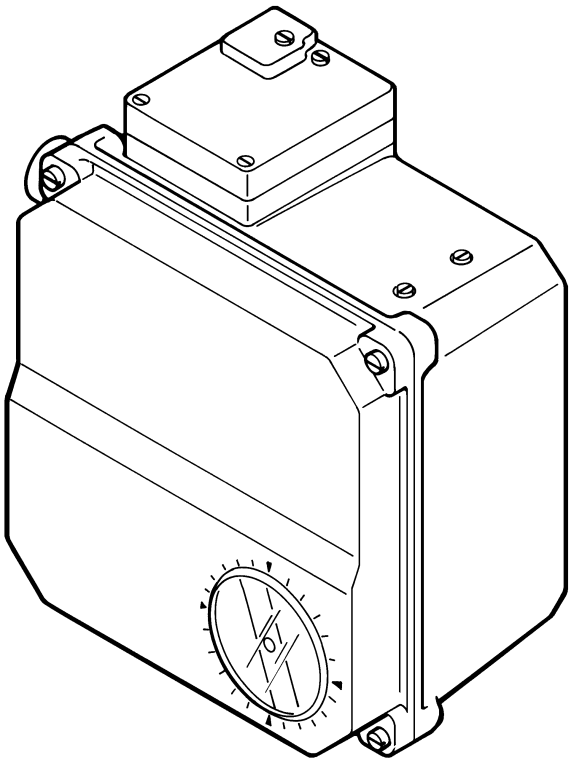
neles

Positioners

Series NE

Installation, Maintenance and
Operating Instructions



metso
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Table of Contents

READ THESE INSTRUCTIONS FIRST!

These instructions provide information about safe handling and operation of the positioner.
If you require additional assistance, please contact the manufacturer or manufacturer's representative. Addresses and phone numbers are printed on the back cover.

SAVE THESE INSTRUCTIONS!

1 INTRODUCTION

1.1 General view

The NE700 electro-pneumatic posiotioner is used for positioning double or single acting actuator.

1.2 Principle of operation

Operation is based on the torque balance. Force coil (152) located in the field of the permanent magnet (168) creates a torque proportional to the signal current on the balance beam (164).

The feed-back spring (41) causes a counter-torque proportional to the actuator position; this position is transmited via the actuator shaft, the coupling (52), the feed-back shaft (26), the cam plate (29) and the lever (33) as a relative displacement to the lower end of the feed-back spring (41).

The nozzle (166) senses the torque balance on the beam (164). When the input signal increases, the balance beam (164) approaches the nozzle (166) and the nozzle pressure rises. This causes the diaphragm piston (8), the beam (5) and the spool (44.2) to move downward. The pilot valve (44) distributes supply air (S) to the upper side of the actuator piston via channel C2, and from the lower side via channel C1 through the pilot valve (44) to the exhaust port. The actuator piston moves until the balance beam is in equilibrium. At this point the actuator is exactly in the position required by the input signal.

The spring (40) causes a negative feed-back between the first amplification stage (nozzle 166 and restriction 24) and the second (pilot valve assembly 44). By changing the lower fastening point for the spring (40) on the balance beam (164), the dynamics of the positioner can be adapted to suit the actuator size.

The zero adjustment (61) is mechanical and the range adjustment (35.6) is electrical.

The differential diaphragms effectively offset the effect of fluctuations in the supply pressure.

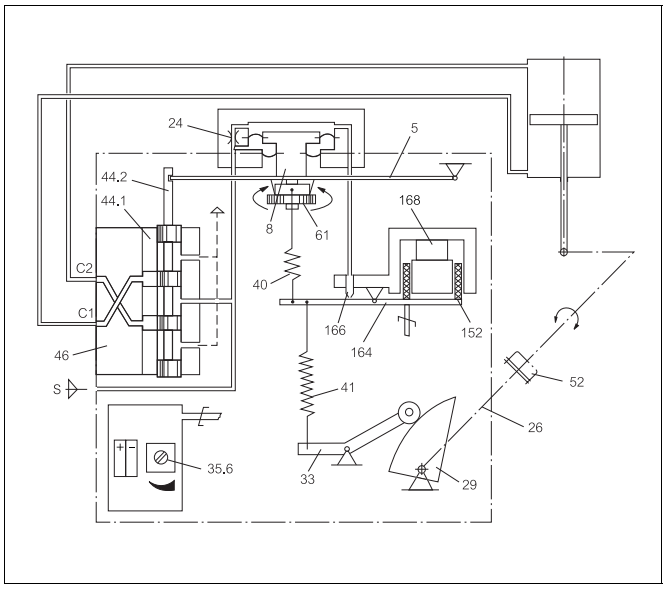


Fig. 1 Schematic diagram

Parts list for Figure 1:

Item	Part
5	Beam
8	Diaphragm piston
24	Restriction
26	Feed-back shaft
29	Camplate
33	Lever
35.6	Range adjustment
40	Internal feed-back spring
41	Feed-back spring
44.1	Pilot valve body
44.2	Pilot valve spool
46	Changeover piece
52	Coupling
61	Zero adjustment
152	Force coil
164	Balance beam
166	Nozzle
168	Permanent magnet

1.3 Marking of positioner

The positioner has an adhesive ID plate, see Fig. 2.
The ID plate contains the following information (from top to bottom):

- ❑ Full type designation of the positioner
- ❑ Input signal
- ❑ Input resistance
- ❑ Max. supply pressure
- ❑ Enclosure class
- ❑ Ambient temperature range
- ❑ Manufacturing series number

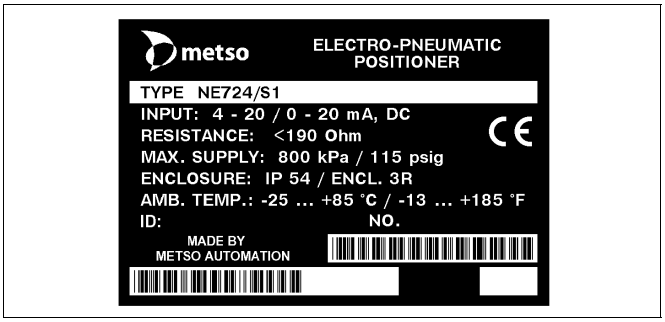


Fig. 2 ID plate

An additional plate, Fig. 3, has markings:

- ❑ Filter regulator (-K)
- ❑ Temperature range
- ❑ Conduit entry (-L, -I or -NJ)

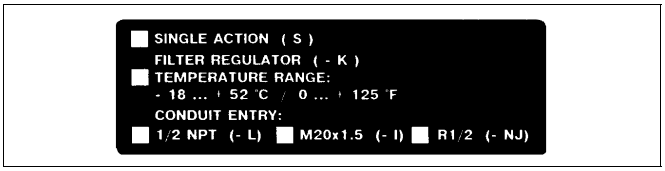


Fig. 3 Additional plate

1.4 Technical specifications

Input signal (direct current)	4–20 mA, 0–20 mA
Split ranges	4–12 mA 12–20 mA
Input resistance	max. 190 Ω
Turning angle of feed-back shaft	max. 90°
Relation between turning angle and signal (standard model)	linear
Supply pressure ps	1.4–8 bar (21–115 psi)
Effect of supply pressure	< 0.2 % / 0.1 bar (< 0.14 % / 1 psi)
Ambient temperature (standard model)	-25° to +85 °C (-13° to +185 °F)
Effect of temperature	< 0.05 % / °C (< 0.025 % / °F)
Performance with 12 % friction loaded double-acting piston actuator	
-dead band	< 0.3 %
- hysteresis	< 0.7 %
-linearity	< 2 %
Effect of vibration (1.5 g, 5-100 Hz)	< 1 %
Enclosure class	IP 54
Weight	approx. 2.2 kg (4.8 lb)
Construction materials:	
-case	anodized Al alloy
-cover	polycarbonate
-internal parts	stainless steel, aluminium alloy and stainless spring steel
- diaphragms and seals	nitrile rubber (standard model)

Table 1 Pilot valve alternatives

Positioner type	Actuator stroke volume dm^3 (litres)	Air consumption nm^3/h / scfm *)	Max. delivery nm^3/h / scfm *)
NE724	1.0–8.0	0.9 / 0.5	12 / 7
NE726	8.0–30.0	1.2 / 0.7	18 / 10.4
NE727	> 30	2.1 / 1.2	32 / 18.6

*) supply pressure 4 bar / 60 psi

1.5 Recycling and disposal of a rejected positioner

Most positioner parts can be recycled if sorted according to material. Most parts have material marking. A material list is supplied with the positioner. In addition, separate recycling and disposal instructions are available from the manufacturer. A positioner can also be returned to the manufacturer for recycling and disposal against a fee.

1.6 Safety precautions

CAUTION:
Do not exceed the positioner performance limitations!
Exceeding the limitations marked on the positioner may cause damage to the posioner, actuator and valve.
Damage or personal injury may result.

CAUTION:
Do not dismantle a pressurized positioner!
Dismantling a pressurized positioner will result in uncontrolled pressure release. Always isolate the relevant part of the pipeline, release the pressure from the positioner and the piping.
Failure to do this may result in damage or personal injury.

CAUTION:
Beware of the parts with live voltage!
A voltage, which is normally not dangerous, is supplied to the positioner. Avoid touching live parts and bare wires and short circuiting live parts and the housing.

CAUTION:
Beware of the moving parts when positioner is operated!

2 MOUNTING ON THE METSO ACTUATOR

2.1 General

When the positioner is supplied together with the valve and actuator, the tubes are mounted and the positioner adjusted in accordance with the customer's specifications.

When the positioner is ordered separately, the mounting parts for the assembly must be ordered at the same time.

Example order: Positioner alone (BC12)-Z-NE724.

The positioner is equipped with VDI/VDE 3845 (S1) mounting face. This mounting face requires a shaft with the H coupling.

Old Metso Automation style mounting face code S2 is no more available.

For mounting parts for Metso actuators, see Sections 13.2 - 13.3.

2.2 Installing positioner NE700/S1 on Metso actuators with VDI/VDE 3845 mounting face

1. The actuator piston must be in the up position (in spring-return actuators as determined by the spring).
2. Install the pointer (only B_U) parallel with the valve closure member and fasten the draught piece (2) with a screw (29) to the pointer cover (B_U) or to the coupling (QP), as shown in Fig. 5. Secure the draught piece fastening screw with a sealant (e.g. Loctite) and tighten it properly.
3. Fasten the mounting bracket (1) to the positioner.
4. Fasten the mounting bracket (1) to the actuator.

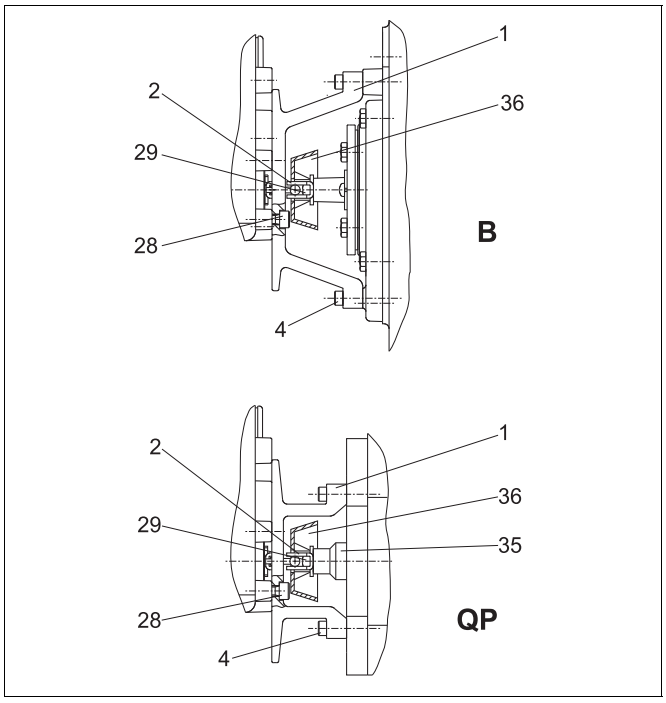


Fig. 4 Installing on a Metso actuator (S1)

2.3 NE_700/700 positioner/limit switch combination (Obsolete since 2013)

The bottom of the limit switch acts also as the cover for the positioner. Remove the limit switch before the adjustment of the positioner.

1. Loosen the cover screws. Note the position of the shaft relative to the positioner when removing the limit switch.
2. When the adjustment of the positioner is done, operate the actuator until the valve is in the closed or open position.
3. Note the position of the actuator and valve when mounting the limit switch on the actuator. Make sure that the position of the shaft is unchanged relative to the positioner.
4. Place the limit switch on the positioner so that the shafts are correctly engaged.
5. Fasten the cover screws.
6. Check the adjustment of the limit switch. See the instruction manual of the limit switch for details.

2.4 Piping of supply air

Table 2 provides the recommended pilot valve and tube sizes in accordance with the actuator sizes. Tube sizes are minimum values allowed.

Connect air supply to S (1/4 NPT).
Connect C1 and C2 (1/4 NPT) to the actuator according to Fig. 6.
See also Chapter 3.

NOTE:
A single action connection alone is permitted for positioners mounted on the spring actuator!
Place a plug in connection C1 or C2. See Figure 6.

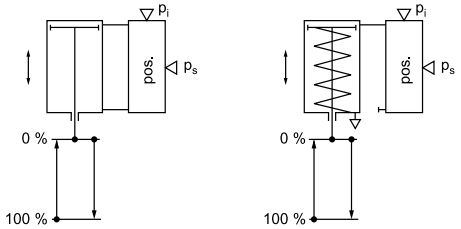
For pipe threads are liquid sealants, e.g. Loctite, recommended.

NOTE:
Exessive sealant may cause faulty operation of the positioner.
Sealing tape is not recommended.
Ensure the cleaness of the air piping.

Table 2 Piping and operating times

Actuator		NPT	Piping						Operating time / stroke (s) pilot valve			
			Plastic/Cu/SS (mm)			Plastic/Cu/SS (")						
B1C	Stroke vol. dm^3/in^3		6/4	10/8	12/10	1/4	3/8	1/2	ø4LC	ø4	ø6	ø6 HC
6	0.3/20	1/4	x			x			1	1		
9	0.6/37	1/4	x			x			1.5	1.5		
11	1.1/67	3/8	x			x			2	2		
13	2.3/140	3/8		x			x			4		
17 20	4.3/262 5.4/330	1/2		x x			x x			7 8.5	(6) (5.5)	
25 32	10.5/640 21/1282	1/2 3/4		x x	(x) (x)		x x	(x) (x)			10 17	(8.5) (16)
40 50	43/2624 84/5130	3/4 1			x x		(x) (x)	x x			(33) (60)	31 57
502	195/11900	1			x			x				
B1J B1JA	Stroke vol. dm^3/in^3	NPT	6/4	10/8	12/10	1/4	3/8	1/2	ø4LC	ø4	ø6	ø6 HC
6	0.47 / 28.7	1/4	x			x			1	1		
8 10	0.9/55 1.8/111	3/8	x	 x		x	 x		1.5/3	1.5/3 2.5/5.5		
12 16	3.6/225 6.7 / 415	1/2		x x			x x			4.5/11 8/18	(3.5/6) (4.5/11)	
20 25	13/795 27 / 1642	3/4		x x	(x) (x)		x x	(x) (x)			8.5/21 17/38	(7.5/19) (15/33)
32 322	53 / 3231 106 / 6480	1			x x		(x)	x x			(33/74)	30/64 60/130
QP	Stroke vol. dm^3/in^3	NPT	6/4	10/8	12/10	1/4	3/8	1/2	ø4LC	ø4	ø6	ø6 HC
1C	0.62/38	3/8	x			x			1.5/2	1.5/2	-	-
2C	1.08/66	3/8	x			x			2/3.5	2/3.5	-	-
3C	2.18/133	3/8		x			x		-	3/5	2/3	-
4C	4.34/265	3/8		x			x		-	6/10	4/6	-
5C	8.7/531	3/8		x			x		-	-	7/10	
6C	17.5/1068	3/4			x			x	-		12/18	10/15

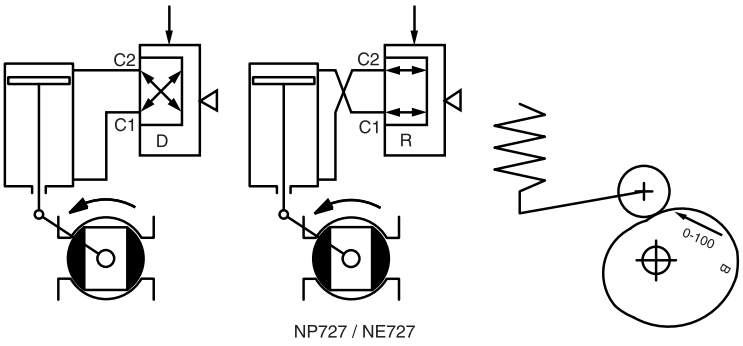
Times in parenthesis are achieved by changing pilot valve alone or pilot valve and tube size.



Operating times for spring return actuators B1J/B1JA and QP:
against the spring / direction of the spring

Actuator without valve:
p_s = 4–5 bar / 58–72 psi

Step of input signal:
p_i = 0–100 % and 100–0 %



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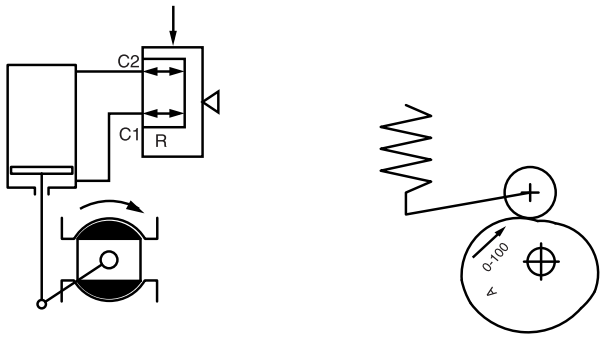
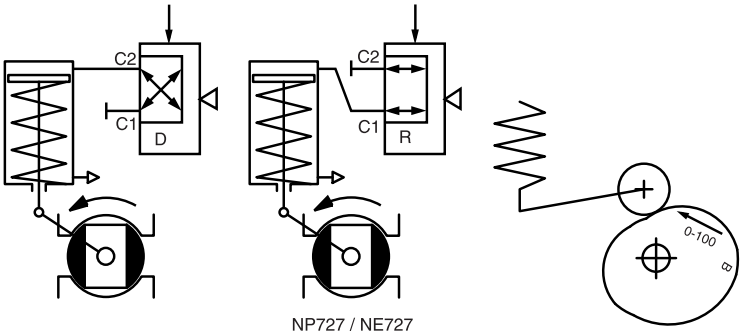


DOUBLE-ACTING

1. Increasing input signal to open valve.
   Cam segments:
   B/0-100, A/0-50, A/50-100

2. Increasing input signal to close valve.
   Cam segments:
   A/0-100, B/0-50, B/50-100

NOTE:
Reverse piping for ST actuators.



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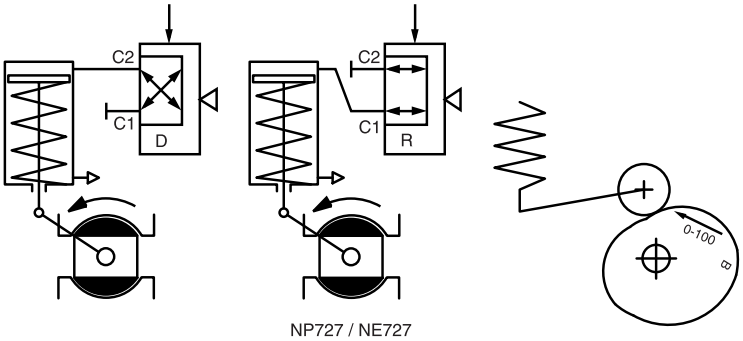


NP727 / NE727

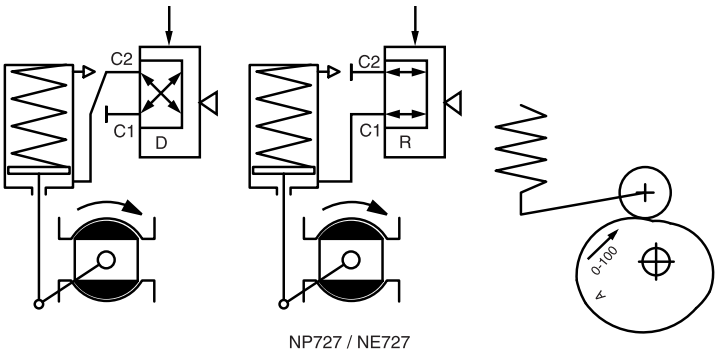
SINGLE-ACTING
(SPRING TO CLOSE)

3. Increasing input signal to open valve.
   Spring to close valve.
   Cam segments:
   B/0-100, A/0-50, A/50-100

4. Increasing input signal to close valve.
   Spring to open valve.
   Cam segments:
   B/0-100, A/0-50, A/50-100

WARNING:
Valve closes exceptionally counterclockwise.
Unsuitable for Q, R, T5, F and L series valve

NOTE:
Reverse piping for ST actuators. Spring and piston in the opposite position from shown.



NP727 / NE727

SINGLE-ACTING
(SPRING TO OPEN)

5. Increasing input signal to close valve.
   Spring to open valve.
   Cam segments:
   A/0-100, B/0-50, B/50-100

NOTE:
Reverse piping for ST actuators. Spring and piston in the opposite position from shown.

Fig. 5 Positioner actions
NOTE: In positioner NE727 the changeover piece can be used in position R only.

2.5 Instrument air supply

CAUTION:
Do not exceed the permitted actuator supply air pressure!

The supply air must be clean, dry and oil-free instrument air, e.g. according to standard ISA S7.3–81. Supply pressure is 1.4–8 bar (20–115 psi).

2.6 Electric connections

The input signal cable is lead trough a PG11 cable gland to the housing. Connect the conductors to the terminal on the terminal card, plus (+) and minus (-) accordingly. See Fig. 7. The wiring schematic is shown in Fig. 8.

NOTE:
The wires should not be led through the operational area of the feed-back lever (33) and feed-back spring (41).

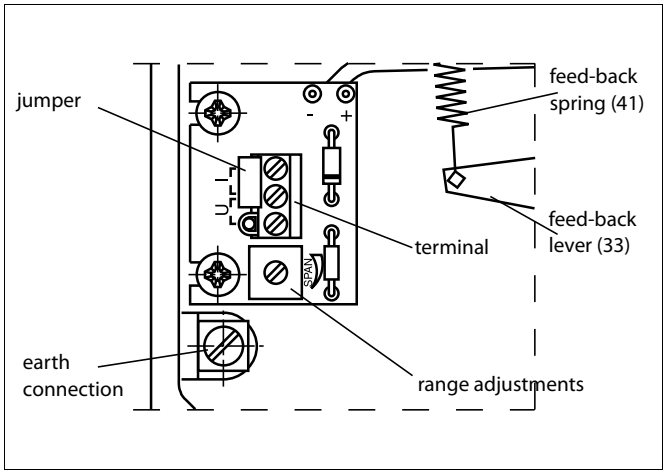


Fig. 6 Terminal card

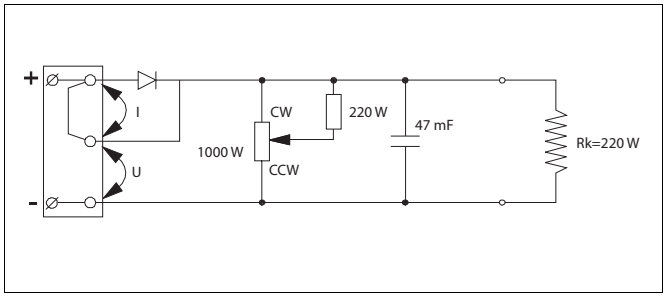


Fig. 7 Wiring schematic

3 INPUT SIGNAL AND DIRECTIONS OF OPERATION

Figure 6 assists in choosing the right segment for the cam plate (29) and position for the changeover piece (46).

3.1 Changeover piece

CAUTION:
Do not dismantle a pressurized positioner!

The function of connection C1 and C2 can be altered by turning the changeover piece (46). The diagram D (or R) shown on the protective plate (48) functions when the symbol D (or R) is visible in the lower lefthand corner of the changeover piece. D = direct, R = reverse.

External changes in the tubes are not needed. Positioner NE727 is an exeption (DIA6HC pilot valve). Then the changeover piece must always be in position R and the external tubes mounted in accordance with Fig. 6.

3.2 Cam plate

The figures marked on the cam plate (29) are the signal ranges expressed as percentages, for example 0–100 corresponds to 4–20 mA, or 50–100 to 12–20 mA. See Fig. 9.

The arrows on the cam plate show the direction it must turn when the input signal is rising in the cam segment in question.

The non-rising segments between the rising segments are roughly 15°–20°.

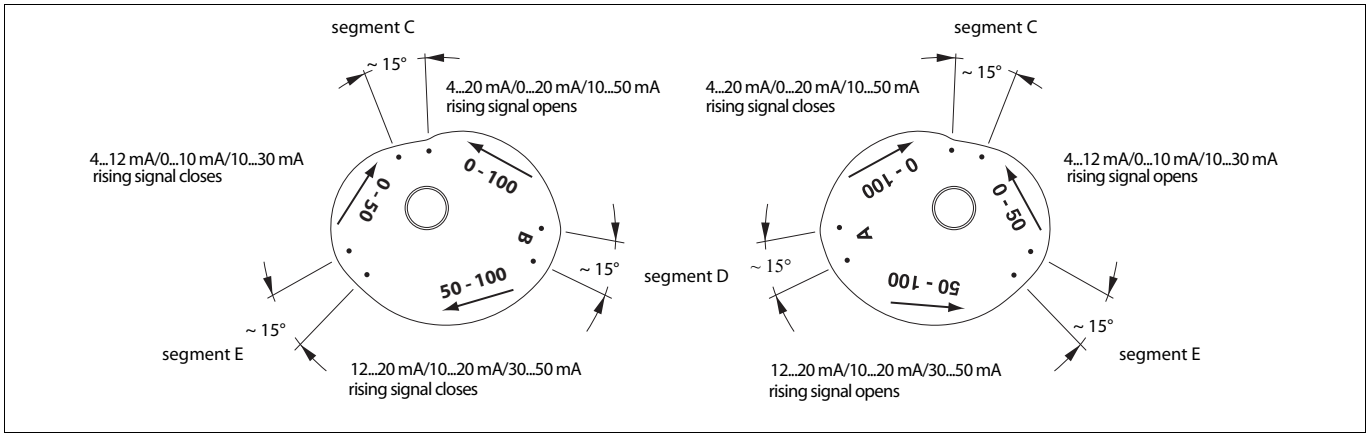


Fig. 8 Input signal ranges

4 PRELIMINARY ACTIONS FOR THE ADJUSTMENT

Set the valve's open and closed limits with the actuator limiter screws; see the valve instruction manual. The changeover piece (46), the cam (29) and the internal feed-back spring (40) must be in correct positions. Check the pilot valve size from Table 2.

The adjustment must always be carried out when the supply pressure has been changed.

Please note that operating of the valve is required during the adjustment.

4.1 Position of the changeover piece

CAUTION:
Do not dismantle a pressurized positioner!

Choose the position of the changeover piece, D or R, from Fig. 6 in accordance with the function desired.
Turn the changeover piece (46) when necessary.

Loosen the nuts (49) and remove the protective plate (48). Pull out the changeover piece (46). Check the O-rings (47, 2 pcs.) and apply silicone grease lightly if needed. Place the changeover piece (46) and the protective plate (48) in the case. Tighten the nuts (49) evenly, one after the other.

NOTE:
Check that the changeover piece is mounted correctly: Symbol D or R is visible in the lower left hand corner.

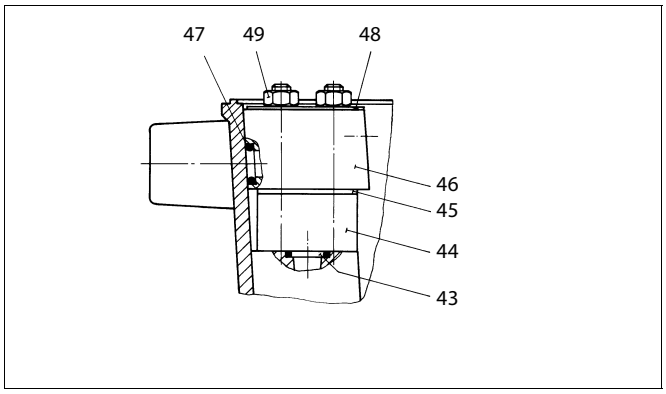


Fig. 9 Mounting the changeover piece

4.2 Pilot valve

Removal of the pilot valve is unnecessary when the changeover piece is turned around. For instructions of removal, see Section 8.2.

4.3 Setting the internal feed-back spring

Select the position for the lower end of the spring (40) from Table 3 in accordance with the actuator size. The spring setting must be made before the zero adjustment of the positioner, as it affects the adjustment.

The amplification of the positioner increases as the spring (40) is moved from position 'a' to position 'e'.

If in the field the valve overshoots, the spring (40) can be moved to the 'a' direction. If the valve goes into position too slowly the spring can be moved to the 'e' direction respectively.

In sticker inside the cover (2) has also been shown the position for the lower end of the spring (40) in accordance with the actuator size.

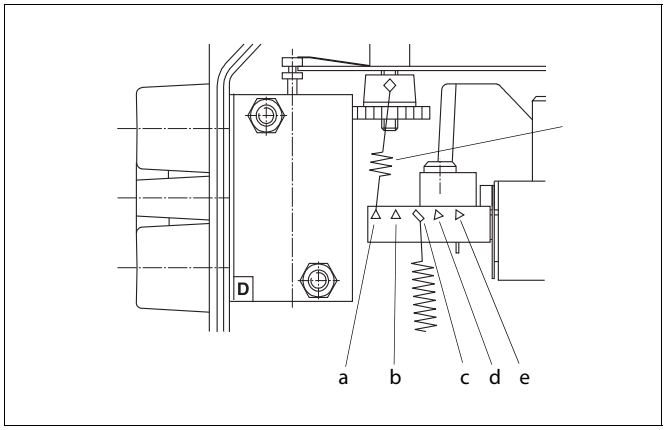


Fig. 10 Setting the internal feed-back spring

Table 3 Setting the internal feed-back spring

Spring (40) setting	Actuator size	Cylinder volume dm^3
a	B1C 6, 8, B1J 6 QP 1	<0,5
b	B1C 9, 11, 12; B1J 8 QP 2 (QP 1 *)	0,5...1
c	B1C 13, 16; B1J 10, 12 QP 3 (QP 2 *)	1...4
d	B1C 17, 20, 25; B1J 16 QP 4, QP 5 (BJ 8 *)	4...11
e	B1C 32, 40; B1J 20, 25 B1C 50, 502; B1J 32, 322	11...50

*) NE729S positioner, (Obsolete since 2013).

4.4 Position of the cam plate

Choose the side, A or B, and the rising segment of the cam plate from Fig. 6 in accordance with the function desired.

Move the actuator piston to the end where the input signal has its lower value. Shut off the supply pressure or move the pilot spool by deflecting the balance beam (164) gently so that the piston strokes to the desired limit. The input signal should be zero or at the lower limit.

NOTE:
Don't move the pilot spool by deflecting the beam (5).
The double diaphragm keeps the beam steadfast in the position.

Loosen the screw (57), remove the indicator (32), loosen the screw (31) and the locking wheel (30). Turn the cam plate (29) to the desired side.

In case of α_0 adjustment, proceed acc. to Sections 6.1 and 6.2.

Place the roller so that its contact point is 1 mm from the beginning of the rising segment. Then tighten the locking wheel (30) and the screw (31).

5 BASIC ADJUSTMENT

Basic adjustment is made to rotary and butterfly valves.

Please note the procedures in Chapter 4 before the adjustment.

1. Switch on the supply pressure (S) and the input signal (+/-). Note the correct polarity.
2. Set the input signal at the closed limit of the valve so that it is 2 % i.e. 0.3 mA higher or lower than the limit value, e.g. 4 + 0.3 = 4.3 mA or 20 - 0.3 = 19.7 mA. Turn the zero adjustment nut (61) with a screwdriver or fingers so that the actuator comes slowly to the closed limit. The valve should open slightly with a 4 % change in signal, that is 0.6 mA, e.g. 4 + 0.6 = 4.6 mA or 20 - 0.6 =19.4 mA. See Figures 12 and 13.
3. Set the input signal to the other limit value. The valve should be entirely open at 100 %, i.e. 20 mA or 0 %, i.e. 4 mA. The valve should start to operate to closed direction at 98 %, i.e. 19.7 mA or 4.3 mA.
   The range, i.e. turning angle, increases by turning the range adjustment potentiometer (35.6) counterclockwise and de-creases by turning clockwise.
4. The zero and range adjustments affect each other, so stages 2 and 3 must be repeated a few times.
5. Screw on the pointer (32) into place so that the yellow line is in the direction of the valve closing member. Tighten the screw (57).

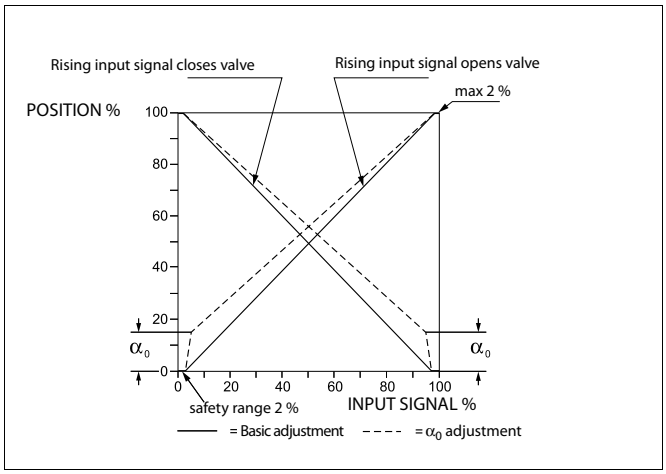


Fig. 11 Basic and α_0 adjustments

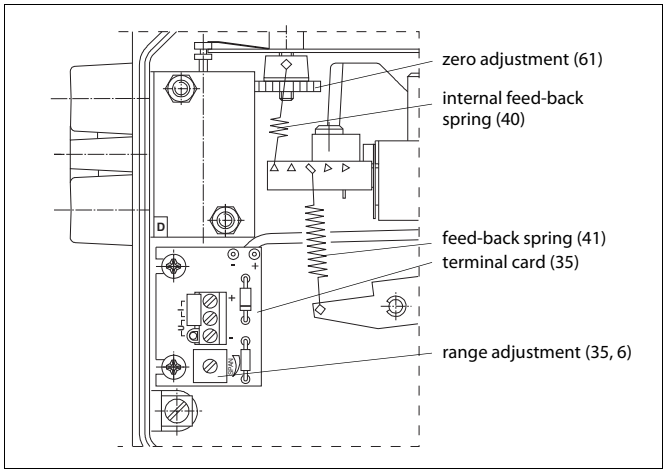


Fig. 12 Zero and range adjustments

6 α_0 ADJUSTMENT

α_0 adjustment is made to segment and ball valves. This adjustment takes into account the "dead angle" α_0 of the ball valve. The entire signal range is then used for effective valve opening 90°-α_0, see Figure 14.

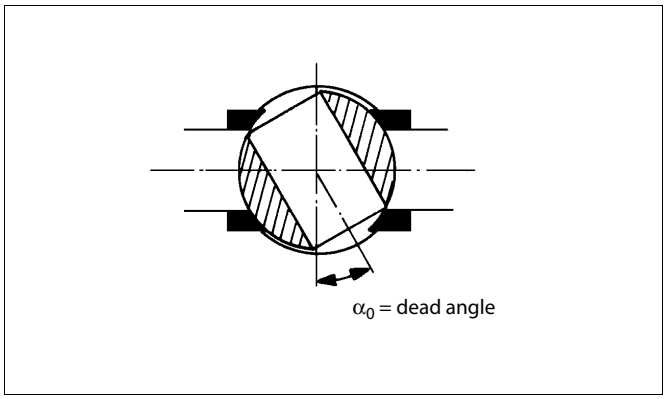


Fig. 13 Zero and range adjustments

The same adjustment method can be applied to butterfly valves in papermills for pulp flow control to avoid the dewatering of the pulp near the closed position of the disc.

Table 4 shows the shift on the circumference of the cam equal to the "dead angle" of the valve, Figure 15, in various cam segments (C, E, D).

Please note the procedures in Chapter 4 before the adjustment.

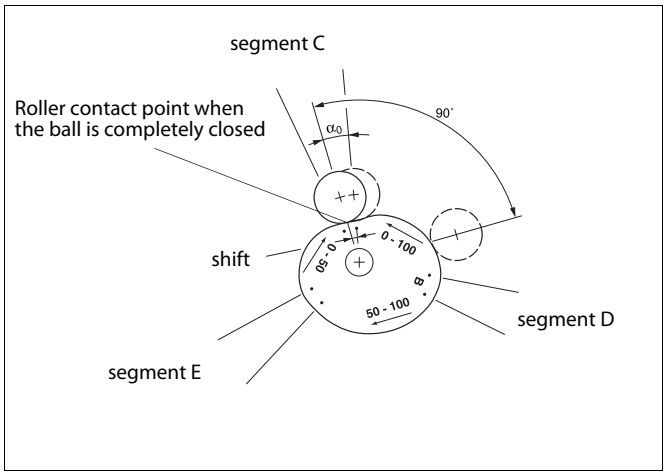


Fig. 14 Shift on circumference of cam equal to dead angle

1. Mark the shift in question on the edge of the cam, Fig. 15 and Table 4. Dimensions do not have to be measured if the dead angle can be reliably noticed from position of the closing member.
2. Lock the cam so that the roller touches the edge of the cam plate at the mark. Tighten the locking wheel (30) and the screw (31).
3. Switch on the supply pressure (S) and the input signal (+/-). Note the correct polarity.

Table 4 Dead angle in degrees

Valve size		Valve series							
		MBV QMBV 1)	MBV QMBV 2)	D 3)	T5, QT5	QXT5	T25, QT25	QXT25	R, QR
mm	mm	Dead angle in degrees							
25	1	12.5	-	-	23.0	17.5	-	-	14
40	1 1/2	11.0	-	-	22.0	11.0	-	-	11
50	2	9.0	8.0	12.0	22.0	11.0	16.0	7.0	15
65	2 1/2	8.0	-	-	-	-	-	-	11
80	3	9.0	7.0	11.0	16.0	7.0	15.0	8.0	8
100	4	9.0	7.0	11.0	15.0	7.5	14.5	8.0	7
125	5	11.0	-	-	-	-	11.0	6.0	7
150	6	9.0	7.0	10.5	14.5	8.0	12.0		7
200	8	8.0	6.5	7.5	11.0	6.0	8.5		6
250	10	8.0	6.5	7.0	12.0		8.5		6
300	12	7.0	5.5	5.5	8.5		7.0		5
350	14		5.4	5.5	-				4
400	16		4.5	5.0	8.5 5 (14")				4
450	18			5.0	7.0 (16")				
500	20			5.5					
600	24			5.0					
650	26			6.0					
700	28			6.0					
750	30			5.5					
800	32			-					
900	36			4.5					

1) Seat supported 2) Trunnion 3) S/G seat

Table 5 Shift caused by dead angle, mm/inch

α_0	Segment C	Segment E	Segment D
20°	*)	6.1/0.24	8.1/0.31
19°	*)	5.8/0.22	7.7/0.30
18°	*)	5.5/0.21	7.3/0.28
17°	*)	5.2/0.20	6.9/0.27
16°	*)	4.9/0.19	6.5/0.25
15°	3.1/0.12	4.6/0.18	6.1/0.24
14°	2.9/0.11	4.3/0.16	5.7/0.22
13°	2.7/0.10	4.0/0.15	5.3/0.20
12°	2.5/0.09	3.7/0.14	4.9/0.19
11°	2.3/0.09	3.4/0.13	4.5/0.17
10°	2.1/0.08	3.1/0.12	4.1/0.16
9°	1.9/0.07	2.8/0.11	3.7/0.14
8°	1.7/0.06	2.5/0.09	3.3/0.12
7°	1.5/0.05	2.2/0.08	2.9/0.11
6°	1.3/0.05	1.9/0.07	2.5/0.09
5°	1.1/0.04	1.6/0.06	2.1/0.08
4°	0.9/0.03	1.3/0.05	1.7/0.06

*) Segment C: α_0 max. 15°

4. Set the input signal at the closed limit of the valve so that it is 2 % i.e. 0.3 mA higher or lower than the limit value, (e.g. 4 + 0.3 = 4.3 mA or 20 - 0.3 = 19.7 mA). Turn the zero adjustment nut (61) with a screwdriver or fingers so that the actuator comes slowly to the closed limit. The valve should open slightly with a 4 % change in signal, that is 0.6 mA, (e.g. 4 + 0.6 = 4.6 mA or 20 - 0.6 = 19.4 mA). See Figure 13.
5. Set the input signal to the other limit value. The valve should be entirely open at 100 %, i.e. 20 mA or at 0 %, i.e. 4 mA. The valve should start to operate to closed direction at 98 %, i.e. 19.7 mA or 4.3 mA.
   The range (turning angle) increases by turning the range adjustment potentiometer (35.6) counterclockwise and decreases by turning clockwise.
6. The zero and range adjustments affect each other, so stages 4 and 5 must be repeated a few times.
7. Screw on the pointer (32) into place so that the yellow line is in the direction of the valve closing member. Tighten the screw (57).

7 SPLIT-RANGE ADJUSTMENT

In principle, split range adjustments are made in the same manner as for a normal signal range. Select a split range, 4–12 mA or 12–20 mA, from the cam plate. See Figure 9.

8 MAINTENANCE

CAUTION:
Do not dismantle a pressurized positioner!

NOTE:
Ensure the cleanness of the air piping.

Regular maintenance is not necessary.

The need for maintenance depends on the quality of the instrument air. See also Section 2.5.

If there is need for servicing proceed according to the following sections.

8.1 Supply air filter

The supply air filter (50) is located in the supply air connection (S); the filter can be removed for cleaning.

8.2 Pilot valve

Remove the pilot valve (44) by first loosening the nuts (49), and then by lifting off the protective plate (48), the change-over piece (46) and the gasket (45).

The pilot valve spool (44.2) should slip easily in the pilot valve body (44.1).

If the pilot valve sticks, wash the body and spool with solvent.

NOTE:
The pilot valve body and spool constitute a pair, and must not be replaced separately.

See the exploded view for the correct installation position of the pilot valve. The size code for the pilot valve on the body, for example DIA 4.0, must be visible on the right side.

Check the condition of the O-rings (43 and 47) and of the gasket (45). The end of the leaf spring on the beam must be on top of the pilot valve spool (Figure 13). Make sure that the end of the beam (5) goes into the spool groove without sideways deflections. After tightening the nuts (49), check the beam once again by hand to see that the pilot valve moves readily.

8.3 Replacement of the diaphragms

Remove the spring (40) and loosen the screws (23). Remove the zero adjustment wheel, the screw (15) and the nut (16). Replace the diaphragms (13, 14). See Fig. 16. Note the installation position of the diaphragms convolution.

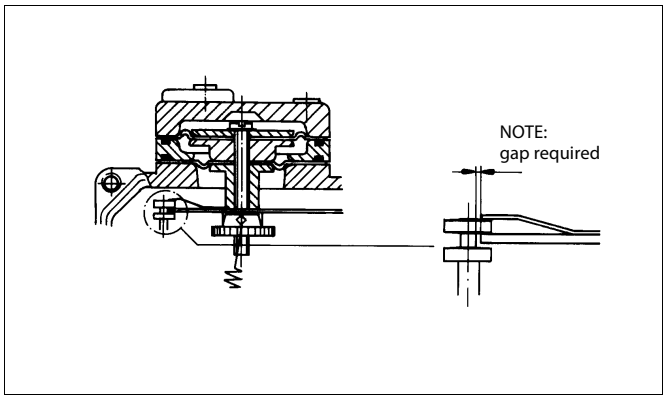


Fig. 15 Replacement of diaphragms

Check during assembly that the large O-rings (11,12) and the small ones (18, 19, 20, 21) are in place. Check the condition of the gasket (55) and secure the nut (16) with Loctite 242. Fasten the zero adjustment wheel (61). Tighten the cover screws (23) evenly. Check the positioner adjustment after replacing of diaphragm.

Note: O-rings (11, 12) in the old construction only (manufactured before 12/94).

8.4 Force coil-nozzle assembly

Repairing of the force coil-nozzle assembly requires good knowledge, workmanship and special tools.

It is highly recommended to replace a faulty assembly with a new one.

Handle and disassemble the coil-nozzle assembly in the cleanest and most dust-free surroundings possible.

8.4.1 Removing the force coil-nozzle assembly

1. Disconnect the signal wires from the terminal.
2. Remove the springs (40, 41) and loosen the terminal screws (36). Remove the terminal card (35).
3. Hold on to the assembly and loosen the screws (38) in the back wall of the case.

8.4.2 Cleaning the magnet air gap

1. Remove the fastening screw (169) of the magnet (168) and lift the magnet carefully out of the body. Clean the magnet air gap with e.g. tape.
2. Place the magnet into the body carefully, making certain that the moving force coil does not jam in the air gap. Tighten the screw (169) firmly.

8.4.3 Mounting the force coil-nozzle assembly

Check the O-ring (39) in the case and the location of the wire in the body groove. Turn the screws (38) until tight. Mount the terminal card and the springs. Note the correct position of the spring (40), see Section 4.3. Check the adjustment.

8.5 Changing the restriction assembly

Loosen the screw (25) to remove the restriction assembly (24). A blocked restriction and/or filter can be cleaned if needed. Replacing the whole assembly is althoug recommended.

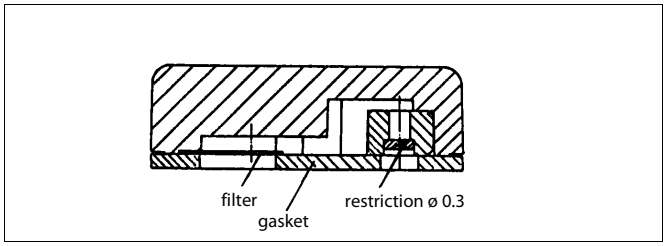


Fig. 16 Restriction assembly (24)

9 TROUBLESHOOTING

9.1 Electrical defects

1. The electrical condition of the positioner can be measured in the field in line without shutting down the apparatus. There are measurement terminals, see Figs. 7 and 8, for voltage (U) and current (I) on the terminal card. Pull out the jumper before taking the measurement. Note the correct polarity of the meter.
2. Current and voltage measurements can be used to determine whether the signal line and the electrical components of the positioner are in order.

Table 6 Current and voltage measurements

Measurement		Possible faults
U (V)	I (A)	
0	(—)	Signal wire polarity wrong
No	No	Signal wire defect. Wire not connected to terminal
>4	When I=20 mA	Coil connection wire or coil winding defect. Shunt resistance defective
0	Yes	Coil or shunt resistance short circuited

9.2 Mechanical defects

1. A change in the input signal does not affect the position of the actuator.
- ❑ supply pressure too low
- ❑ diaphragms damaged
- ❑ pilot valve sticks
- ❑ seals in the changeover piece leak
- ❑ tubes between the positioner and the actuator, change-over piece or position of the cam wrong, see Fig. 6
- ❑ actuator and/or valve jammed
- ❑ restriction assembly blocked, see Fig. 17

2. The actuator goes to the final position with a small change input signal.
- ❑ tubes between the positioner and the actuator, the changeover piece or the position of the cam wrong.

3. Inaccurate positioning
- ❑ pilot valve dirty
- ❑ beam (5) pushes the pilot valve spool sideways
- ❑ diaphragms damaged
- ❑ dirt in the magnet air gap
- ❑ actuator torque too low
- ❑ supply pressure too low
- ❑ valve torque requirement increased

4. Overshooting or too slow
- ❑ positioning setting for the internal feed-back spring wrong
- ❑ pilot valve dirty or of the wrong size, see Table 2
- ❑ supply air tube too small or supply air filter dirty
- ❑ valve sticks

5. Zero point unstable
- ❑ restriction assembly dirty
- ❑ inaccurate dead angle α_0 adjustment

10 OPTIONS

10.1 NE700/R dust-proof construction (IP65)

For extremely dusty environments. The protective cover (3) behind the standard posioner is replaced with an exhaust port with a 3/4 NPT filter.

Please note: do not remove the exhaust port.

10.2 NE700/A with pressure gauges

The positioner (manufactured after 9/92) can be equipped with a pressure gauge block. The block (70) is attached with tree sef-tapping screws (72). The O-rings (71, 3 pcs.) must be in position before mounting. Check tightness after mounting.

For all other constructions see Type code, Chapter 14.

11 TOOLS

In addition to standard general tools, you need the following equipment:

- ❑ calibration device for adjustments
- ❑ multimeter

12 ORDERING SPARE PARTS

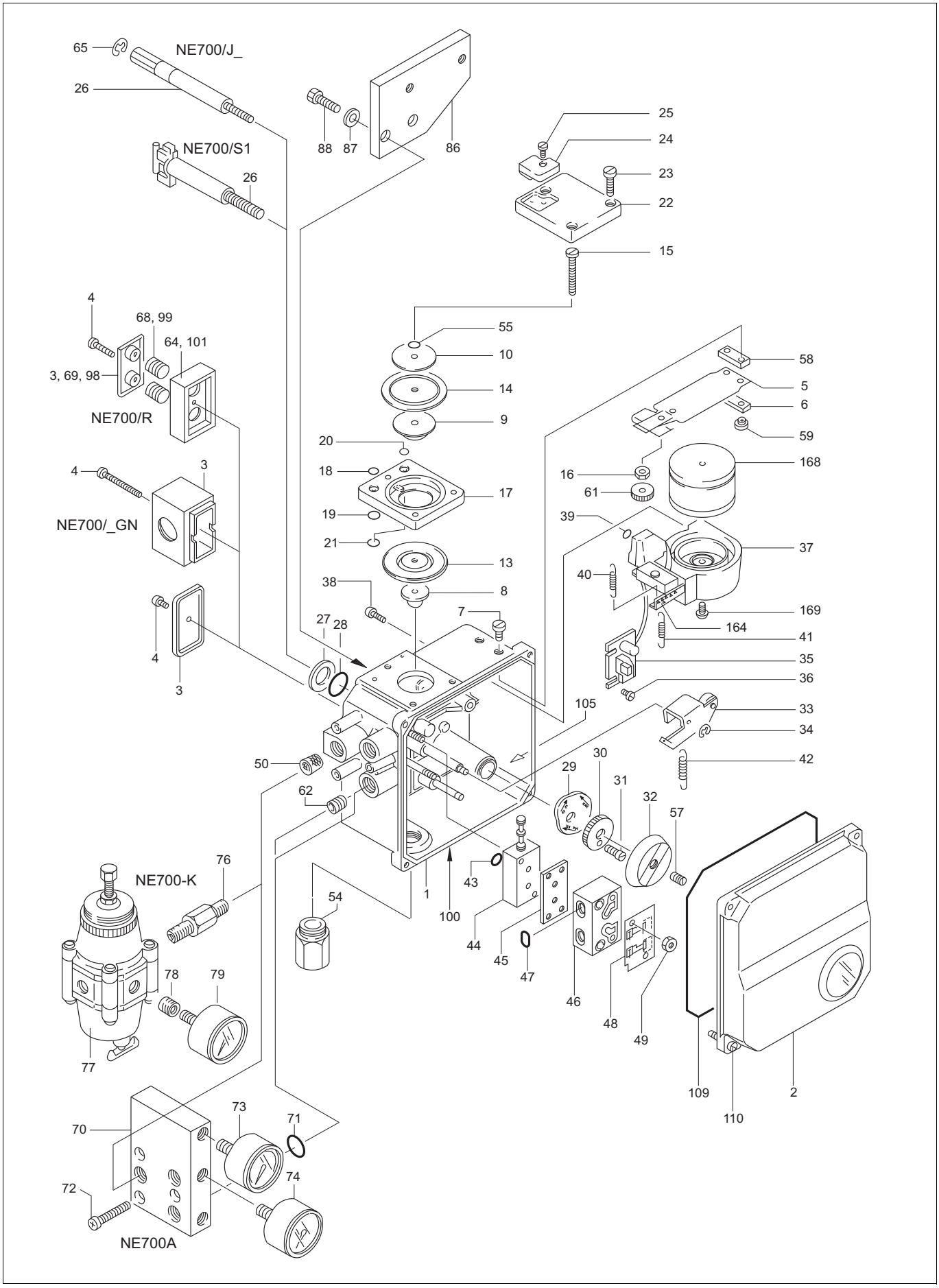
When ordering spare parts, always include the following information:

- ❑ type code, sales order number, serial number
- ❑ number of the parts list, part number, name of the part and quantity required

This information can be found from the identification plate or documents.

13 DRAWINGS AND PARTS LISTS

13.1 Exploded view and parts list

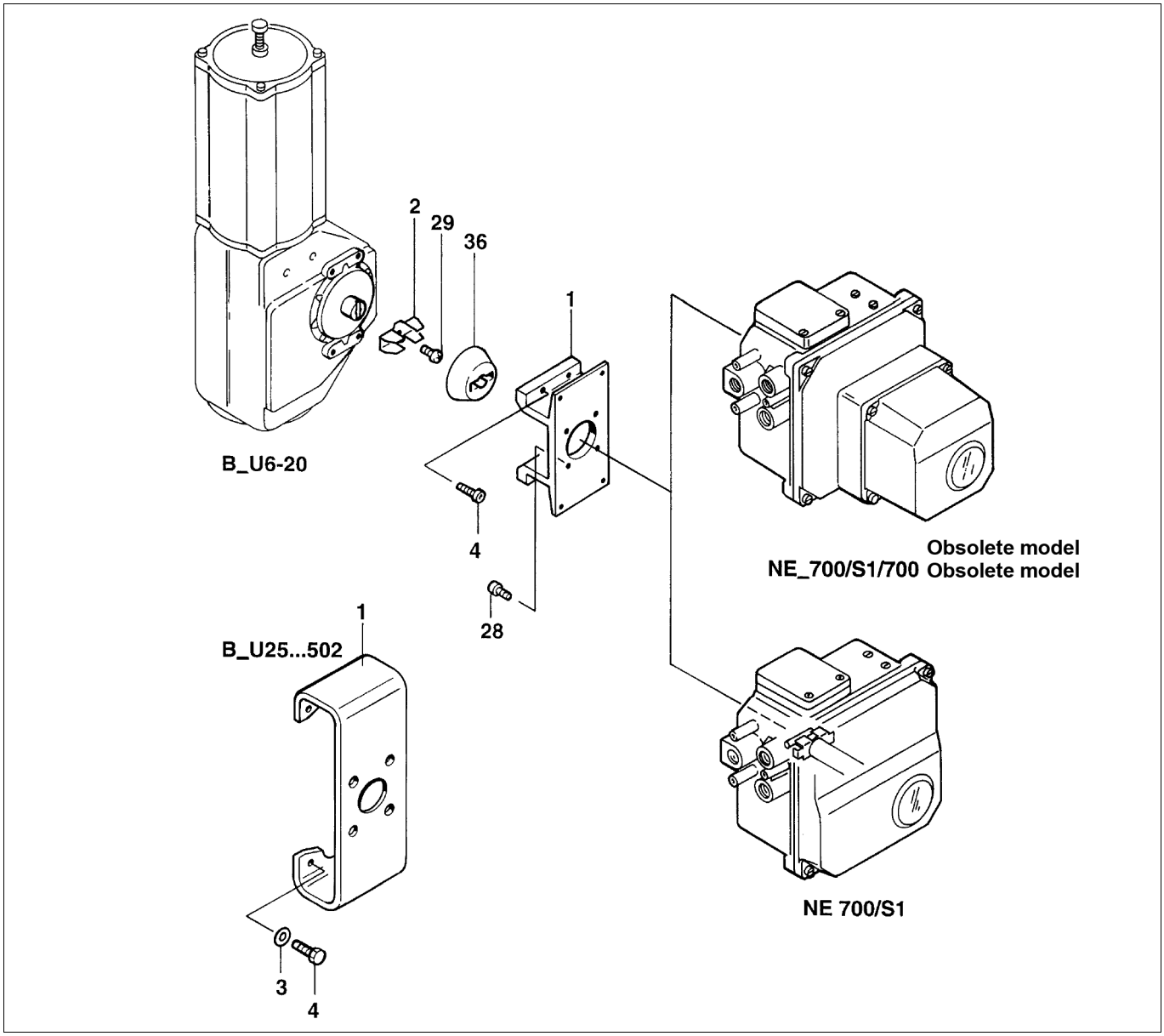


Item	Qty	Description	Spare part category
1	1	Housing assembly	
2	1	Cover assembly	2
3	1	Protective cover	
	1	Exhaust port (NE700/_G)	
4	1	Screw	
5	1	Beam assembly	
6	1	Plate	
7	2	Screw	
8	1	Lower diaphragm plate	1
9	1	Middle diaphragm plate	1
10	1	Upper diaphragm plate	
13	1	Diaphragm	1
14	1	Diaphragm	1
15	1	Screw	
16	1	Hexagon nut	
17	1	Diaphragm housing assembly	
18	1	O-ring	1
19	1	O-ring	1
20	1	O-ring	1
21	1	O-ring	1
22	1	Diaphragm cover	
23	1	Screw	
24	1	Restriction assembly	1
25	1	Screw	
26	1	Shaft assembly	3
27	1	Washer	
28	1	O-ring	1
29	1	Cam plate	
30	1	Locking wheel	
31	1	Screw	
32	1	Pointer	
33	1	Lever arm assembly	
34	1	Retaining ring	1
35	1	Terminal card assembly	3
36	2	Screw	
37	1	Force coil-nozzle assembly	3
38	2	Screw	
39	1	O-ring	1
40	1	Spring	1
41	1	Spring	1
42	1	Spring	
43	1	O-ring	1
44	1	Pilot valve assembly	2
45	1	Gasket	1
46	1	Changeover piece	
47	2	O-ring	1
48	1	Protective plate	
49	2	Hexagon nut	
50	1	Filter	
53	3	Connector	
54	1	Adapter	
55	1	Gasket	1
57	1	Grub screw	
58	1	Upper support plate	
59	2	Barrel nut	
61	1	Zero adjustment nut	
62	1	Hexagon socket plug	
64	1	Body	
65	1	Lock ring	
68	2	Spring	
69	2	Guide	
70	1	Pressure gauge block	
71	3	O-ring	
72	3	Screw	
73	1	Pressure gauge	
74	2 (1)	Pressure gauge	
76	1	Double fitting	
77	1	Filter regulator	
78	1	Reduction fitting	
79	1	Pressure gauge	
98	2	Screw	
99	2	Spring plate	
100	1	Additional plate	
101	2	O-ring	
102	1	Plug	
105	1	ID plate	
109	1	Seal	
110	4	Screw	

*) Only in positioners manufactured before 12/94

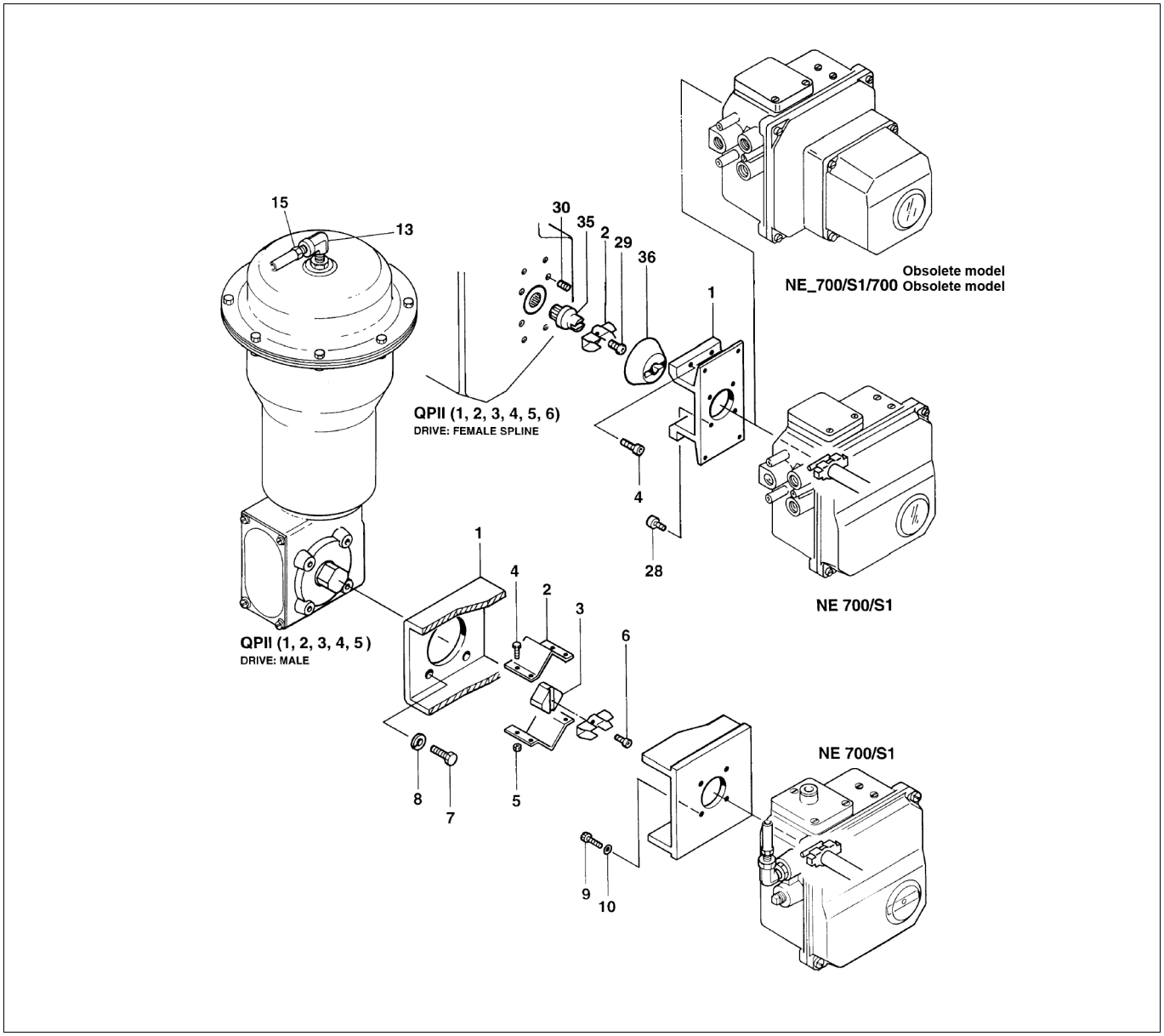
Spare part category 1: Parts for basic maintenance. Delivered as a set
Spare part category 2: Parts for spool valve and cover replacement.
Spare part category 3: Parts for shaft and force coil-nozzle replacement.

13.2 Mounting parts for B1C6-502 and B1J8-322 actuators (S1)



Item	Qty	Description
1	1	Mounting bracket
2	1	Draught piece
3	4	Washer
4	4	Screw
28	4	Screw
29	2	Screw
36	1	Coupling jacket

13.3 Mounting parts for Quadra-Powr® actuators (S1)



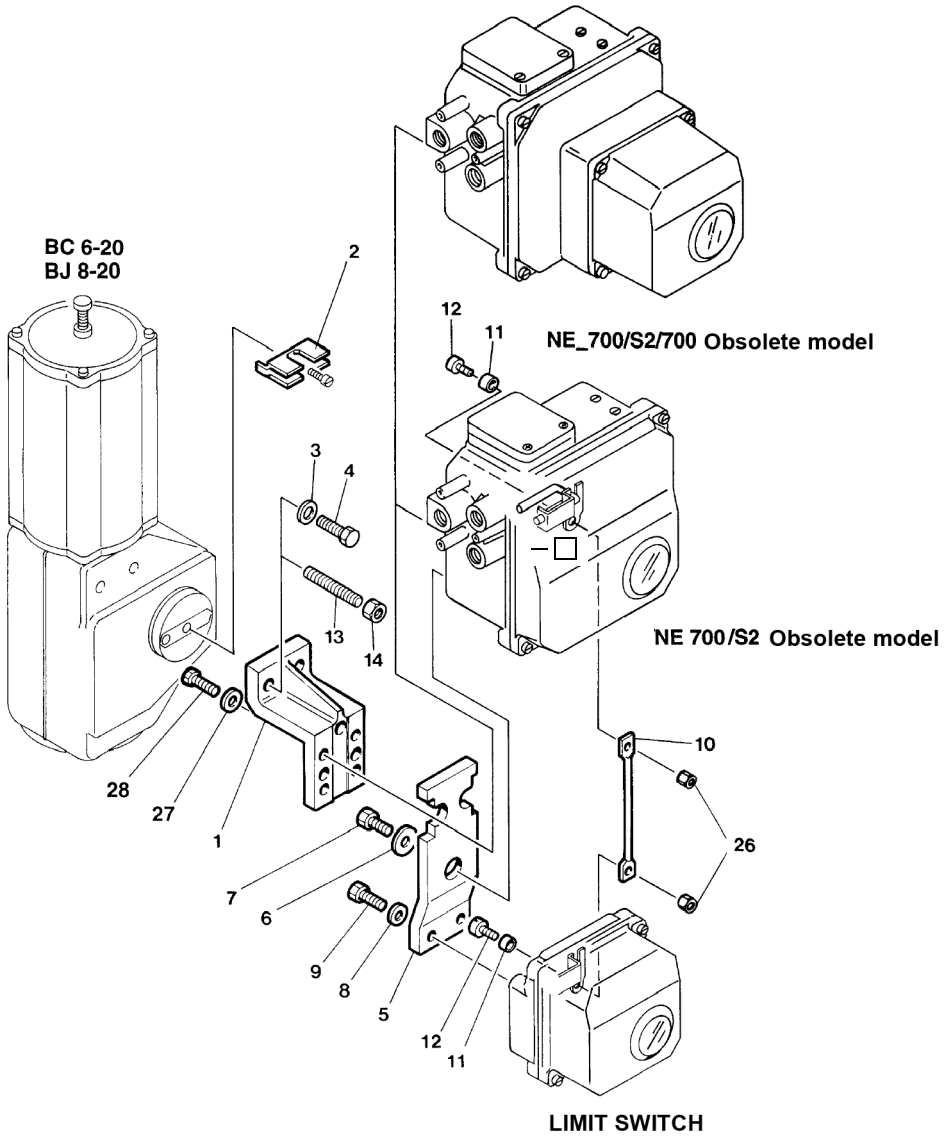
Drive: male

Item	Qty	Description
1	1	Mounting bracket
2	2	Coupling half
3	1	Adapter
4	4	Screw
5	4	Hex nut
6	1	Screw
7	4	Screw
8	4	Washer
9	4	Screw
10	4	Washer

Drive: female spline

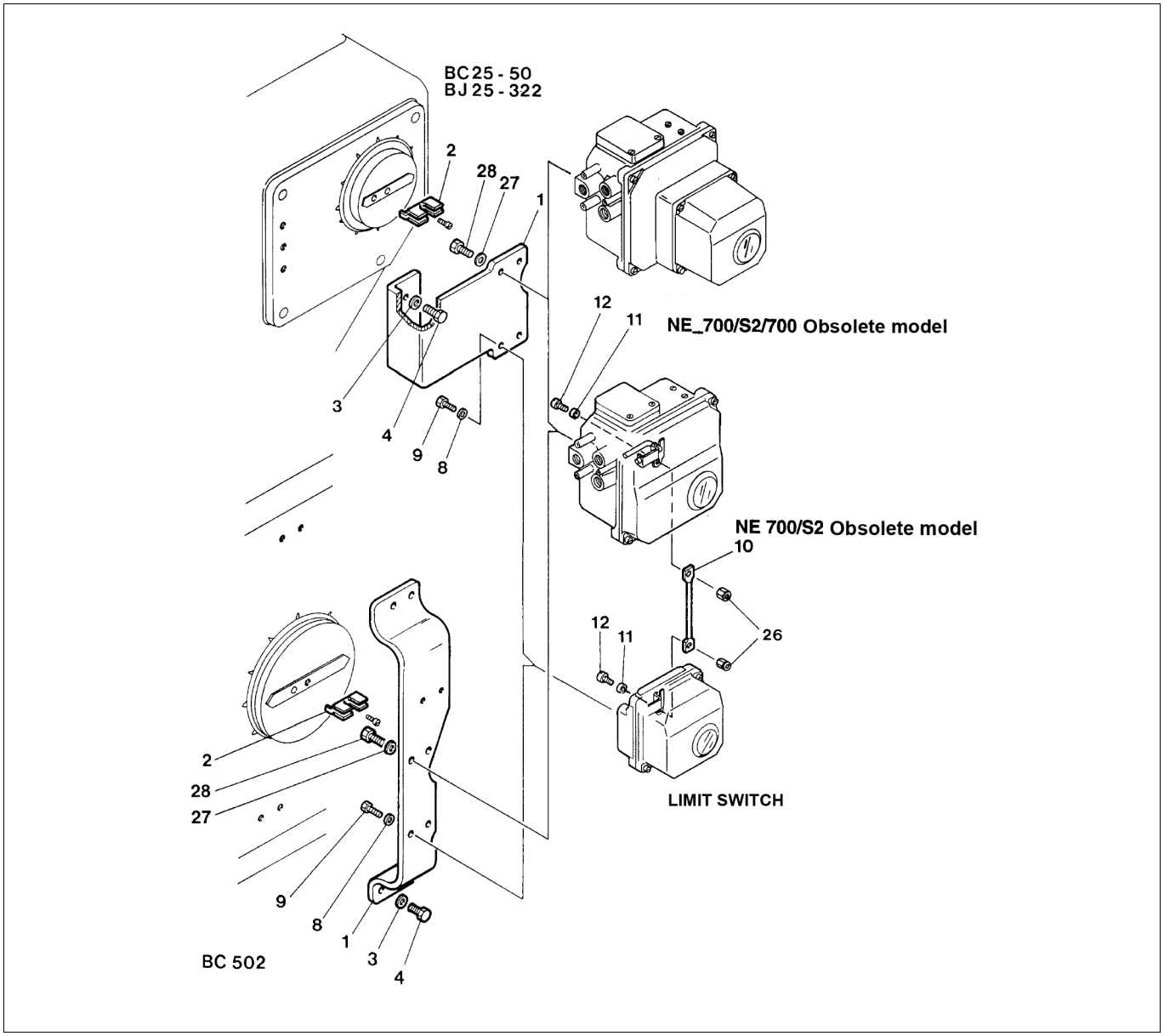
Item	Qty	Description
1	1	Mounting bracket
2	1	Ear
4	4	Screw
28	4	Screw
29	1	Screw
30	(4)	Screw
35	1	Coupling
36	1	Coupling jacket

13.4 Mounting parts for B1C6-20 and B1J8-20 actuators (S2)



Item	Qty	Description
1	1	Mounting bracket
2	1	Draught piece
3	2	Washer
4	2	Screw
5	1	Bracket
6	1	Washer
7	1	Screw
8	2	Washer
10	1	Rod
11	2	Bushing
12	2	Screw
13	2	Stud (B1C6 only)
14	2	Hexagon nut (B1C6 only)
26	2	Locking nut
27	2	Washer
28	2	Screw

13.5 Mounting parts for B1C25-502 and B1J25-322 actuators (S2)



Item	Qty	Description
1	1	Mounting bracket
2	1	Draught piece
3	2 (4)	Washer
4	2 (4)	Screw
8	2	Washer
9	2	Screw
10	1	Rod
11	2	Bushing
12	2	Screw
26	2	Locking nut
27	2	Washer
28	2	Screw

14 TYPE CODE

ELECTRO-PNEUMATIC POSITIONER NE 700

1.	2.	3.	4.	5.		6.		
NE	**7**	**2**	**6**		**/**	**S1**	**–**	**K**

1.	PRODUCT GROUP
NE	Electro-pneumatic positioner

2.	SERIES CODE

3.	INPUT SIGNAL RANGE
2	4-20 mA; 0-20 mA

4.	PILOT VALVE SIZE	CONNECTIONS S, C1, C2
4	Ø4 mm	1/4 NPT
6	Ø6 mm	1/4 NPT
7	Ø6 mm HC	3/8 NPT

5.	ACTION
	Suitable for Double and Single action, without sign.
A	Single action, linear motion. Applicable ONLY to D/R series spring diaphragm linear actuators, max. stroke size 57 mm (2-¼ in).

6.	OPTIONS
	If several options below are needed to the same positioner, the codes shall be marked in presented order from top. Temperature range for various options shall be considered carefully.
-	Standard, IP 54 enclosure, PG11 conduit entry. S1 always to be defiened. Temperature range -25° to +85 °C / -13° to +185 °F.
R	Water and dustproof enclosure IP65 / NEMA 4 and 4X.
W	Better vibration resistance. Special flexure pivot and diamond coated pilot. Not available with option U.
H	High temperature construction. Viton diaphragms and seals. Temperature range -10° to +120 °C/ +14° to +248 °F. Not available with options U, A,P and K.
S1	Positioner with attachment face acc. to standard VDI/VDE 3845, equipped with an H-clip. When the units are separate deliveries,VDI/VDE ear is supplied. Not applicable to globe valve actuators (5th sign A).
J30	Square shaft and special mounting kit.
A	Pressure gauges, scale bar/psi/kPa, basic material brass, nickel plated, housing stainless steel, glycerine filled. 5th sign always to be defined. Temperature range -25° to +70 °C/ -13° to +158 °F.
Y	Special construction.

-□	EXTERNAL CONNECTION PARTS
K	Filter regulator for supply air type BELLOFRAM 51FR. Pressure gauge, scale bar/psi/kPa, basic material brass, nickel plated, housing stainless steel, glycerine filled. Temperature range -18 °C - +52 °C / -10 °F - +125 °F. Filter size 5 µm. Not available with HC-pilot (4th sign 7) Specified in the option sticker. In connection with the Ø6 HC-pilot valve (4th sign 7), must be used large capacity filter regulator (not K) for actuator bigger than B1C 40 and B1J 32. Installation with mounting bracket.
L	PG11 / 1/2 NPT conduit entry. Specified in the option sticker.
I	PG 11 / M20x1,5 conduit entry. Specified in the option sticker.
Nj	PG11 / R1/2 (PF1/2) conduit entry. Specified in the option sticker.

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