von Rohr
Armaturen AG

Operating and maintenance manual Series MA-Actuator

Original operating manual

Table of contents

1 General data

This operating manual contains instructions that enable the product to be safely and properly installed, put into operation and maintained.
The target group for this operating manual is exclusively specially trained and authorised technical personnel.
Please contact the manufacturer if you encounter problems that cannot be solved with the aid of this operating manual
The product is subject to technical changes at any time.

1.1 Contact details

Further information about the product can be obtained from:

Manufacturer's address

von Rohr Armaturen AG
Fichtenhagstrasse 4
CH - 4132 Muttenz
Tel.: +41 (0)61 467 91 20
Fax: +41 (0)61 467 91 21
E-Mail: info@von-rohr.ch
Web: www.von-rohr.ch

1.2 Other applicable documents

The product can be delivered as part of an actuator and equipped with additional components that are described in their own operating manuals. The instructions as well as the warning and safety information contained therein must also be observed.

1.3 Place of storage of manual

The operating manual and all other applicable documents are part of the product. They must be kept in the immediate vicinity of the product and must be accessible to the personnel at all times.

2 Safety

2.1 General safety information

The operating manual contains detailed descriptions for the safe installation, commissioning and maintenance of the product.

- Read this operating manual attentively in its entirety in order to familiarise yourself with the product.
- Particular attention must be paid to the information in this chapter.

2.2 Symbols and notices

Safety and warning instructions are intended to avoid hazards to the life or health of operating or maintenance personnel, and to avoid material damage. They are highlighted by the use of the signal terms defined herein. In addition, the warning symbols (pictograms) are marked where they appear. The signal terms used have the following meanings:

⚠ DANGER

means that death, serious injuries and/or considerable damage to property will occur if the corresponding preventive measures are not taken and maintained.

⚠ WARNING

means that death, serious injuries and/or considerable damage to property can occur if the corresponding preventive measures are not taken and maintained.

⚠ CAUTION

means that minor injuries and/or damage to property can occur if the corresponding preventive measures are not taken and maintained.

NOTICE

Indicates important information about the product itself or the handling of the product, to which special attention should be paid.

2.3 Structure of warning notices

Section-related warning notice

Section-related warning notices refer to the entire chapter, sections or several paragraphs within this operating manual. Section-related warning notices are structured as follows:

⚠ DANGER

Type and source of the danger

Possible consequences of disregard

► Measures to avoid the danger

► Further measures

Embedded warning notice

Embedded warning notices refer to a certain area within a section. They apply to smaller information units than the section-related warning notices. Embedded warning notices are structured as follows:

⚠DANGER! Instructions to avoid dangerous situations.

2.4 Intended use

The product complies with laws, regulations and standards valid at the time of delivery.

The product does not pose a danger to people, property or environment if it is used for its intended purpose and the warning notices contained in this operating manual and attached to the product are observed. This applies to the entire lifetime, from delivery, over assembly and operation to the disassembly and disposal.

The following shall be regarded as the intended use:

- Operate the product exclusively in accordance with this operating manual and in accordance with the specification in the order confirmation and the device pass.
- Use exclusively original von Rohr spare parts for the maintenance of the product

⚠ DANGER

Risk of death and serious injuries as well as damage to property and the environment!

Risk of death and serious injuries as well as damage to property and the environment due to hazardous operating media, high temperatures and pressures as well as moving parts.

► it is imperative to comply with the following requirements and conditions.

► Observe warning notices.

Maintenance

Ensure or observe the following before performing any maintenance work:

- Depressurise the actuator and the mounted valve.
- If necessary, cool down or warm up the drive to ambient temperature.
- If applicable, disconnect electrical connections.
- The actuator springs are fitted with high pre-load, disassembly instructions according to chapter *[11.9 Diaphragm]* must be followed.
- Exclude commissioning of the system by third parties.

Explicit reference is made to the need to comply with the regulations for potentially explosive atmospheres, if applicable.
See also chapter *[2.6. Use in potentially explosive atmospheres]*

Limits of use

Operate the actuator only within the following limits of use.

Max. operating temperature [bar]	Min. operating temperature [°C]	Max. operating temperature [°C]
6	-20 / Low temperature version -40	+80

2.5 Inappropriate use

Inappropriate use is use of the product other than as described in the chapter entitled *[2.4 intended use]*.

In addition, the following applies:

- Unauthorised modifications to the product can lead to injuries, damage to property and malfunctions. The user alone bears the risk for this. Warranty and liability claims are excluded.

2.6 Use in potentially explosive atmospheres

The product can be used in explosion group IIB if the layer thickness including special paint and stickers is less than 2 mm. If the total value is less than 0.2 mm, the product can be used in explosion group IIC. The temperature class depends on the order and can vary from T5 to T6.

⚠DANGER! Only use the actuator in the explosion group defined on the type plate! If there is no indication, the actuator cannot be used in a potentially explosive atmosphere!

⚠ WARNING

Inappropriate product for potentially explosive atmospheres area

Risk of explosion!

- ► Only use products that are approved for use in Ex areas and labelled accordingly.
- ► Make sure that the product is appropriate for the intended use.

⚠ WARNING

Unauthorised accessories and spare parts

Explosion hazard or product damage!

- ► Make sure to use only original accessories and/or original spare parts.
- ► Comply with all relevant installation and safety instructions specified in the manuals for the product, accessories and spare parts.

⚠ WARNING

Exceeding the maximum environment or media temperature

Explosion hazard due to increased surface temperature!

If the maximum permissible environment or media temperature is exceeded, the temperature class of the product is no longer valid!

- ► Make sure the maximum permissible environment or media temperature of the product is not exceeded.

⚠ WARNING

Contaminated operating medium

Danger of explosion due to clogging and damage to the product due to fine dust or solids!

- ► Install a filter
- ► Clean the filter after 100,000 operating cycles, at least 2x a year or as required.

⚠ WARNING

Thermal radiation

Risk of explosion due to increased surface temperature as a result of heat radiation from additionally mounted components!

- ► Ensure that the max. permissible surface temperature is not exceeded.
- ► If necessary, insulate or uncouple attached products with increased heat radiation.

The temperature class of the drive depends on the maximum ambient temperature:

Temperature class of the drive	Maximal permissible ambient temperature
T6 *(suitable for gases and vapours of temperature classes T6, T5, T4, T3, T2 or T1)*	68°C
T5 (suitable for gases and vapours of temperature classes T5, T4, T3, T2 or T1)	80°C

⚠ WARNING

Dust deposits

Explosion hazard due to increased product temperature as a result of dust deposits!

- ► Remove dust deposits regularly.
- ► Do not use any operating materials, e.g., cleaning agents, that are not suitable for Atex.
- ► Avoid static charging of the surface, remove dust deposits properly without rubbing the surface.
- ► Use only damp cloths for cleaning.

⚠ WARNING

Damaged surface coating

Risk of explosion due to damage to the surface coating in connection with corrosion and aluminium!

- ► Ensure that the surface coating is not damaged and no corrosion exists.

⚠ WARNING

Exceeding the layer thickness of the surface coating

Explosion hazard due to static charge of the electrically non-conductive surface coating!

- ► In the case of overcoating, ensure that the surface coating does not exceed a total layer thickness of 2 mm for IIB and 0.2 mm for IIC.
- ► Ensure that only suitable stickers are used.

⚠ WARNING

External impact

Danger of explosion due to sparks following impact!

- ► Avoid external impact to the product.

⚠ WARNING

Disassembly of the product

Risk of explosion due to ingress of explosive atmosphere!

- ► The product should only be opened if it is proven that there is no explosive atmosphere in the environment of the product
- ► If this is not possible, move the product into an ex-free zone.

⚠ WARNING

Non-conductive materials for piping work

Explosion hazard due to potential differences when using non-conductive materials!

- ► When using non-conductive materials for piping or sealing, make sure that they are conductively bridged.
- ► Only use damp cloths when cleaning.
- ► Hoses must be mounted as tightly as possible and may not be wound up.

⚠ WARNING

Non-conductive lubricants

Explosion hazard due to potential differences when using non-conductive lubricants!

- ► Make sure to only use electrically conductive lubricants to lubricate the components.
- ► Only use lubricants with an ignition temperature or flash point of >130°C

⚠ WARNING

Exceeding the max. surface temperature at bearing points

Danger of explosion due to increased surface temperature in the event of insufficient lubrication and dust deposits at the bearing points!

- ► Make sure that the max. permissible surface temperature is not exceeded and adjust the switch frequency accordingly.
- ► A check of the lubrication and dust deposits at the load points must be carried out after 100,000 switching cycles, at least twice a year or as required.

2.7 Remaining risks

⚠ DANGER

Risk of serious injury, environmental damage

Bruising, hearing loss, burnings, environmental damage

► Secure actuator

► Wear protective clothing according to chapter *[2.10 Personal protective equipment]*

► Notes on safety and commissioning

► Refer to operating instructions

There may still be residual risks even if the product is used for its intended purpose.

- Danger of being crushed by unsecured actuators

In case of negligent use of personal protective equipment:

- Danger due to noise resulting in hearing loss
- Thermal hazards (incineration, scalding, etc.)
- Danger due to escape of the operating medium

Furthermore, there may be unapparent residual risks despite all precautions taken

Residual risks can be minimised if the notes of safety and commissioning as well as the operating manual as a whole are observed.

2.8 Qualification of personnel

The product is exclusively intended for use in plants and installations in which trained technical personnel carry out the necessary work. Technical personnel are persons who are entrusted with the installation, commissioning and operation of this product and who have the appropriate qualifications for their work activities, such as, for example:

- Training or instruction in accordance with current technical safety standards in the maintenance and usage of appropriate safety equipment.
- Training in First Aid.
- In the case of systems with explosion protection: training or instruction and authorisation to carry out work on potentially explosive systems.

Repair work may be carried out only by trained and qualified technical personnel.

Work on electrical equipment may be carried out only by trained electricians or persons who have received electrotechnical instructions.

Persons Activity	Instructed persons	Persons with a recognised technical education	Persons with a recognised electro-technical education	Superiors with relevant skills	von Rohr Service-technician
Transport	X	X	X	X	X
Installation	X	X	X	X	X
Commissioning		X	X	X	X
Maintenance	X	X	X	X	X
Troubleshooting		X	X	X	X
Mechanical troubleshooting		X			X
Electrical trouble-shooting			X		X
Repairs		X	X	X	X
Disposal	X	X	X	X	X

2.9 Operator's duty of care

To avoid accidents, malfunctions and environmental impacts, the respective person responsible for the transport, commissioning, operation, maintenance and disposal of the product must ensure the following:

- Observation of all warning and danger notices.
- Regular instruction of personnel in all applicable questions of work safety, the operating manual and in particular the safety instruction.
- Keep regulations and operating instructions for safe working and the corresponding instructions for the behaviour in case of accidents and fire handy at all times. If necessary, display them on the notice board at the operating site.
- Operate the product only if it is in perfect working order.
- Use only spare parts, lubricants and operating resources approved by the manufacturer.
- Observe the specified operating conditions and requirements at the place of installation.
- Provide all necessary devices and the personal protective equipment required for the respective task.
- Refer to the chapter entitled *[10.2 Maintenance]* for the prescribed maintenance intervals and comply with the corresponding regulations.
- Allow installation, commissioning and maintenance of the product to be carried out only by qualified and trained personnel in accordance with this operating manual and not by third parties.
- The operator must ensure that the product is used for its intended purpose.
- Before commissioning the product, the operator must carry out a risk assessment and define appropriate inspection and maintenance intervals according to the operating conditions.

2.10 Personal protective equipment

Personal protective equipment must be worn during work in order to minimise health risks.

- During work, always wear the protective equipment necessary for the respective work.
- Follow the notices about personal protective equipment displayed in the working area.

Basic equipment	
	**Protective clothing** Tight-fitting work clothes with a low tear resistance, with narrow sleeves and without protruding parts. They primarily serve to protect against being caught up by moving machine parts. Do not wear rings, chains or other jewellery.
	**Safety shoes** To protect against heavy falling parts and slipping on smooth floors.

Additional equipment	**Clothing appropriate to the environment must be ensured at all times. The following additional protective equipment may be necessary.**
	**Safety glasses** To protect the eyes against flying parts and splashes of liquids.
	**Helmet** To protect against falling and flying parts and materials.
	**Hearing protection** To protect against hearing damage.

3 Transport, storage and packaging

3.1 Transport

⚠ WARNING

Tipping or falling load!

Danger of death and danger of damage to property due to load tipping over or falling!

- ► Only suitable and approved means of transport and lifting equipment may be used for transporting the product.
- ► Lifting equipment must generally be attached to the housing of the product, not to attachments.
- ► Allow only instructed persons to select and attach the lifting equipment.
- ► Do not stand under suspended loads.

- ► Transport at temperatures below -40°C or above +80°C is not permitted.
- ► Attachment points on actuators (lifting eyes, eyebolts, etc.) are only dimensioned for the transport of the actuator and are available on customer request. Under no circumstances may these attachment points be used if the actuator is coupled to a valve.

3.2 Storage

NOTICE

Improper storage!

If stored improperly, there is a risk of the product and in particular the attached electronic accessories no longer functioning if stored improperly.

- ► Storage at temperatures below -40°C or above +80°C is not permitted.
- ► Product must be stored in roofed-over and weather-proof storage places.

To protect against contamination and to protect the sealing surfaces, openings such as nozzles, flanges, etc. must be sealed using suitable means. These should be removed by technical personnel upon installation.

3.3 Packaging

The product is packed inside its outer packaging (cardboard box, wooden crate, pallet, lattice box).

For transport of the product by ship, plane, train or lorry, the product must be packed weatherproof or seaworthy.

4 Name plate

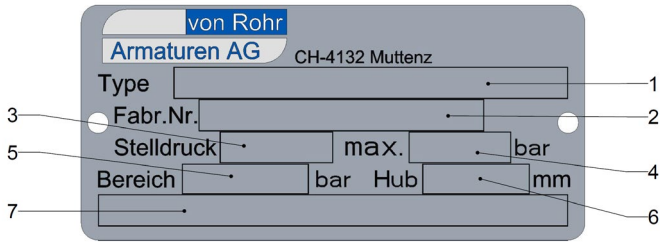

Illustration 1: Standard Name plate

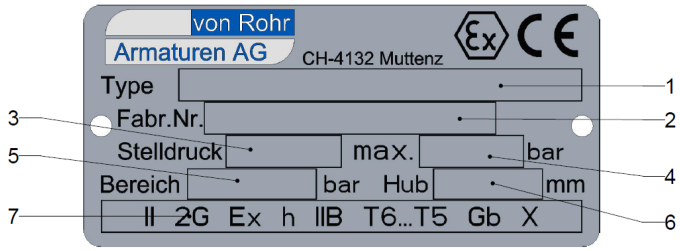

Illustration 2: Name plate IIB

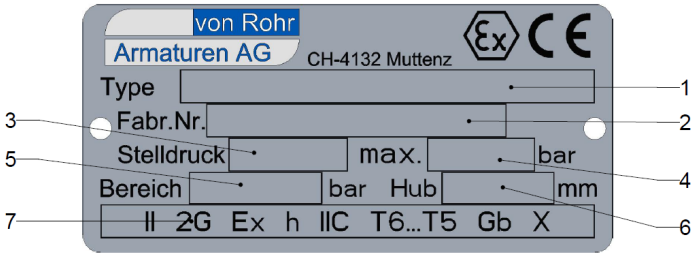

Illustration 3: Name plate IIC

Place of installation

The name plate is attached to the top cover of the drive unit.

1	Type designation
2	Serial number
3	Minimum signal pressure
4	Maximum signal pressure
5	Range of signal pressure
6	Hub
7	Atex type code (depending on version)

Example for *7 Atex type code see page* 16.

ATEX Type key:

Devices with surface coatings thinner than 0.2 mm:

II 2G Ex h IIC T6…T5 Gb X
-40 °C < T_a < +68 °C…+80 °C

Devices with surface coatings thinner than 0.2 mm

II 2G Ex h IIB T6…T5 Gb X
-40 °C < T_a < +68 °C…+80 °C

Explanation of the labelling:

Equipment Group II =	Non-mining
Device category 2G =	Devices that ensure a high level of safety suitable for zone 1
G =	explosive atmosphere generated by gases, vapours or mists
Ex h =	Non-electrical explosion protection
IIB =	Gases, vapours or mists of explosion group IIC (includes IIA)
IIC =	Gases, vapours or mists of explosion group IIC (includes IIA and IIB)
T6…T5 =	Temperature class of the drives, depending on the surrounding temperature
Gb =	Equipment protection level EPL, analogue to equipment category
-40°C < Ta < +68°C…+80°C =	Permitted ambient temperature from -40°C to +68°C resp. from -40°C to +80°C
X =	For the safe use of the units, special conditions are applicable. The conditions are listed in the operating instructions.

5 Type key

MA	9	HB.1	H23.1	.	21	A	6	4	S	Po	A	SB	S..
[1]	[2]	[3]	[4]		[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]

1. Reversible diaphragm actuator

2. Series

3. Stroke limitation (option)

4. Manual emergency override (option)

5. Actuator diameter in cm

6. Stroke

7. Maximum permissible actuating pressure in bar

8. Quantity of springs

9. Spring colour

10. Operating direction

11. Material

12. Use in potentially explosive atmospheres

13. Special version (S)

Example of type designation

MA9.21A6 3R Po

Reversible Diaphragm actuator – Series 9 – Actuator diameter 21 cm – Stroke A max. 25 mm – max. actuating pressure 6 bar – Amount of springs 3 – Spring colour red – Spindle extended in case of air failure

6 Sectional drawings

Some versions of the actuator are illustrated below. Further versions are possible by combining the different components.

Connections

for R see *[9.2 Actuating signal connection]*

6.1 Parts list

Standard		
1		Bottom part
3		Spring centring plate
4		Sheet metal screw
6	*	Complete lead-through (7, 8 ,9 ,10 ,11)
7	*	Lead-through
8	*	Lead-through camp
9	*	O-ring
10	*	O-ring
11	*	Ring
13		Retaining washer
15	*	O-ring
16		Pillar
17		Complete Diaphragm (18, 19, 20, 21, 22, 24, 32)
18		Spindle
19	*	Stem ring half
20		Compression plate
21	*	O-ring
22	*	Diaphragm
24		Diaphragm plate
31	*	Washer
32	*	Hex nut
35	*	Compression spring
44		Upper part
50		Lid
51	*	O-ring
52	*	Hexagon head screws
64	*	Hexagon head screws
65	*	Washer
66	*	Hex nut
67		Bellows
68	*	Hex nut
69		Clutch
71		Stroke scale
75		Ventilation screw
76	*	Hex nut
77	*	Hexagon head screws

79	*	Hex nut
80		Name plate
81		Round head grooved nail
82		Warning sign

HB: Hubbegrenzung		
50		Upper part
51		Screw
52	*	O-ring
60	*	Sealing nut with corrosion protection
61	*	Hexagon head screw

H23: Handnotbetätigung		
17		Complete Diaphragm (18, 19, 20, 21, 22, 24, 32)
64		Hex nut
101		Upper part
102		Coupling nut
103		Hexagon socket head screw
104	*	O-ring
105		Cylinder
106	*	Hex screw
107		Spindle nut
108		Thrust washer
109		Spindle
110	*	O-ring
111		Lid
112	*	O-ring
113	*	Bearing
114		Safety chain
115	*	Washer
116	*	Hex nut
117	*	Hex nut
118		Handwheel
119		Disc
120	*	Hex nut
121		Key
122		Carabiner

* = recommended spare part / wear part

6.2 MA***Po

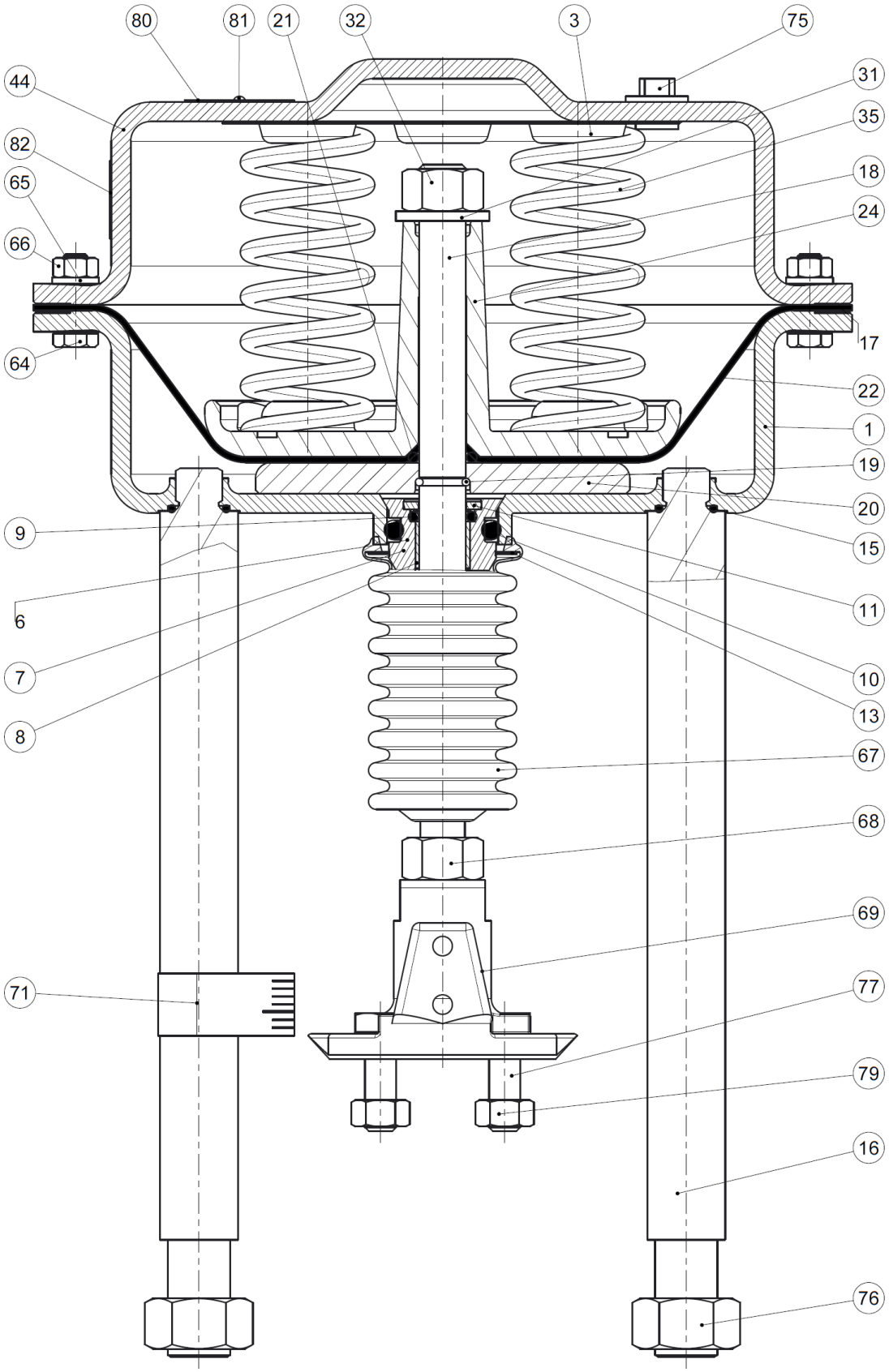

*Illustration 4: MA***Po*

6.3 MA***Ps

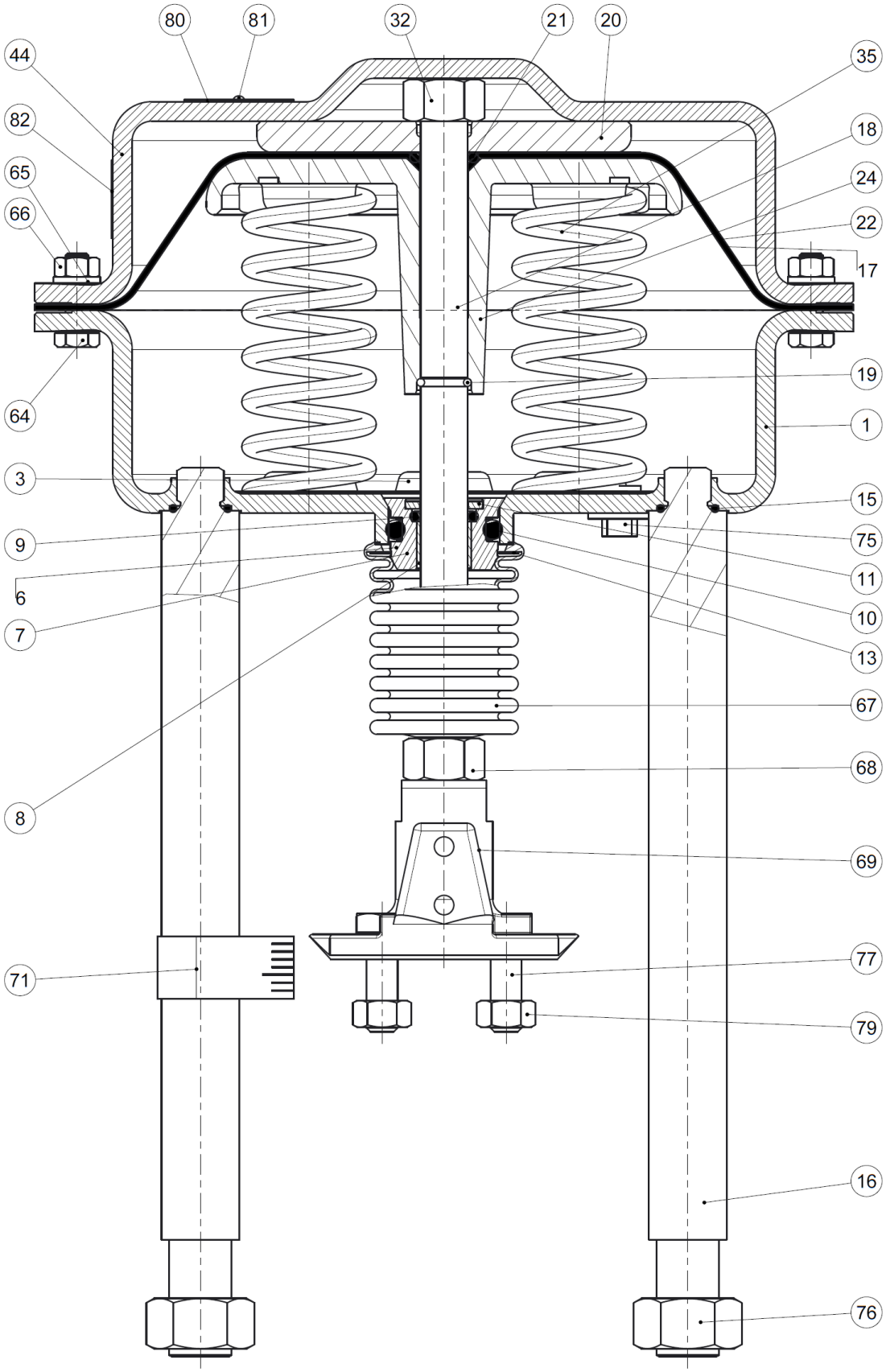

*Illustration 5: MA***Ps*

6.4 MA***HB***Po

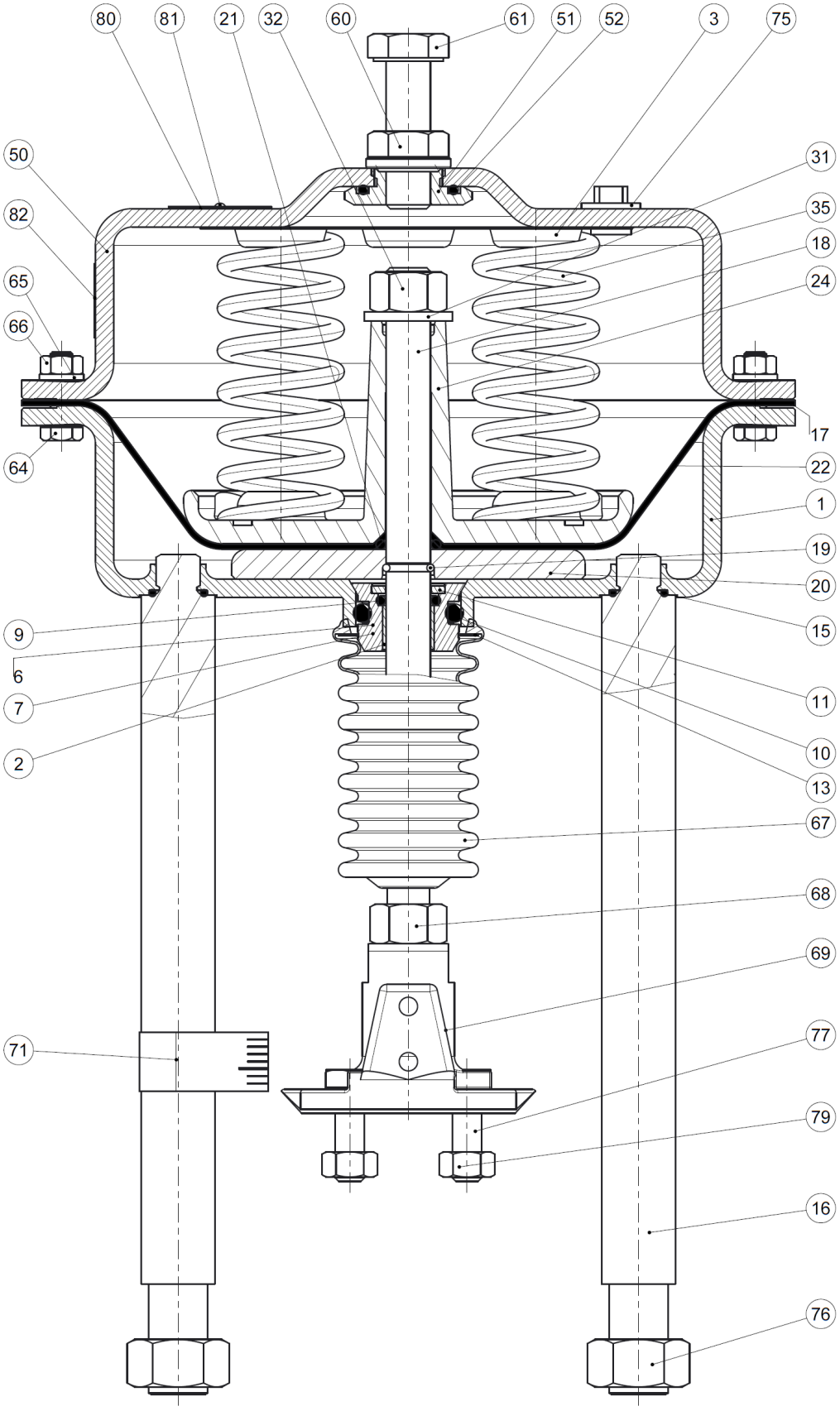

*Illustration 6: MA***HB***Po*

6.5 MA***HB***Ps

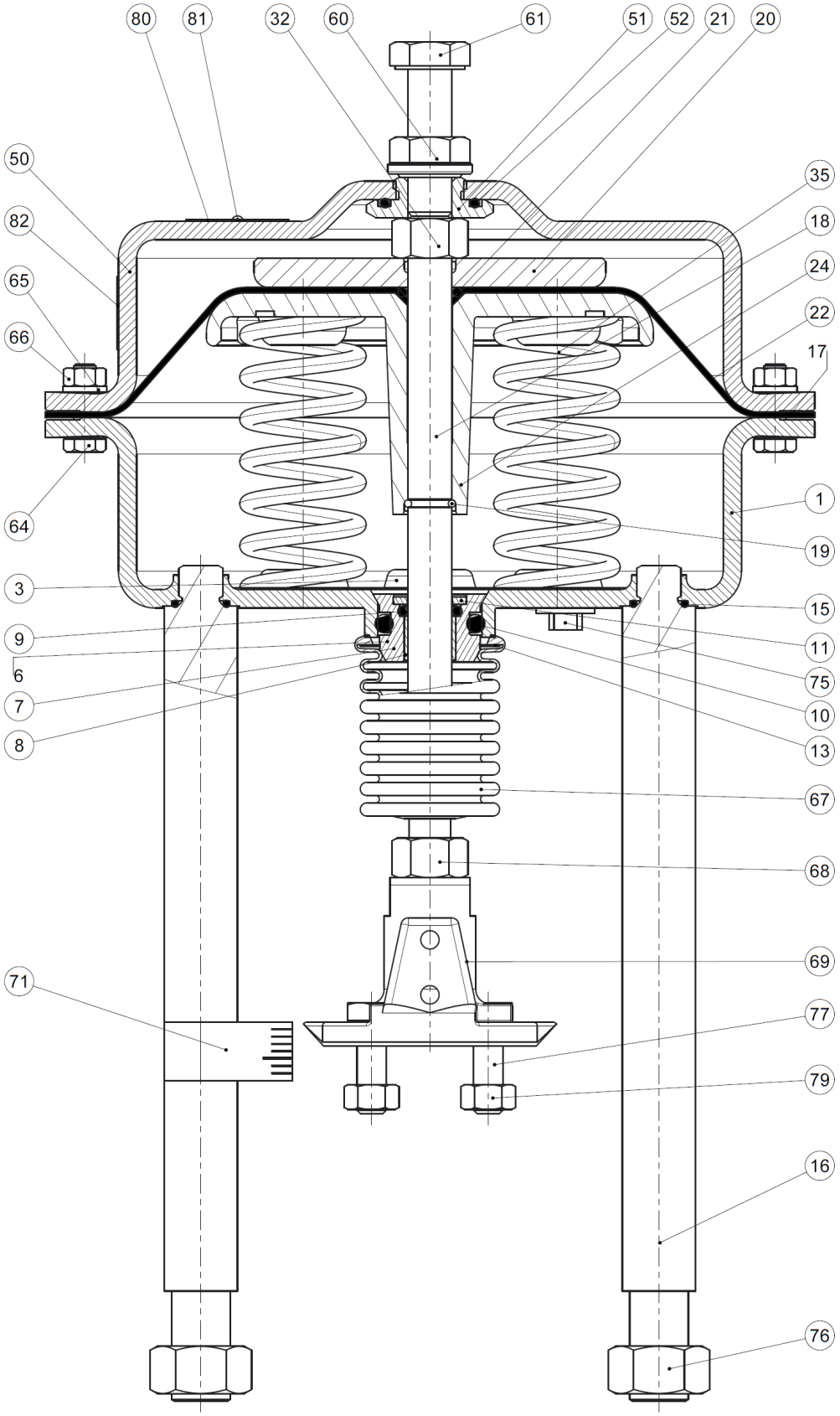

*Illustration 7: MA***HB***Ps*

6.6 MA***H23***Po

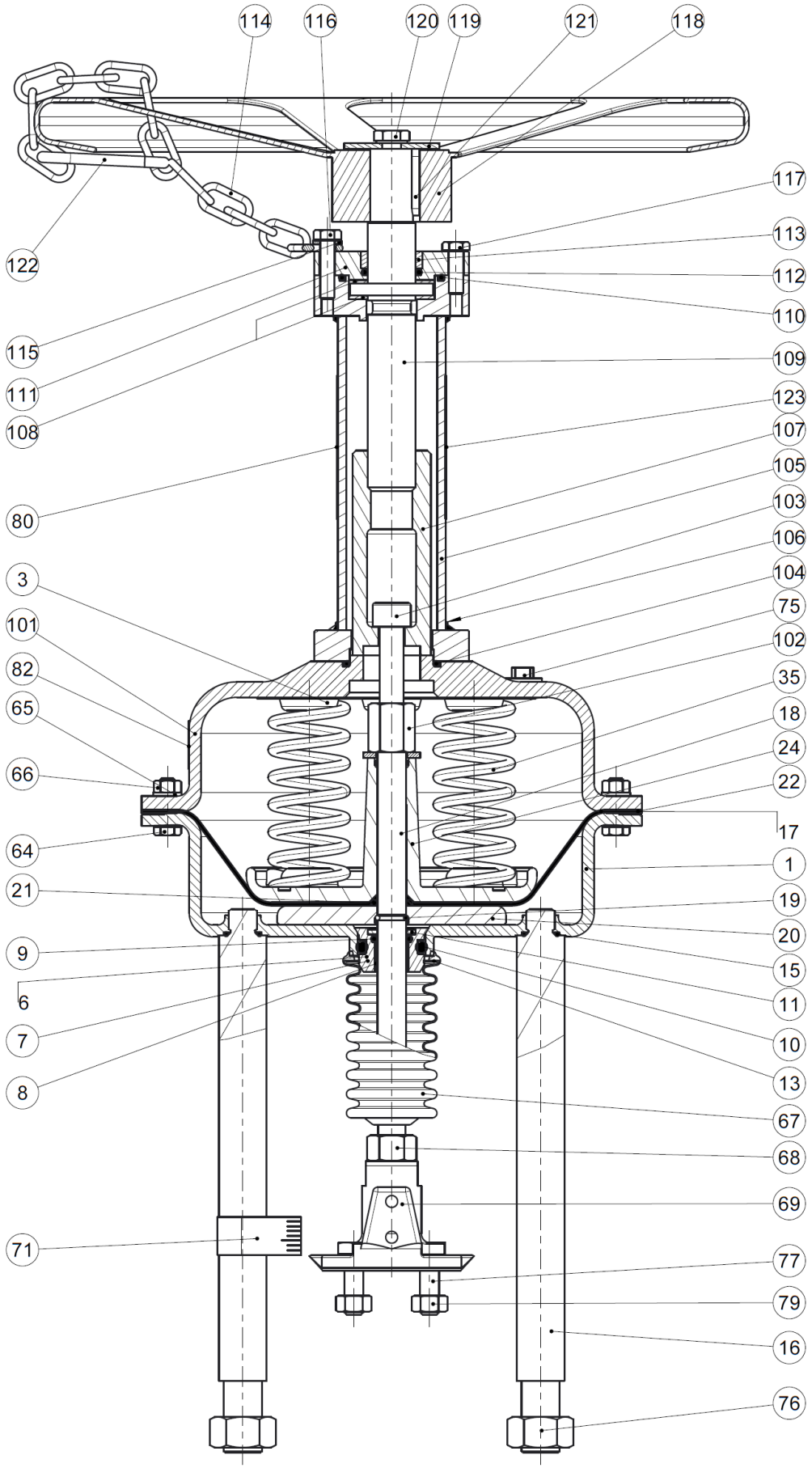

*Illustration 8: MA***H23***Po*

6.7 MA***H23***Ps

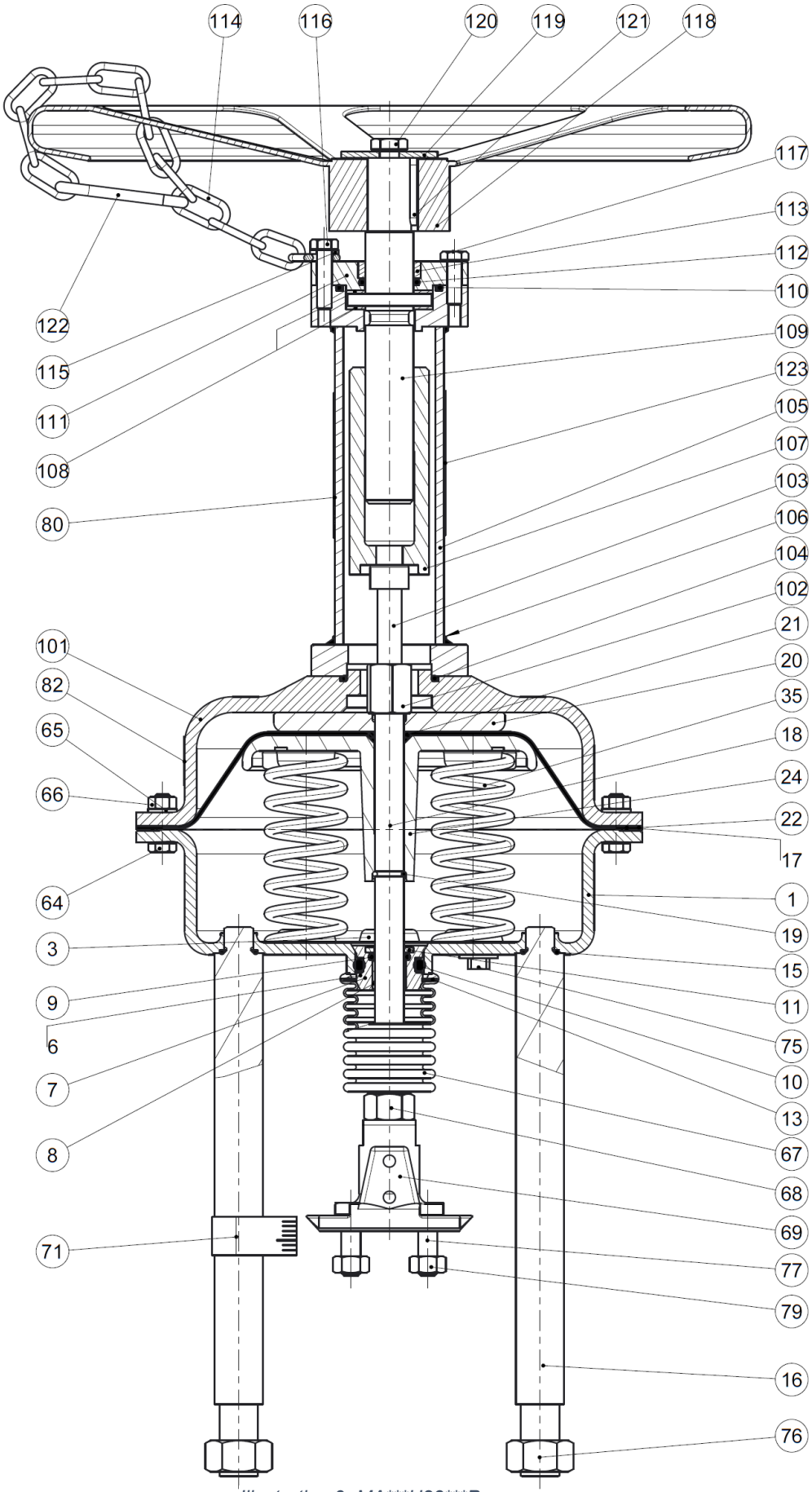

*Illustration 9: MA***H23***Ps*

7 Functional description

The MA series has been developed as a diaphragm actuator for lifting valves The centrally arranged spindle (18) is coupled to the actuating spindle of the fitting by means of a coupling.

The spindle is guided completely (6) via a lead-through and the air-loaded pressure chamber is sealed via an O-ring (21). Connected to the spindle (18) is a diaphragm plate (24) which supports the diaphragm (22) and transmits its movement to the spindle (18The diaphragm (22) divides the actuator housing (lower part 1, upper part 44 / 50 / 101) into pressure and spring chambers. The spindle (18) moves when the force of the air pressure control signal on one side of the diaphragm (22) exceeds or falls below the force of the compression springs (35).

To avoid over- or under pressure in the spring chamber, it is ventilated and vented via a ventilation screw (75).

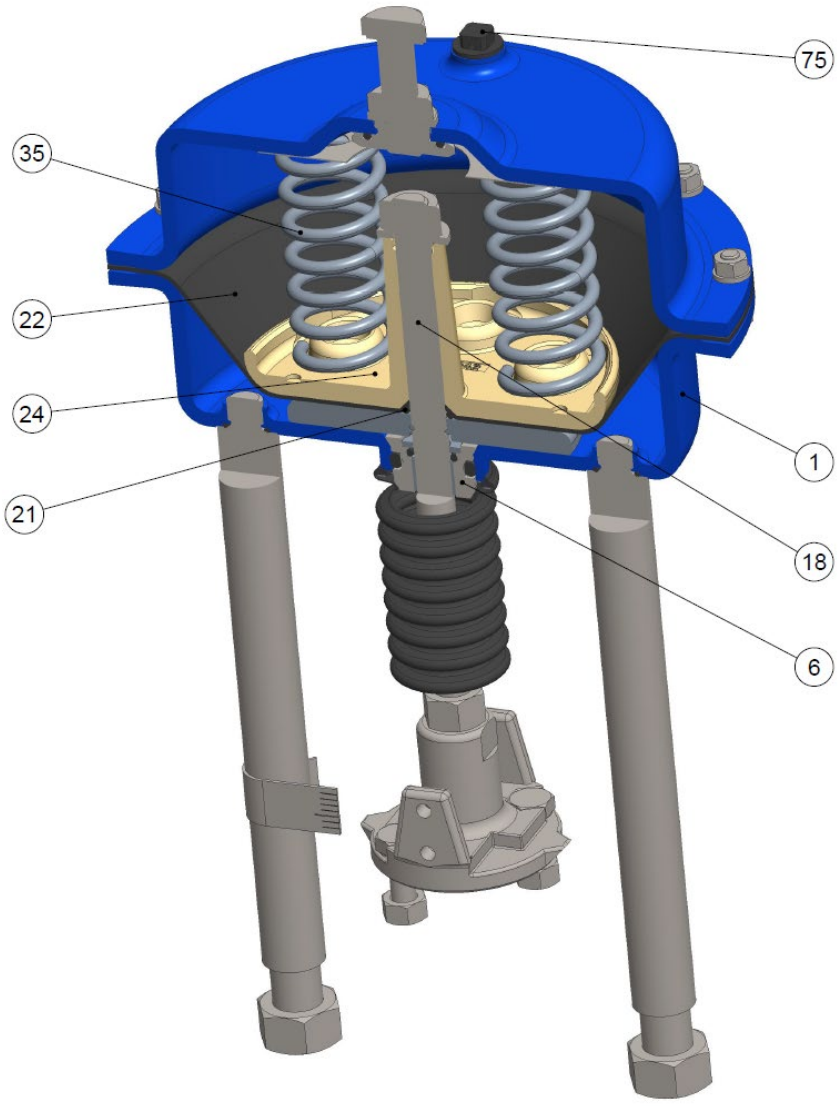

Illustration 10: Sectional view

8 Installation

Place of installation

The drive should be easily accessible from at least one side and from above.

In case of installation at height, include a stage or similar in the planning.

Use lifting equipment as required.

Installation

The crossbeam (valve component) has a central bore that allows drive rotation in any of four directions. Fastening to the fitting is done with stud bolts and hexagon nut. The actuator and the valve are coupled via the coupling* (69).

** Delivery upon request*

Installation position

Please note:

⚠ CAUTION

Installation position

- ▶ Pipeline must be horizontal
- ▶ Actuator upwards

For other installation positions, consult the manufacturer!

Grounding

The operator must ensure adequate, correct potential equalisation (earthing). Recommendation of earthing via mounting.

Lightning rod

The operator must provide a lightning rod in the outdoor area. Recommendation of earthing via mounting.

9 Commissioning

Exclude commissioning by third parties!

9.1 Adjustment

Stroke adjustment

⚠ CAUTION! Shear forces must not be transmitted to the actuator stem (18) when coupling actuator and valve.

⚠ CAUTION! Do not turn the stem (18) in a radial direction.

NOTICE! Adjust the stroke so that the closing or opening function is guaranteed.

9.1.1 With mounted stroke limiter (HB)

The actuator can be limited in its upper or lower end position by means of a hexagon head screw (61). See chapter *[6.4 MA***HB***Po]* and *[6.5 MA***HB***Ps]*

- Depressurize drive
- Loosen sealing nut (60)
- Adjust end position with hexagon head screw (61)
- Lock hexagon head screw (61) with sealing nut (60)

9.1.2 With mounted manual override (H23)

With the manual override, the actuator can be operated within its stroke range without a control signal being applied. See chapter *[6.6 MA***H23***Po*] and *[6.7 MA***H23***Ps].*

- Detach the carabiner (122) from the safety chain (114).
- Operate handwheel (118)
- After use, return the safety chain (114) through the handwheel (118) and secure with the carabiner (122).

NOTICE! To move the actuator with the control signal over the entire stroke range, the manual override must be returned into the neutral position.

NOTICE! One turn with the handwheel corresponds to a stroke movement of 3 mm in one direction.

PO Spindle extended without pressure

The neutral position can be reached by turning the handwheel (118) clockwise as far as it will go.

PS Spindle drawn in without pressure

The neutral position can be reached by turning the handwheel (118) counter clockwise as far as it will go.

9.2 Actuating signal connection

Air quality

⚠ **CAUTION!** Ensure correct air quality!

Oil-free, instrument-quality air with no water or dust, solid material content max. 1 mg/m³ (standard atmospheric conditions), max. particle size 0.1 mm, oil content max. 1 mg/m³ (standard atmospheric conditions), pressurised dew point 20 K below the lowest ambient temperature.

When working on the compressed air system ensure that any contamination present such as water, oil, chips, soldering material residues, etc. are expelled by blowing out.

Air connection

The actuator has air connections(R) with an internal thread.

Drive size	Connection R
MA16	G ¼“
MA21	G ¼“
MA31	G ¼“
MA41	G ¼“

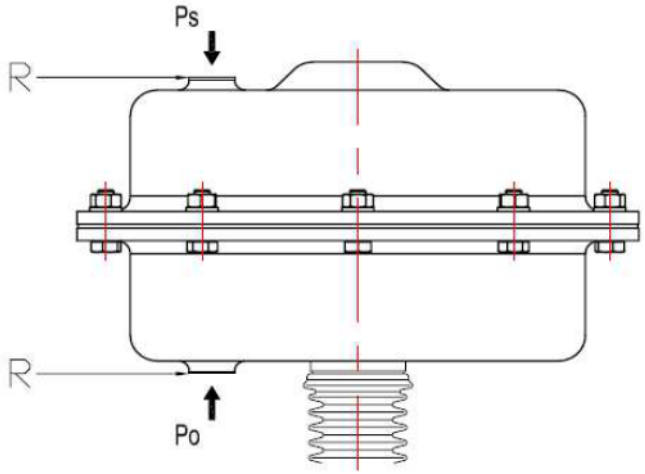

Illustration 11: Air connections R

Po: Zuluft von unten

Ps: Zuluft von oben

Pos: Zuluft von unten und oben (Antrieb ohne Federn)

Weitere Ausführungen sind optional auf Anfrage erhältlich.

9.3 Positioner installation

Integrated mounting S 100 of ARCA positioners

The signal pressure connection is integrated in the S100 extension and is connected directly to the actuator via the positioner and pillar. For installation instructions, please refer to the operating instructions of the respective device.

Attachment of additional devices according to IEC 534 (NAMUR)

Additional devices can be attached according to IEC 534 (NAMUR).

10 Maintenance

Exclude maintenance by third parties!

10.1 Care

Clean Spindle (18) if necessary

– Clean the Spindle (18) of adhering dirt using a soft cloth

NOTICE! Never use sanding paper, as this will damage the surface of the spindle and reduce the lifetime of the spindle sealing.

10.2 Maintenance

The drive is largely maintenance-free.

Nevertheless, the connections must be checked after 100,000 operating cycles or twice per year for leaks.

In addition, it is necessary to check and clean the gliding surfaces.

Depending on the operating conditions of the actuator, the operator is responsible for defining appropriate inspection and maintenance intervals.

11 Disassembly / assembly of actuator

The actuators of the MA series are mounted and dismounted at the factory with special devices. The following assembly instructions are based on basic tools. They are intended for work on existing drives on the user's premises and are listed under chapter *[12.2 Chart 2: assembly tool]*. These assembly tools are available for purchase.

⚠ WARNING

Non-compliance with the safety instructions

Risk of injury!

► Note the instructions in chapter *[2 Safety]* .

11.1 Procedure

- Disassembly in specified order.
- Disassembled parts must be carefully secured against falling down (risk of injury or damage)).
- Clean all components.
- Before assembly, all components must be inspected for damage or wear and replaced where necessary.
- Assembly in reverse order, including the new components.

  Diaphragm, lead-through, bellows, O-rings, circumferential bolts, nuts and washers are generally to be replaced.

  In case of corrosive atmosphere, humidity, salty air or similar, the spring pack must be replaced at regular intervals.

Recommended lubricants

O-rings, form rings, plain bearings
Klübersynth VR 69-252 N

Recommended safety glue

Hexagon nuts
Loctite 222

11.2 Assembly Po

- Apply specified grease to the centre hole of the bottom part (1).
- Insert the grommet (6) and secure with retaining washer (13).
- Screw the pillar (16) into the bottom part (1) (in the case of MA21, first slide the O-ring (15) over the thread).
- Place the two stem ring halves (19) in the recess of the spindle (18).
- Push the compression plate (20) onto the spindle (18) (from the side with the short thread).
- Slide the O-ring (21), diaphragm (22) and diaphragm plate (24) onto the spindle (18).
- Screw on hex nut (32) slightly, hand-tight, with a little locking glue.
- Subsequently tighten hex nut (32) with torque spanner according to chapter *[12.3 Table 3: Hexagon nuts].*
- Clamp the pre-assembled bottom part (1) to the pillars (16) in a vice.
- Apply specified grease to the lower end of the spindle (18) and insert it into the feed-through (6).
- Align diaphragm (17) according to the air connections.
- Set up compression springs (35) according to arrangement chapter *[11.9 Springs]*
- Mount the spring centring plate (3) in the upper part (44) (mind the position) and place it on the compression springs (35).
- The air connections of the upper part (44) and the lower part (1) must be one above the other. Make sure that the pressure springs (35) are correctly centred at the top.
- Use long screws, see chapter *[12.2 Table 2: Assembly tool]* to tighten the upper part (44) and lower part (1) evenly together.
- Fit the hexagon head screw (64), hex nuts (66) and washers (65). Exchange long bolts with the short ones.
- Tighten all hexagon nuts (66) with torque locks according to chapter *[12.1 Table 1: Drive screws]*.

11.3 Assembly Ps

- Apply specified grease to the centre hole of the bottom part (1).
- Insert the grommet (6) and secure with retaining washer (13).
- Fit the spring centring plate (3) into the bottom part (1).
- Screw the pillar (16) into the bottom part (1) (in the case of MA21, first slide the O-ring (15) over the thread).
- Place the two stem ring halves (19) in the recess of the spindle (18).
- Push the diaphragm plate (24) onto the spindle (18) (from the side with the short thread).
- Slide the diaphragm (22), O-ring (21) and compression plate (20) onto the spindle (18).
- Screw on hex nut (32) slightly, hand-tight, with a little locking glue.
- Subsequently tighten hex nut (32) with torque spanner according to chapter *[12.3 Table 3: Hexagon nuts].*
- Clamp the pre-assembled bottom part (1) to the pillars (16) in a vice.
- Apply specified grease to the lower end of the spindle (18) and insert it into the feed-through (6).
- Align diaphragm (17) according to the air connections.
- Set up compression springs (35) according to arrangement chapter *[11.9 Springs]*
- The air connections of the upper part (44) and the lower part (1) must be one above the other. Make sure that the pressure springs (35) are correctly centred at the top.
- Use long screws, see chapter *[12.2 Table 2: Assembly tool]* to tighten the upper part (44) and lower part (1) evenly together.
- Fit the hexagon head screw (64), hex nuts (66) and washers (65). Exchange long bolts with the short ones.
- Tighten all hexagon nuts (66) with torque locks according to chapter *[12.1 Table 1: Drive screws]*.

11.4 Assembly Stroke Limitator (HB) Po

- Apply specified grease to the centre hole of the bottom part (1).
- Insert the grommet (6) and secure with retaining washer (13).
- Screw the pillar (16) into the bottom part (1) (in the case of MA21, first slide the O-ring (15) over the thread).
- Place the two stem ring halves (19) in the recess of the spindle (18).
- Push the compression plate (20) onto the spindle (18) (from the side with the short thread).
- Slide the O-ring (21), diaphragm (22) and diaphragm plate (24) onto the spindle (18).
- Screw on hex nut (32) slightly, hand-tight, with a little locking glue.
- Subsequently tighten hex nut (32) with torque spanner according to chapter *[12.3 Table 3: Hexagon nuts].*
- Clamp the pre-assembled bottom part (1) to the pillars (16) in a vice.
- Apply specified grease to the lower end of the spindle (18) and insert it into the feed-through (6).
- Align diaphragm (17) according to the air connections.
- Set up compression springs (35) according to arrangement chapter *[11.9 Springs]*
- Mount screw (51) and O-ring (52) on the lid (50).
- Screw the hexagon head screw (61) and the sealing nut (60) into the lid (50).
- The air connections of the upper part (44) and the lower part (1) must be one above the other. Make sure that the pressure springs (35) are correctly centred at the top.
- Use long screws, see chapter *[12.2 Table 2: Assembly tool]* to tighten the upper part (44) and lower part (1) evenly together.
- Fit the hexagon head screw (64), hex nuts (66) and washers (65). Exchange long bolts with the short ones.
- Tighten all hexagon nuts (66) with torque locks according to chapter *[12.1 Table 1: Drive screws]*.

11.5 Assembly Stroke Limitator (HB) Ps

- Apply specified grease to the centre hole of the bottom part (1).
- Insert the grommet (6) and secure with retaining washer (13).
- Fit the spring centring plate (3) into the bottom part (1).
- Screw the pillar (16) into the bottom part (1) (in the case of MA21, first slide the O-ring (15) over the thread).
- Place the two stem ring halves (19) in the recess of the spindle (18).
- Push the diaphragm plate (24) onto the spindle (18) (from the side with the short thread).
- Slide the diaphragm (22), O-ring (21) and compression plate (20) onto the spindle (18).
- Screw on hex nut (32) slightly, hand-tight, with a little locking glue.
- Subsequently tighten hex nut (32) with torque spanner according to chapter *[12.3 Table 3: Hexagon nuts].*
- Clamp the pre-assembled bottom part (1) to the pillars (16) in a vice.
- Apply specified grease to the lower end of the spindle (18) and insert it into the feed-through (6).
- Align diaphragm (17) according to the air connections.
- Set up compression springs (35) according to arrangement chapter *[11.9 Springs]*
- Mount screw (51) and O-ring (52) on the lid (50).
- Screw the hexagon head screw (61) and the sealing nut (60) into the lid (50).
- The air connections of the upper part (44) and the lower part (1) must be one above the other. Make sure that the pressure springs (35) are correctly centred at the top.
- Use long screws, see chapter *[12.2 Table 2: Assembly tool]* to tighten the upper part (44) and lower part (1) evenly together.
- Fit the hexagon head screw (64), hex nuts (66) and washers (65). Exchange long bolts with the short ones.
- Tighten all hexagon nuts (66) with torque locks according to chapter *[12.1 Table 1: Drive screws]*.

11.6 Assembly manual override (H23) Po

- Apply specified grease to the centre hole of the bottom part (1).
- Insert the grommet (6) and secure with retaining washer (13).
- Screw the pillar (16) into the bottom part (1) (in the case of MA21, first slide the O-ring (15) over the thread).
- Place the two stem ring halves (19) in the recess of the spindle (18).
- Push the compression plate (20) onto the spindle (18) (from the side with the short thread).
- Slide the O-ring (21), diaphragm (22) and diaphragm plate (24) onto the spindle (18).
- Screw on coupling nut (102) slightly, hand-tight, with a little locking glue
- Then tighten coupling nut (102)
- Clamp the pre-assembled bottom part (1) to the pillars (16) in a vice.
- Apply specified grease to the lower end of the spindle (18) and insert it into the feed-through (6).
- Align diaphragm (17) according to the air connections.
- Set up compression springs (35) according to arrangement chapter *[11.9 Springs]*
- Mount the spring centring plate (3) in the upper part (101) (mind the position) and place it on the compression springs (35).
- The air connections of the upper part 101) and the lower part (1) must be one above the other. Make sure that the pressure springs (35) are correctly centred at the top.
- Use long screws, see chapter *[12.2 Table 2: Assembly tool]* to tighten the upper part (101) and lower part (1) evenly together.
- Fit the hexagon head screw (64), hex nuts (66) and washers (65). Exchange long bolts with the short ones.
- Tighten all hexagon nuts (66) with torque locks according to chapter *[12.1 Table 1: Drive screws]*.
- Screw the spindle nut (107) with the hexagon socket screw (103) into the coupling nut (102).
- Place thrust washer (108) in cylinder (105).
- Push in the spindle (109) with the external thread facing downwards.
- Insert another thrust washer (108).
- Place the O-ring (112) in the lid (111) and press the bearing (113) in.
- Mount the cover (111) with the O-ring (110) on the cylinder (105) with three hexagon head screws (117) and one hexagon head screw (116) which has a washer (115). the first chain link of the safety chain (114) is located under the washer (115).
- Mount handwheel (118) with key (121) on spindle (109) and secure with washer (119) and hexagon head screw (120).
- Push the O-ring (104) onto the upper part (101).
- Screw the prefabricated handwheel onto the upper part (101) with hexagonal screws (106).

11.7 Assembly manual override (H23) Ps

- Apply specified grease to the centre hole of the bottom part (1).
- Insert the grommet (6) and secure with retaining washer (13).
- Fit the spring centring plate (3) in the bottom part (1).
- Screw the pillar (16) into the bottom part (1) (in the case of MA21, first slide the O-ring (15) over the thread).
- Place the two stem ring halves (19) in the recess of the spindle (18).
- Push the compression plate (20) onto the spindle (18) (from the side with the short thread).
- Push the diaphragm (22), O-ring (21) and compression plate (20) onto the spindle (18).
- Screw on coupling nut (102) slightly, hand-tight, with a little locking glue
- Then tighten coupling nut (102)
- Clamp the pre-assembled bottom part (1) to the pillars (16) in a vice.
- Apply specified grease to the lower end of the spindle (18) and insert it into the feed-through (6).
- Align diaphragm (17) according to the air connections.
- Set up compression springs (35) according to arrangement chapter *[11.9 Springs]*
- The air connections of the upper part 101) and the lower part (1) must be one above the other. Make sure that the pressure springs (35) are correctly centred at the top.
- Use long screws, see chapter *[12.2 Table 2: Assembly tool]* to tighten the upper part (101) and lower part (1) evenly together.
- Fit the hexagon head screw (64), hex nuts (66) and washers (65). Exchange long bolts with the short ones.
- Tighten all hexagon nuts (66) with torque locks according to chapter *[12.1 Table 1: Drive screws]*.
- Screw the hexagon socket head screw (103) into the coupling nut (102).
- Place thrust washer (108) in cylinder (105).
- Push in the spindle (109) with the external thread facing downwards.
- Insert another thrust washer (108).
- Place the O-ring (112) in the lid (111) and press the bearing (113) in.
- Mount the cover (111) with the O-ring (110) on the cylinder (105) with three hexagon head screws (117) and one hexagon head screw (116) which has a washer (115). the first chain link of the safety chain (114) is located under the washer (115).
- Screw the spindle nut (107) from below, in the cylinder (105), to the spindle (109).
- Mount handwheel (118) with key (121) on spindle (109) and secure with washer (119) and hexagon head screw (120).
- Push the O-ring (104) onto the upper part (101).
- Screw the prefabricated handwheel onto the upper part (101) with hexagonal screws (106).
- .

11.8 Grommet

⚠ DANGER

Risk of death and serious bodily injury as well as damage to property due to high spring preload.!

If the following instructions are not complied with, serious injuries resulting in death as well as considerable damage to property cannot be excluded.

► The following instructions and procedure must be complied with.

► Note warning notices.

- Remove any attachments (positioner, limit switch, etc.).

▪ Disassembly Po (Spindle extended without pressure)

- Loosen hex nut (68).
- Remove clutch (69) und hex nut (68).
- For actuator MA16, MA21 and MA31, remove three hexagon head screws symmetrically distributed, replace them with longer screws according to chapter *[12.2 Table 2: Assembly tools]* (do not use stainless steel bolts) and tighten nuts.
- For actuator MA41, remove four hexagon head screws symmetrically distributed, replace them with longer screws according to chapter *[12.2 Table 2: Assembly tools]* (do not use stainless steel bolts) and tighten nuts.
- Remove all remaining short hex screws (64).
- Evenly loosen the hex nuts (66) from the long bolts.
- Remove compression springs (35).
- Pull the diaphragm plate (24) with diaphragm (17) out of the bottom part (1).
- Screw 2 hexagon nuts onto the spindle thread and lock them.
- Clamp hexagon nuts in a vice.
- Detach hex nut (32).
- Remove the diaphragm plate (24), diaphragm (22), O-ring (21), compression plate (20) and stem ring halves (19) from the spindle (18).
- Remove the grommet (6) from the bottom part (1).

▪ Disassembly Ps (Spindle retracted without pressure)

- Loosen hex nut (68).
- Remove clutch (69) und hex nut (68).
- For actuator MA16, MA21 and MA31, remove three hexagon head screws symmetrically distributed, replace them with longer screws according to chapter *[12.2 Table 2: Assembly tools]* (do not use stainless steel bolts) and tighten nuts.
- For actuator MA41, remove four hexagon head screws symmetrically distributed, replace them with longer screws according to chapter *[12.2 Table 2: Assembly tools]* (do not use stainless steel bolts) and tighten nuts.
- Remove all remaining short hex screws (64).
- Evenly loosen the hex nuts (66) from the long bolts.
- Remove compression springs (35).
- Pull the diaphragm plate (24) with diaphragm (17) out of the bottom part (1).
- Screw 2 hexagon nuts onto the spindle thread and lock them.
- Clamp hexagon nuts in a vice.
- Detach hex nut (32).
- Remove the compression plate (20), O-ring (21), diaphragm (22), diaphragm plate (24) and stem ring halves (19) from the spindle (18).
- Remove the grommet (6) from the bottom part (1).

11.9 Diaphragm

⚠ DANGER

Risk of death and serious bodily injury as well as damage to property due to high spring preload.!

If the following instructions are not complied with, serious injuries resulting in death as well as considerable damage to property cannot be excluded.

► The following instructions and procedure must be complied with.

► Note warning notices.

▪ Remove any attachments (positioner, limit switch, etc.).

- **Disassembly Po (Spindle extended without pressure)**
- Disassembly see chapter *[11.8 Implementation disassembly Po]* up to: Remove the diaphragm plate (24), diaphragm (22).
- **Disassembly Ps (Spindle retracted without pressure)**
- Disassembly see chapter *[11.8 Implementation disassembly Ps]* up to: Remove the compression plate (20), O-ring (21), diaphragm (22).

11.10 Spring

- **Disassembly Po (Spindle extended without pressure)**
- Disassembly see chapter *[11.8 Implementation disassembly Po]* up to: Remove compression springs (35).
- **Disassembly Ps (Spindle retracted without pressure)**
- Disassembly see chapter *[11.8 Implementation disassembly Ps]* up to: Remove compression springs (35).
- ⚠ **CAUTION!** Always replace the pressure springs (35) as a complete set! Note the arrangement of the compression springs (35)!

Assembly position

- **MA 16 to MA 31**

No. of springs	Mounting at position	Springs left	Springs right
1	1		
2	2 + 5	2	5
3	3 + 5 + 7	7	3 + 5
4	2 + 4 + 5 + 7	2 + 5	4 + 7
5	1 + 2 + 4 + 5 + 7	2 + 5	1 + 4 + 7
6	2 + 3 + 4 + 5 + 6 + 7	2 + 4 + 6	3 + 5 + 7
7	1 + 2 + 3 + 4 + 5 + 6 + 7	2 + 4 + 6	1 + 3 + 5 +7

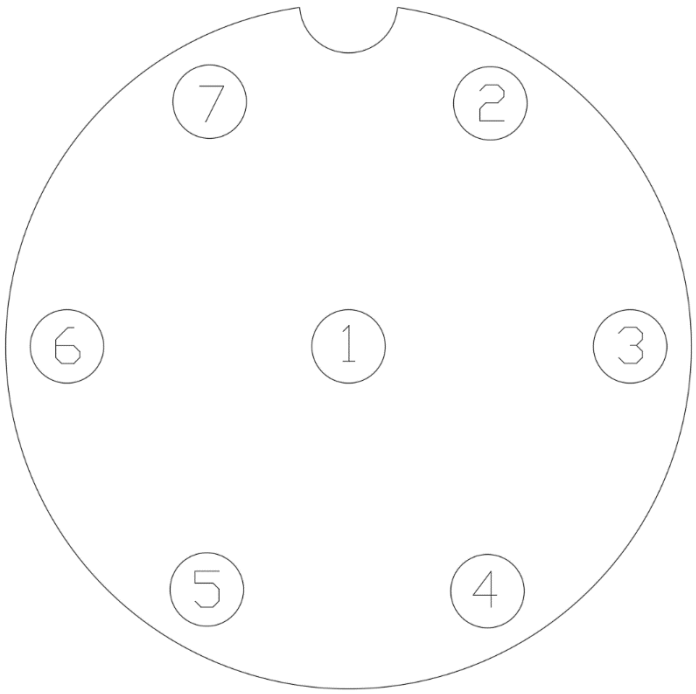

Illustration 12: Spring arrangement MA16 to MA31

▪ MA 41

No. of springs	Mounting at position	Springs left	Springs right
1			
2	7 + 12	7	12
3			
4	1 + 2 + 3 + 4	1 + 3	2 + 4
5	6 + 7 + 9 + 11 + 13	5 + 9	7 + 11 + 13
6	1 + 2 + 3 + 4 + 7 + 12	2 + 4 + 7	1 + 3 + 12
7	1 + 3 + 5 + 7 + 9 + 11 + 13	5 + 9 + 11	1 + 3 + 7 + 13
8	1 + 2 + 3 + 4 + 6 + 8 + 11 + 13	2 + 4 + 6 + 11	1 + 3 + 8 + 13
9	1 + 2 + 3 + 4 +5 + 7 + 9 + 11 + 13	2 + 4 + 5 + 11	1 + 3 + 7 + 9 + 13
10	1 + 2 + 3 + 4 + 6 + 7 + 8 + 11 + 12 + 13	1 + 3 + 7 + 11 + 12	2 + 4 + 6 + 8 + 13
11			
12	1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 10 + 11 +12 + 13	1 + 3 + 5 + 7 + 10 +12	2 + 4 + 6 + 8 + 11 + 13
13			
14	1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 + 11 + 12 + 13 + 14	1 + 3 + 6 + 8 + 10 + 12 + 14	2 + 4 + 5 + 7 + 9 + 11 + 13

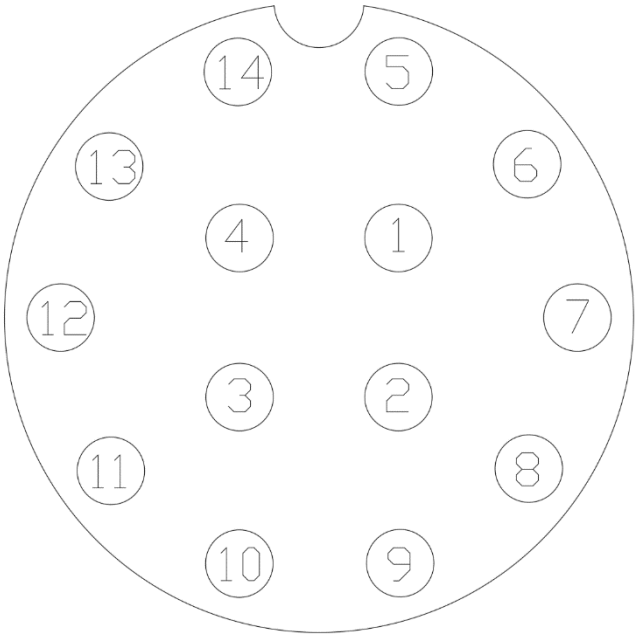

Illustration 13: Spring arrangement MA41

NOTICE! For the tandem diaphragm actuator TMA1.41, the arrangement may differ.

11.11 Conversion from Po to Ps

- Disassembly as per chapter *[11.8 Disassembly Po (Spindle extended without pressure)]* up to: Remove the diaphragm plate (24), diaphragm (22), O-ring (21), compression plate (20) and stem ring halves (19) from the spindle (18).
- Remove the spring centring plate (3) from the upper part (44) and mount it in the bottom part (1).
- Assembly as per chapter *[11.3 Assembly Ps]* from: Place the two stem ring halves (19) in the recess of the spindle (18).
- ⚠ **CAUTION!** If, for example, 3R Po becomes 5R Ps, all compression springs must be replaced. Mind the mounting position.

11.12 Conversion from Ps to Po

- Disassembly as per chapter *[11.8 Disassembly Ps (Spindle retracted without pressure)]* up to: Remove the compression plate (20), O-ring (21), diaphragm (22), diaphragm plate (24) and stem ring halves (19) from the spindle (18).
- Remove the spring centring plate (3) from the bottom part (1) and mount it in the upper part (44).
- Assembly as per chapter *[11.2 Assembly Po]* from: Place the two stem ring halves (19) in the recess of the spindle (18).
- ⚠ **CAUTION!** If, for example, 3R Po becomes 5R Ps, all compression springs must be replaced. Mind the mounting position.

12 Torque tables – Bolt connections

NOTE! Only use screws of A4-80 quality!

12.1 Table 1: Hexagon screw (64)

Thread	Torque [Nm]
M6	11
M8	23

12.2 Table 2: Assembly tools

Drive size	Description
MA16 A and B	3 screws M6 x 70
MA21 A and B	3 screws M6 x 70
MA31 A, B and C	3 screws M8 x 80
MA41 A and B	4 screws M8 x 100
MA41 C	4 screws M8 x 220
MA41 D	4 screws M8 x 320

12.3 Table 3: Hexagon nuts (32)

Thread	Torque [Nm]
M10	60
M12	60

13 Troubleshooting

⚠ WARNING

Inappropriate work to rectify faults

Risk of injury!

► For any troubleshooting work, the relevant instructions, in particular the safety instructions, in this operating manual or the operating instructions of the additionally attached components must be complied with.

In case of problems that are not described in the following table, please contact the manufacturer.

Störung	Mögliche Ursachen	Massnahme
Actuator stem doesn't move	No actuation air pressure signal available	Check signal source
	Actuation signal connection incorrectly implemented	Check actuation signal connection and direction of action of the actuator
	Actuation signal air pressure too low	Increase air pressure, observe max. permissible air pressure
	Actuator diaphragm defective	Replace actuator diaphragm
	Possible manual adjustment is engaged	Relieve manual override
	Insufficient preload	Increase preload
	Rear spring area closed	Clean vent hole
Air outlet at circumferential screws	Screws not tightened enough	Tighten screws according to *[Table 12.1 Hexagon screws]*
Membrane retracted around the circumference	Too high air pressure, wrong screws, poorly tightened	Exchange actuator, replace diaphragm
Actuator stem seal is leaking	Sealing element worn	Replace sealing element, clean stem surface
	Stem surface damaged	Replace stem and sealing elements
Actuating force too low	Actuation signal air pressure too low	Increase air pressure, observe max. permissible air pressure
	Leaks in the actuation signal line	Check the signal line
	Positioner, if mounted, is incorrectly set	Check the positioner adjustment
	Incorrect actuator	Use a more powerful actuator, check operating data, contact the manufacturer

14 Disposal and recycling

⚠ DANGER

Danger of death and serious injuries as well as damage to property due to high spring tension!

If the following instructions are disregarded, serious injuries resulting in death as well as severe damage to property cannot be ruled out.

- ► The actuator may only be disposed of with dismantled actuator springs.
- ► Remove actuator springs prior to disposal.
- ► Strictly follow the disassembly instructions.

⚠ WARNING

Operating media and auxiliary materials that are hazardous to health

Danger to people and the environment!

- ► Wear suitable protective equipment according to chapter *[2.10 Personal protective equipment].*
- ► If applicable, collect and dispose of rinsing medium or residual medium. Particular attention is to be paid to dead spaces (pressure compensation, bellows, etc.)
- ► Observe the legal regulations for the disposal of media that is hazardous to health.

von Rohr products are modularly constructed and can be sorted by material into the following components.

- Electronic components
- Metals
- Plastics
- Greases and oils
- Packaging material

The general rules are:

- Greases and oils are usually water pollutants and must not be allowed to escape into the environment.
- Dispose of dismantled materials properly or recycle the separate materials.
- Observe national disposal rules and regulations.