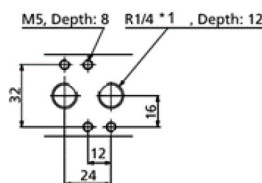
Single acting with spring return



Size 210-240 all types



Hole pattern for solenoid valves according to EN 15714-3

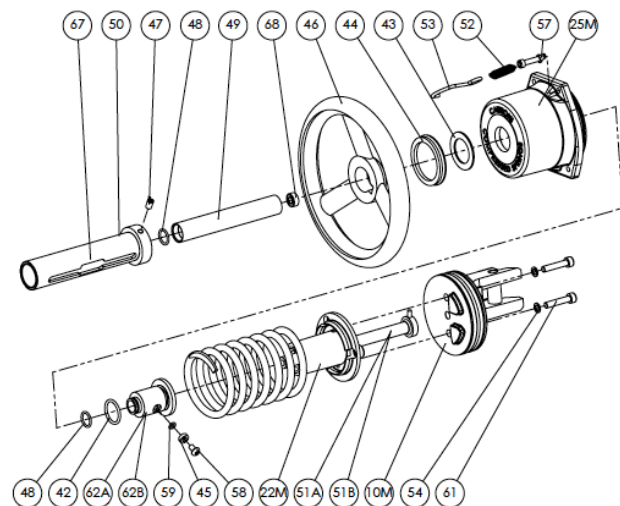


*1 BSP threads standard, NPT threads indicated with letter N on the actuator sticker for size 200 with all other threads metric.

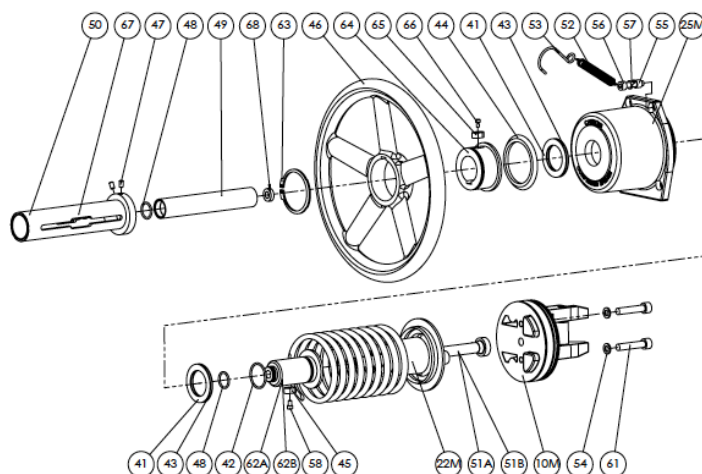
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Pneumatic actuator - AL 77-200

Size 210-240



Size 250-280



Material specification for size 210-280 MI

Part no	Description	No	Material 7)	Surface treatment
10M	Piston M	1	Aluminium	-
22M	Spring guide M	1	Aluminium	-
25M	Spring housing M	1	Aluminium	Powder coated
41	Needle roller bearing size 250-280	1	Ball bearing steel	-
42	O-ring	1	Nitrile	-
43	Needle roller bearing size 250-280	1	Ball bearing steel	-
43	Slide bearing size 210-240	1	Bronze	-
44	Cuff sealing	1	Nitrile / Steel	Zinc plated
45	Key	2	Steel	-
46	Handwheel	1	Aluminium Size 280: Steel	Anodized Powder coated
47	Set screw	1	Stainless steel	-
48	O-ring	1	Nitrile	-
49	Tube, transparent	1	Acrylic plastic	-
50	Protecting tube	1	Aluminium	Anodized
51A	Stem, DA (right threaded)	2	Steel	-
51B	Stem, SR (left threaded)	1	Steel	-
52	Spring	1	Stainless spring steel	-
53	Locking hood	1	Stainless steel	-
54	Tredo-sealing	2	Nitrile / Steel	Zinc plated
55	Spacer size 210-260	1	Stainless steel	-
56	Screw size 210-260	1	Stainless steel	-
57	Spring holder	1	Stainless steel	-
58	Screw	1	Steel	Zinc plated
59	O-ring size 210-240	1	Nitrile	-
61	Screw	2	Steel	Zinc plated
62A	Stem nut, DA (right threaded)	1	Size 210-240: Brass Size 250-280: Ductile iron	- Zinc plated
62B	Stem nut, DA (left threaded)	1	Size 210-240: Brass Size 250-280: Ductile iron	- Zinc plated
63	Retaining ring, size 250-280	1	Steel	-
64	Handwheel bushing, size 250-280	2	Aluminium	Anodized
65	Key	1	Steel	Corrosion protected
66	Screw, size 250-280	1	Steel	Zinc plated
67	Label	1	Polymer material	-
68	Indication ring	1	Polymer material, yellow	-

7) For standard versions, contact us for other versions 8) For actuator size 270 and 280: The double amount of details

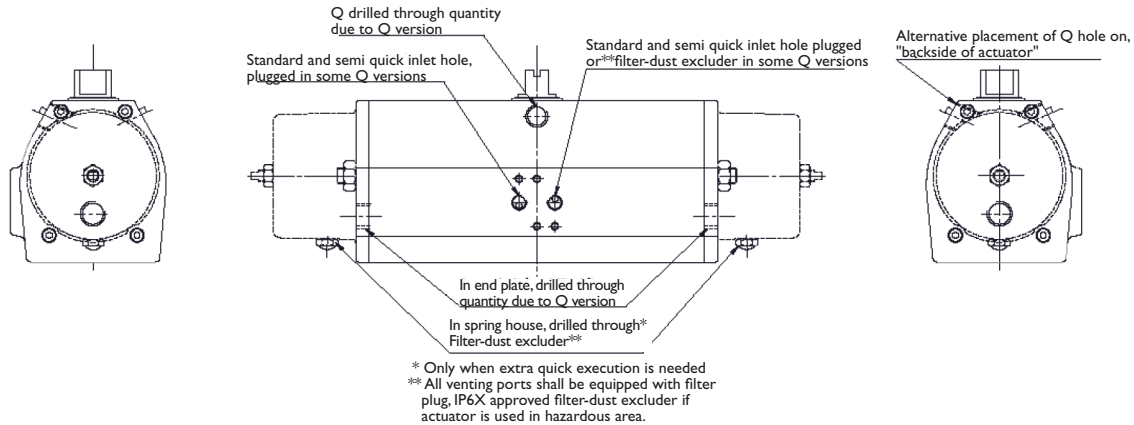
 = Included in repair kit / seal kit

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Quick actuator

Q.. actuator is used there faster operating time is requested. One quick version is the semi quick that has enlarged holes in the connection ports for the solenoid valve. The version with larger connections, has extra holes in cylinder, endplates or spring house depending on actuator function, see figure below.



Dimension, thread type and number of hole for medium connection can be found on the Q actuator sticker.

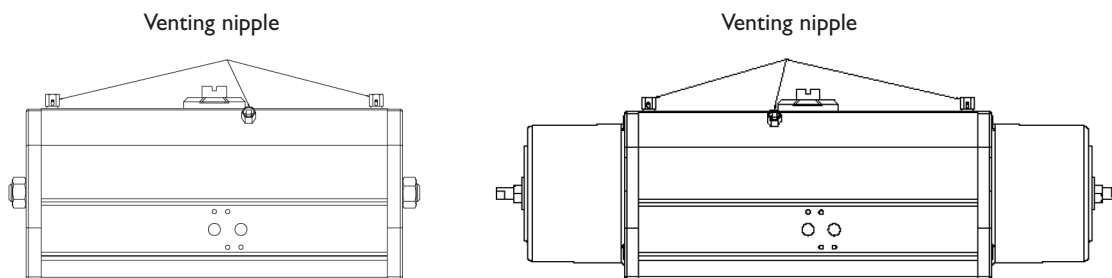
Hydraulic actuator

Hydraulic actuators has venting nipples on the actuator. The venting nipples may be placed in different positions depending on actuator mounting orientation. For venting of the pressurized actuator, use PPE and protect the surroundings from spillage.

For opening and closing of the venting nipples, use the supplied key.



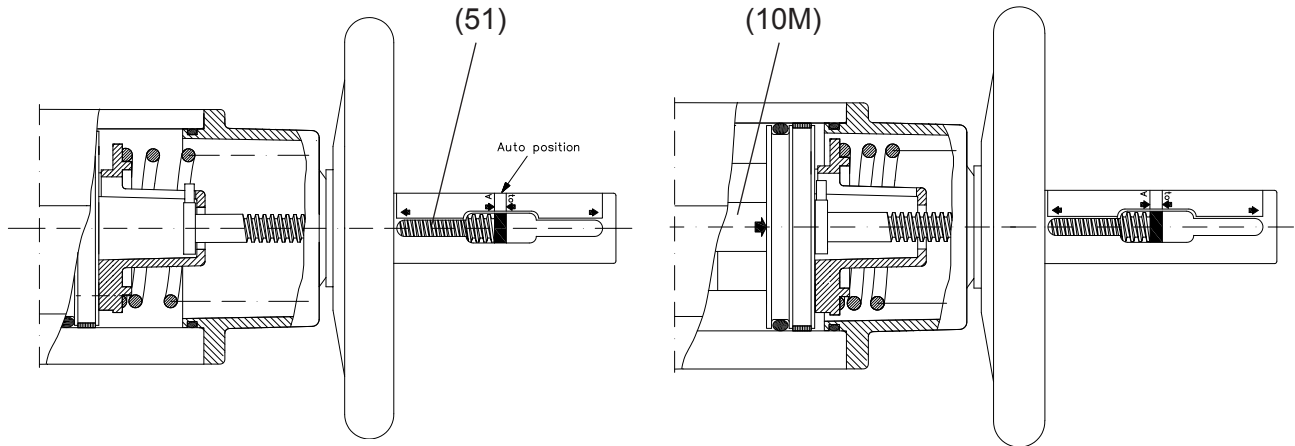
Example for venting nipple positions.



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Function - MI

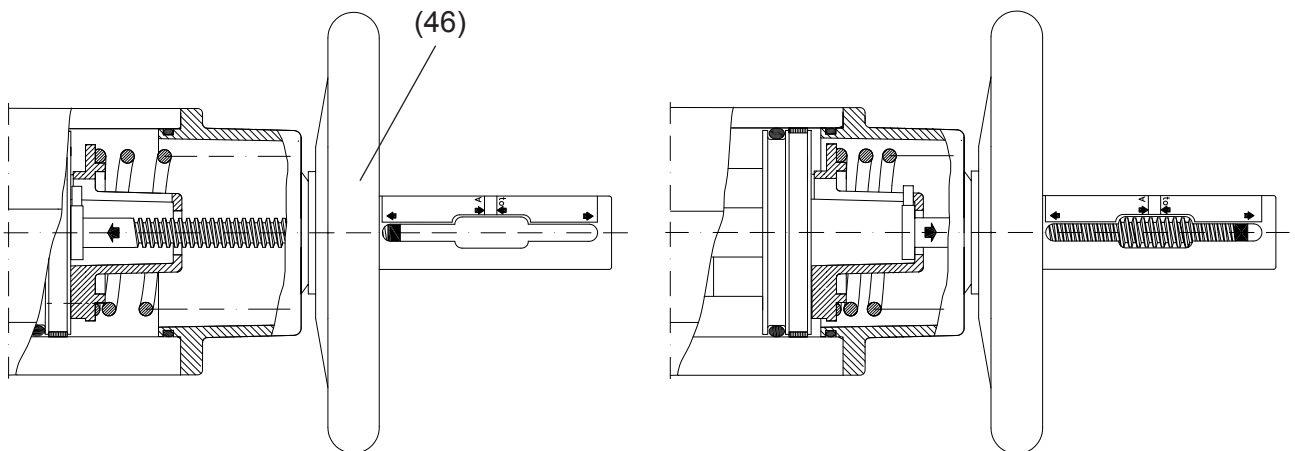


Neutral position

With the stem (51) in Auto position, the piston (10M) can move freely and the actuator can be operated pneumatically. The picture shows a double acting actuator, DA, in "open" position or a single acting actuator, SR, in "closed" position.

End position adjustments

MI in Auto position works as an end position stop.
 DA: Adjustment of closed valve position.
 SR: Adjustment of open valve position.
 Adjustment degree: $+3^\circ / -90^\circ$ in relation to the end position.



Manual operation

DA: The handwheel (46) is turned anti-clockwise.
 The stem (51) and piston (10M) are pressed inwards.
 The valve opens.
 SR: The handwheel is turned clockwise. The stem and piston are pressed inwards. The valve closes.

Manual operation

DA: The handwheel is turned clockwise. The stem and piston are drawn outwards. The valve closes.
 SR: The handwheel is turned anti-clockwise. The stem and piston are drawn outwards. The valve opens.

The actuator (15) shaft is thus turned in the same direction as the handwheel. When the actuator has been operated manually, a return to the Auto position must take place before remote operation can be performed again. On dismantling the manual operation housing (25M), the actuator must first be ventilated, for SR actuators the stem (51) must also be in Auto position.