

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. I, page 2, or Fig. Ia, in order to achieve the following functions.

According to Fig. I:

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. Ia:

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.

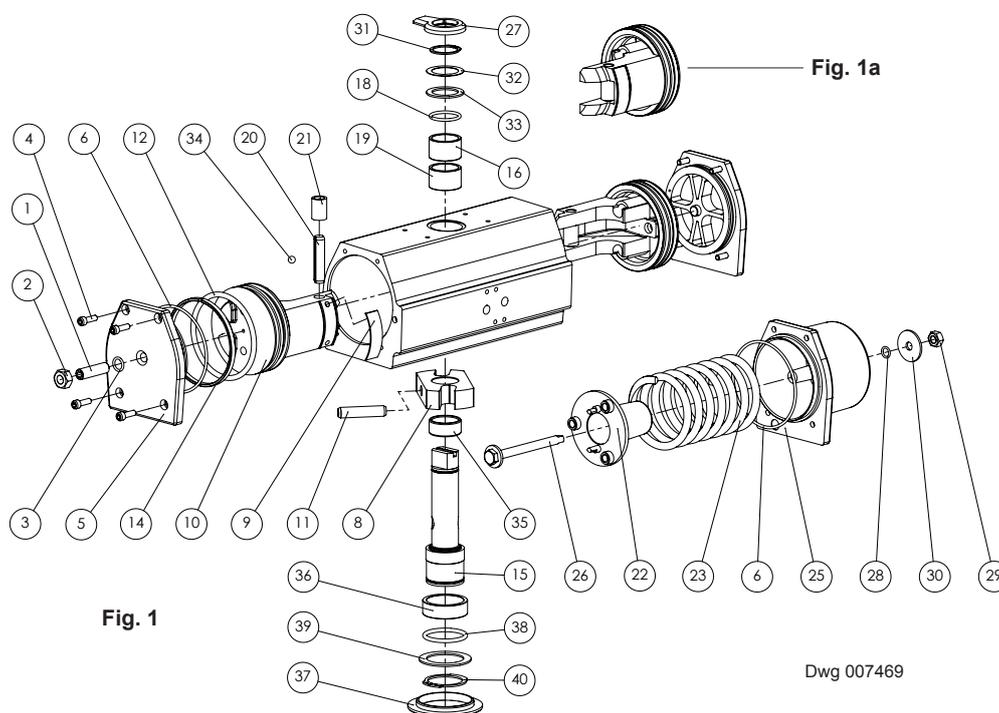
As mentioned previously, the DA actuators can, as standard, be adjusted in "closed" valve position and the SR actuators in "open" position. The adjustment occurs by loosening the lock nut on the end plate, after which the set screw is turned clockwise for reduced and anti-clockwise for increased rotary 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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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 ^{1,6}	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 ⁶	2	2	Nitrile	-
7	Cylinder	1	1	Aluminium	Powder coated
8	Scotch Yoke	1	1	Steel	-
9	Support element ^{1,6}	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 ^{1,6}	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 ⁶	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 ^{1,6}	-	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 ⁶	1	1	Spring steel	Corrosion protected
32	Middle washer ⁶	1	1	Stainless steel	-
33	Support washer, upper ⁶	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 ⁶	1	1	Nitrile	-
39	Support washer, lower ⁶	1	1	Polymer material, chemically resistant	-
40	Retaining ring, lower ⁶	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. 6) Included in seal kit.

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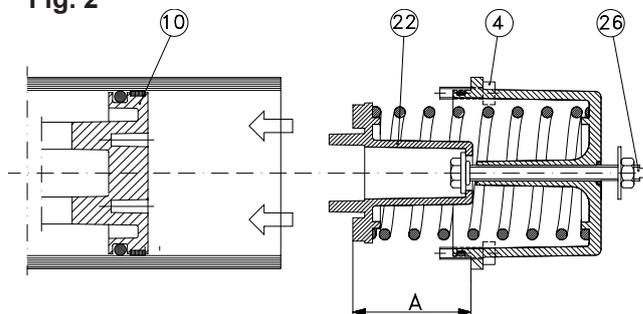
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Converting to SR Actuators

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

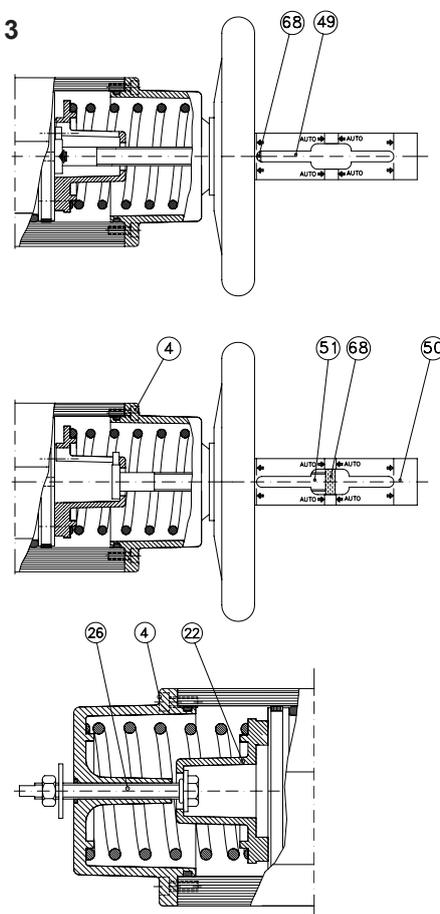
WARNING!

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.

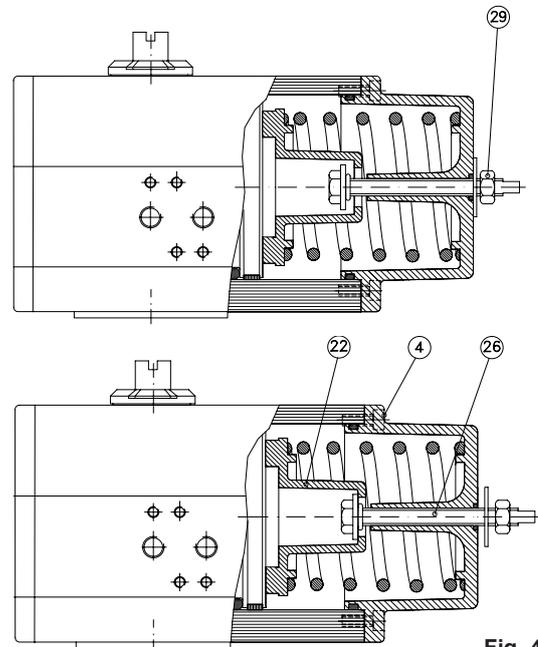


Fig. 4

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.

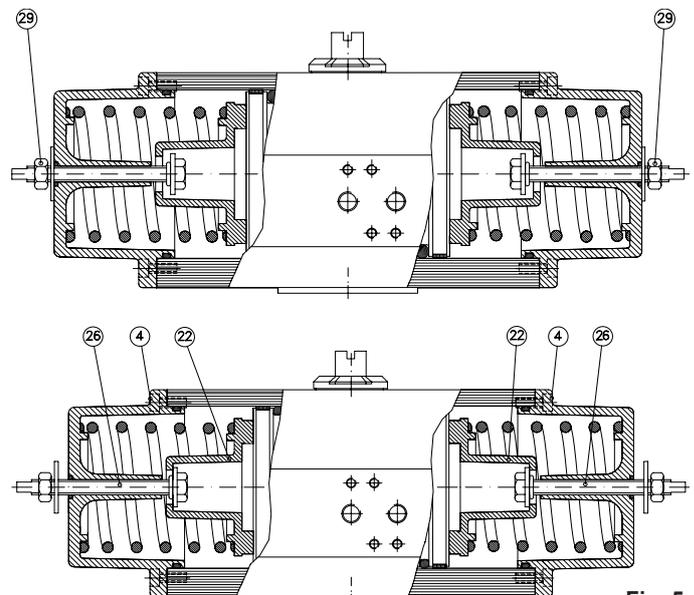


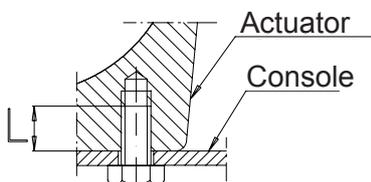
Fig. 5

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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

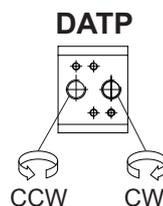
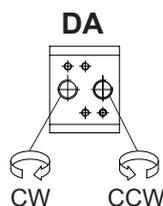
Within brackets: Tightening torque with Stainless steel screw, A2 70 quality.

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	-	-	-

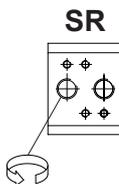
Air Connections

Double Acting

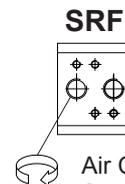


Reversed direction of rotation

Single Acting with Spring Return



Air CCW rotation
Spring CW rotation



Air CW rotation
Spring CCW rotation

Lubrication

AL 77-200 actuators are permanently lubricated and additional lubrication is normally not required. However, for actuators performing 100,000 operation cycles or more under very heavy load, an oil mist lubrication is recommended. Oil mist lubrication requires a mineral oil type ISO VG32 according to DIN 51524HLP for usage in temperature range -10°C to +70°C. Oil mist lubricator must be set at lowest possible value. Commenced oil mist lubrication must continue.

If the actuator is equipped with pneumatic or electropneumatic positioner, oil mist must not be used

Recommended Lubrication Grease

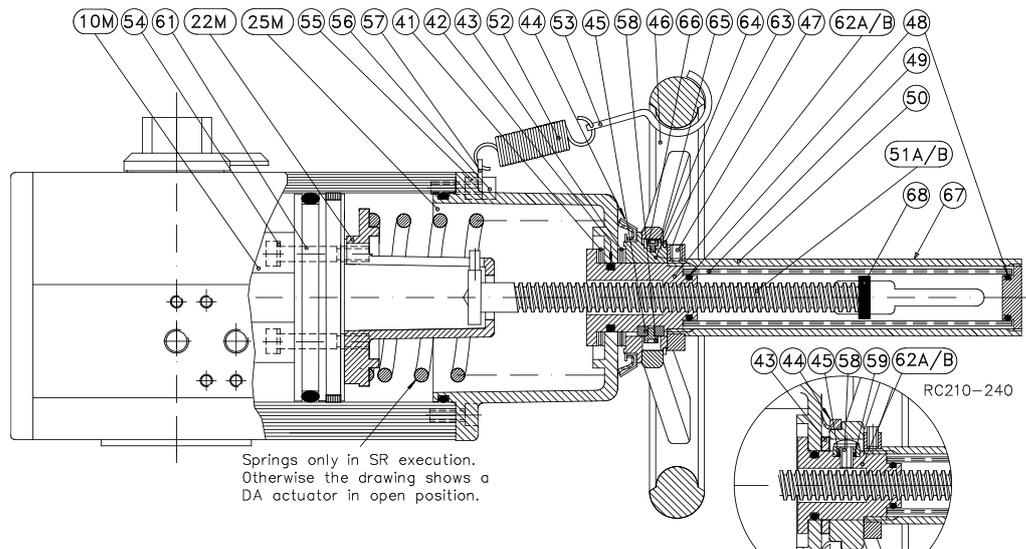
Cylinder bore and drive shaft with shaft sealings	Grease
200 standard	Klübersynth AR 34-402
200 high temperature	Klübertemp HM 83-402
200 low temperature	Klüber Isoflex Topas NCA 52

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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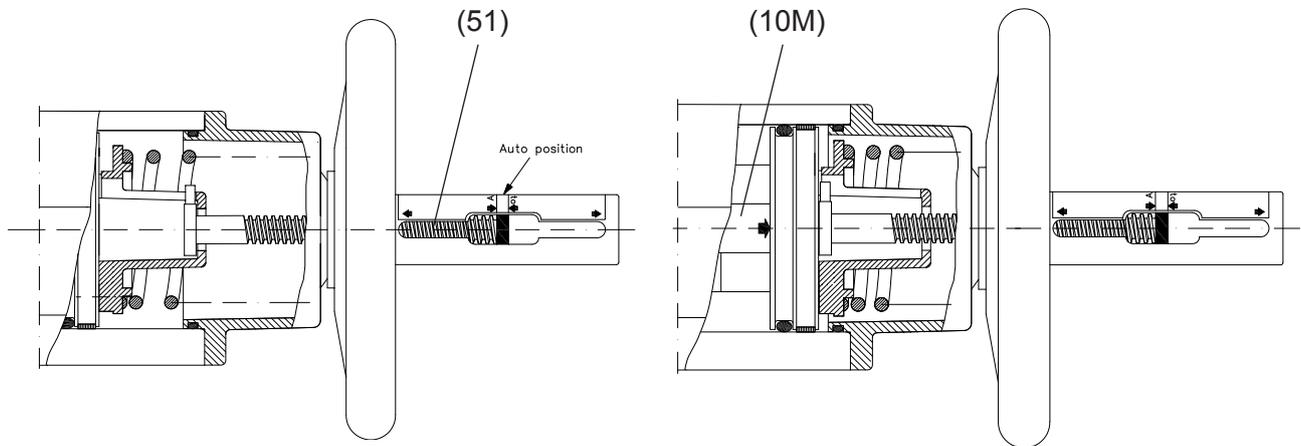
Material specification for size 210-280 MI

Part no	Description	No	Material	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	Anodized
			Size 280: Steel	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	-

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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.

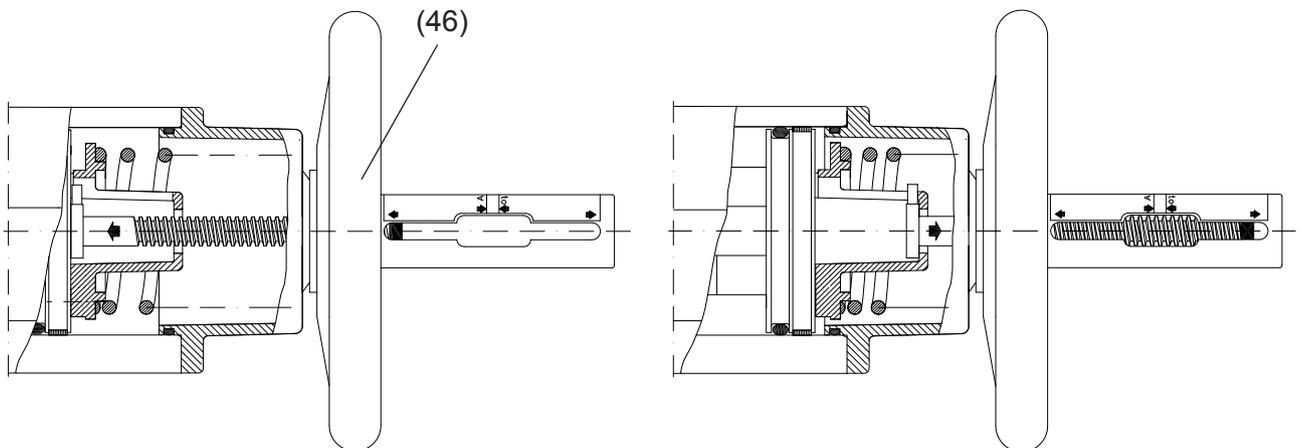
End position adjustments

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.

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