



## Sequence Valve ND 4

with check valve, max. operating pressure 500 bar



### 1 Description of the product

Sequence valves are used in hydraulic circuits for pressure dependent sequence control.

The compact size allows mounting directly to the fixture, requiring only one pressure line from the pressure generator to the fixture for single-acting cylinders.

### 2 Validity of the documentation

This document applies to the following products:

Sequence valve ND 4 of data sheet C 2.954. The following types or part numbers are concerned:

#### Sequence valves for manifold mounting:

- 2954 419
- 2954 427
- 2954 428
- 2954 429
- 2954 441
- 2954 442
- 2954 449

#### Sequence valve pipe thread:

- 2954 410
- 2954 420
- 2954 440

#### Sequence valve combination:

- 2954 427 Input valve
- 2954 441 Input valve
- 2954 428 Series valve
- 2954 442 Series valve

### Table of contents

1	Description of the product	1	3	Target group of this document	1
2	Validity of the documentation	1		• Specialists, fitters and set-up men of machines and installations with hydraulic expert knowledge.	
3	Target group of this document	1		<b>Qualification of the personnel</b>	
4	Symbols and signal words	1		<b>Expert knowledge</b> means that the personnel must	
5	For your safety	2		• be in the position to read and completely understand technical specifications such as circuit diagrams and product-specific drawing documents,	
6	Application	2		• have expert knowledge (electric, hydraulic, pneumatic knowledge, etc.) of function and design of the corresponding components.	
7	Transport	3		An <b>expert</b> is somebody who has due to its professional education and experiences sufficient knowledge and is familiar with the relevant regulations so that he	
8	Installation	3		• can judge the entrusted works,	
9	Operation	6		• can recognize the possible dangers,	
10	Maintenance	6		• can take the required measures to eliminate dangers,	
11	Trouble shooting	6		• knows the acknowledged standards, rules and guidelines of the technology.	
12	Technical characteristics	7		• has the required knowledge for repair and mounting.	
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### 4 Symbols and signal words

## ⚠ WARNING

### Person damage

Stands for a possibly dangerous situation.  
If it is not avoided, death or very severe injuries will result.

## ⚠ CAUTION

### Easy injuries / property damage

Stands for a possibly dangerous situation.  
If it is not avoided, minor injuries or material damages will result.



### Hazardous to the environment

The symbol stands for important information for the proper handling with materials that are hazardous to the environment.  
Ignoring these notes can lead to heavy damages to the environment.



### Mandatory sign!

The symbol stands for important information, necessary protection equipment, etc.

## i NOTE

- This symbol stands for tips for users or especially useful information. This is no signal word for a dangerous or harmful situation.

## 5 For your safety

### 5.1 Basic information

The operating instructions serve for information and avoidance of dangers when installing the products into the machine as well as information and references for transport, storage and maintenance.

Only in strict compliance with these operating instructions, accidents and property damages can be avoided as well as trouble-free operation of the products can be guaranteed.

Furthermore, the consideration of the operating instructions will:

- avoid injuries
- reduce down times and repair costs,
- increase the service life of the products.

### 5.2 Safety instructions

## ⚠ WARNING

### Poisoning due to contact with hydraulic oil!

Wear, damage of the seals, ageing and incorrect mounting of the seal kit by the operator can lead to escapes of oil.

Incorrect connection can lead to escapes of oil at the ports.

- For handling with hydraulic oil consider the material safety data sheet.
- Wear protection equipment.

## ⚠ WARNING

### Injury by high-pressure injection (squirting out of hydraulic oil under high pressure)!

- Improper connection can lead to escapes of oil under high pressure at the connections.
- Mounting or dismounting of the element must only be made in depressurised mode of the hydraulic system.
- Connection of the hydraulic line as per DIN 3852/ISO 1179.
- Unused connections have to be locked professionally.
- Use all mounting holes.

### Injury by high-pressure injection (squirting out of hydraulic oil under high pressure)!

Wear, damage of the seals, ageing and incorrect mounting of the seal kit by the operator can lead to escapes of oil under high pressure.

- Before using them make a visual control.

## ⚠ CAUTION

### Operating pressure of 500 bar does not exceed

The maximum operating pressure of 500 bar must not be exceeded.

### High forces are generated!

With hydraulic pressure very high forces are generated.

- The fixture or machine must be in the position to compensate these forces.

## i NOTE

### Qualification of personnel

All works may only be effected by qualified personnel familiar with the handling of hydraulic components.

## 6 Application

### 6.1 Intended use

Sequence valves are used in power workholding circuits for pressure dependent sequence control.

Several sequence valves can be manifold mounted together to form a battery with only one common P-line for sequence control.

Furthermore the following are intended uses:

- Max. forces and / or torques at the drive and output only with the values indicated below technical characteristics.
- Use only within closed, low-dust rooms
- Use within the capacity indicated in the technical characteristics (see data sheet).
- Use as per operating instructions.
- Compliance with service intervals.
- Qualified and trained personnel for the corresponding activities.
- Mounting of spare parts only with the same specifications as the original part.

## 6.2 Misapplication

### **WARNING**

#### **Injuries, material damages or malfunctions!**

- The product must never be opened. At the product no changes must be made, except the ones expressly mentioned in the operating instructions!

The use of these products is not admitted:

- For domestic use.
- On pallets or machine tool tables in primary shaping and metal forming machine tools.
- If due to physical / chemical effects (vibrations, welding currents or others) damages of the products or seals can be caused.
- In machines, on pallets or machine tool tables that are used to change the characteristics of the material (magnetise, radiation, photochemical procedures, etc.).
- In areas for which special guidelines apply, especially installations and machines:
  - For the use on fun fairs and in leisure parks.
  - In food processing or in areas with special hygiene regulations.
  - For military purposes.
  - In mines.
  - In explosive and aggressive environments (e.g. ATEX).
  - In medical engineering.
  - In the aerospace industry.
  - For passenger transport.
- For other operating and environmental conditions e.g.:
  - Higher operating pressures than indicated on the data sheet or installation drawing.
  - With hydraulic fluids that do not correspond to the specifications.
  - Higher flow rates than indicated on the data sheet or installation drawing.

The use of these products is not admitted:

- For domestic use.
- On pallets or machine tool tables in primary shaping and metal forming machine tools.
- If due to physical/chemical effects (vibrations, welding currents or others), damages of the products or seals can be caused.
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  - For the use on fun fairs and in leisure parks.
  - In food processing or special hygiene regulations.
  - For military purposes.
  - In mines.
  - In explosive and aggressive environments (e.g. ATEX).
  - In medical engineering.
  - In the aerospace industry.
  - For passenger transport.

## **NOTE**

### **Troubles of functioning**

To avoid malfunctions, a minimum pressure difference from sequence valve to sequence valve has to be met in sequence valve battery combinations.

- Comply with the indications for minimum pressure difference (see technical data).

## 7 Transport



### **Hazardous to the environment**

During improper transit, escaping oil residuals can lead to environmental pollutions.

Transport the product only in an upright position! Pay attention to the sign on the packaging: "Top, do not overturn".

The product is delivered in a suitable packing.

## 8 Installation

### **WARNING**

#### **Injury by high-pressure injection (squirting out of hydraulic oil under high pressure)!**

- Improper connection can lead to escapes of oil under high pressure at the connections.
- Mounting or dismounting of the element must only be made in depressurised mode of the hydraulic system.
- Connection of the hydraulic line as per DIN 3852/ISO 1179.
- Unused connections have to be locked professionally.
- Use all mounting holes.

#### **Injury by high-pressure injection (squirting out of hydraulic oil under high pressure)!**

Wear, damage of the seals, ageing and incorrect mounting of the seal kit by the operator can lead to escapes of oil under high pressure.

- Before using them make a visual control.

#### **Injury by falling parts!**

- Keep hands and other parts of the body out of the working area.
- Wear personal protection equipment!

#### **Poisoning due to contact with hydraulic oil!**

Wear, damage of the seals, ageing and incorrect mounting of the seal kit by the operator can lead to escapes of oil.

Incorrect connection can lead to escapes of oil at the ports.

- For handling with hydraulic oil consider the material safety data sheet.
- Wear protection equipment.

#### **Injury by crushing!**

- Due to the stored energy, an unexpected start of the product can occur.
- Maintenance works at the product must only be made in depressurised mode!
- Keep hands and other parts of the body out of the working area!

#### **Injury by cutting!**

- Sharp-edged threads can cause cut injuries.
- Wear personal protection equipment!

## ⚠ CAUTION

### Great weight may fall

Some product types have a considerable weight. These have to be secured against working free during transport. Weight specifications see chapter "Technical characteristics".

### Side loads and forced conditions acting on the piston lead to increased wear

- Provide external guides.
- Avoid forced conditions (overdetermination) of the piston.

## i NOTE

### The arrangement of the ports

- The shown figure is a schematic diagram. The arrangement of the ports depends on the respective product (see chapter "Design").

a Socket head cap screw	d1 Mounted O-ring
b Sealing ring	e Screw plug (accessory)
d O-ring (accessory, depending on the version)	e1 Mounted screw plug

## 8.1 Design

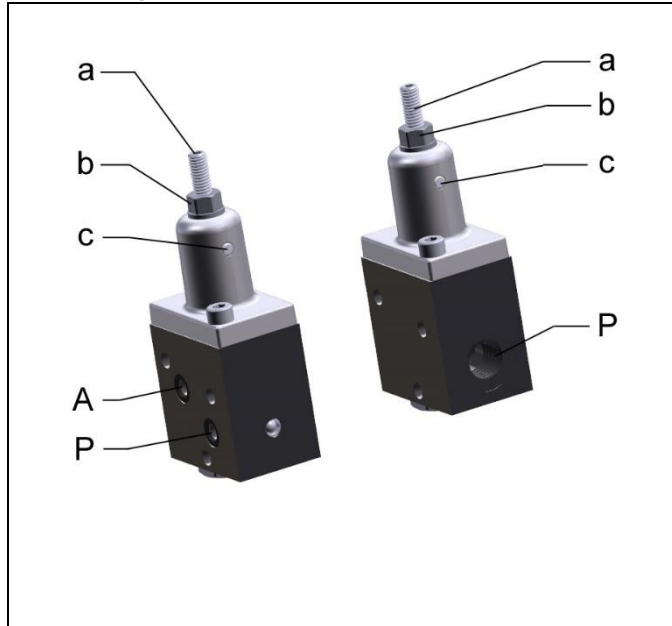


Figure 1: Mounting position of the valves (principle figure)

a Adjustment screw	A Output (secondary side)
b Lock nut	P Pressure supply (primary side)
c Safety plug	

## 8.2 Installation preparations

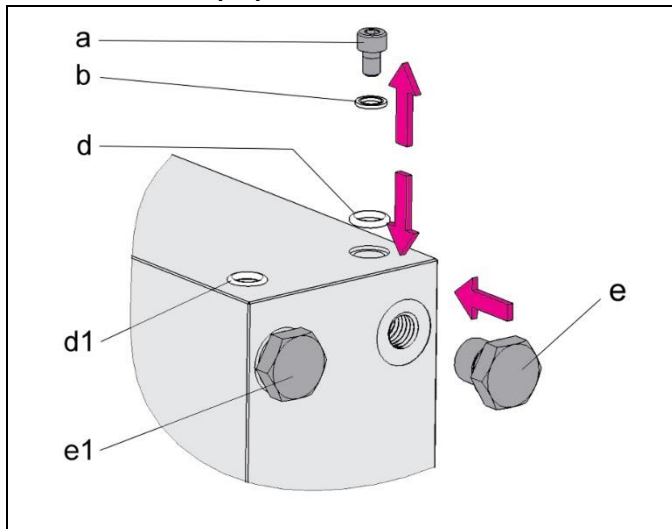


Figure 2: Example, preparation for hydraulic ports without pipes

1. Drill the holes for hydraulic oil supply and return in the fixture (see also data sheet).
2. Grind or finish mill the manifold-mounting surface ( $Ra \geq 0.8$  and a flatness of 0.04 mm to 100 x 100 mm, marks, scratches, shrink holes, concentric machining marks are inadmissible).

For some versions:

- 3a. Remove socket head cap screws and sealing rings, insert o-rings (accessories, if required).
  - 3b. Tighten pipe ports with screw plugs (accessories, if required)
4. Clean the support surfaces.
  5. Position and fasten on the fixture.
  6. Install bleeding screws at the upper ends of the piping.

## 8.3 Installation

## ⚠ CAUTION

### Malfunctions!

Chips, coolants and cutting fluids can cause malfunctions.

- Protect the power units against penetration of chips, coolants and cutting fluids!

According to the type of the sequence valves, they can be used as individual valve, input valve, and series valve.

Type	Part-no.
Individual valve	2954-410
	2954-419
	2954-420
	2954-440
	2954-429
	2954-449
Sequence valve - input valve	2954-427
	2954-441
Sequence valve - series valve	2954-428
	2954-442

#### 8.4 Connection diagram - individual valve

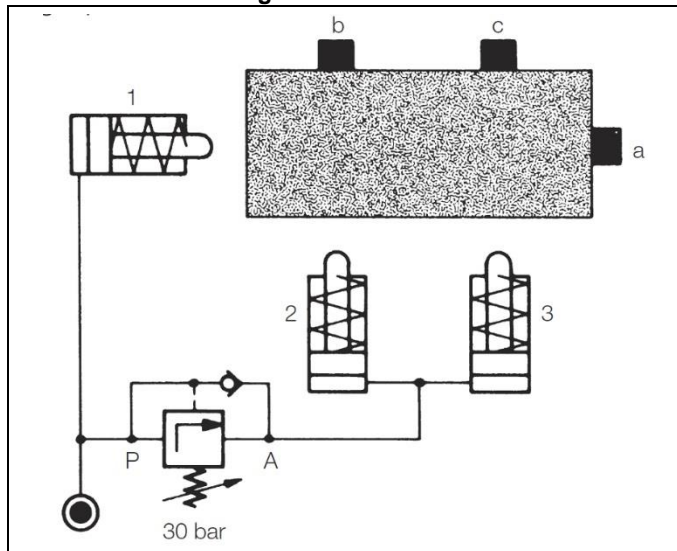


Figure 3: Example: use of individual valve

Here an example of a sequence valve that shall control two hydraulic cylinders after reaching a determined pressure. In this example a sequence valve is used as individual valve. The connection of the sequence valve can be made with pipes and by manifold mounting.

### 8.5 Connection diagram for battery combination

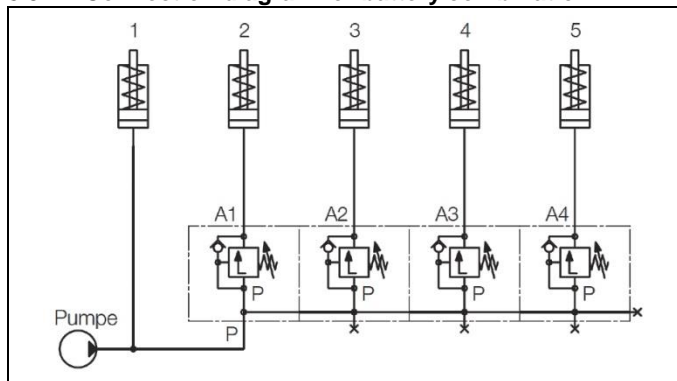


Figure 4: Example: battery combination

Here an example of four sequence valves, each of them shall control a hydraulic cylinder after reaching a determined pressure.

For this example, one sequence valve as input valve and three sequences valves as series valves are used.

These batteries always consist of one input valve and up to five series valves.

The pressure line (P) is only connected to the input valve.

Oil supply to the series valves is made without tubes through drilled channels.

## 8.6 Connection of the hydraulic equipment

1. Connect hydraulic lines to qualifying standards and pay attention to scrupulous cleanliness!

**NOTE**

### More details

- See ROEMHELD data sheets A 0.100, F 9.300, F 9.310 and F 9.360.

### Screwed Plug

- Use only fittings "screwed plug B and E" as per DIN 3852 (ISO 1179).

## hydraulic connection

- Do not use sealing tape, copper rings or coned fittings.

## Pressure fluids

- Use hydraulic oil as per ROEMHELD data sheet A 0.100.

The following chart shows the basic symbols of sequence valve types.

Part-no. 2954-XXX	Connection type
410/420/429/440	Pipe
419/427/428/441/442/449	without pipes <sup>(a)</sup>

- (a) Sequence valves are manifold-mounted at the fixture body. The manifold-mounted sequence valve is supplied with hydraulic oil via the drilled channels in the fixture body.

### Hydraulic connection via pipes

- Clean the support surfaces.
- Fasten the valve at the flange with screws M5.

### Hydraulic connection without pipes

- Drill holes for hydraulic oil supply and return in the fixture.
- Grind flange surface.
- Clean the support surfaces.
- Fasten the valve with O-rings on the fixture.

## Hydraulic connection for battery combination

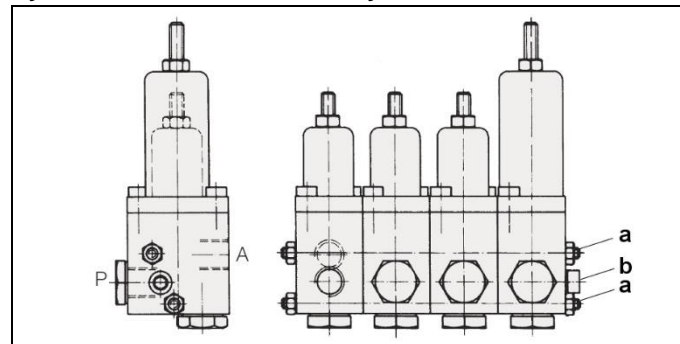


Figure 5: Battery combination screwed together

a Threaded rod M5	b Screw plug
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- Assemble valves with inserted O-rings and screw with threaded bolts M5 (a).
- Remove the screw plug (b) of the input valve and close the port P of the last series valve with this plug.

### Adjust switching pressure

Check the switching pressure during adjustment with a pressure gauge.

**CAUTION**

### Acceptable performance conditions

The admissible performance data of the product and the downstream components must not be exceeded (see chapter "Technical characteristics" of the products and the downstream components).



- Unscrew lock nut.
- Increase switching pressure by screwing in (clockwise) the adjustment screw.
- Reduce switching pressure by screwing out (counterclockwise) the adjustment screw.
- Tighten lock nut.
- Carry out some clamping and unclamping operations to ensure proper operation.

## NOTE

### Troubles of functioning

To avoid malfunctions, a minimum pressure difference from sequence valve to sequence valve has to be met in sequence valve battery combinations.

- Comply with the indications for minimum pressure difference (see technical data).

## 9 Operation

### WARNING

#### Injury by high-pressure injection (squirting out of hydraulic oil under high pressure)!

Wear, damage of the seals, ageing and incorrect mounting of the seal kit by the operator can lead to escapes of oil under high pressure.

- Before using them make a visual control.

- The hydraulic system has to be bled completely!
- It is imperative to check the high-pressure range by a pressure gauge!
- Use hydraulic oil as per ROEMHELD data sheet A 0.100.

## NOTE

- Procedures, see individual sections.

## 10 Maintenance

### WARNING

#### Burning due to hot surface!

- In operating conditions, surface temperatures of more than 70 °C can appear at the product.
- All maintenance and repair works must only be effected in cooled mode or with safety gloves.



**For works at and with the product, wear suitable protection equipment!**

## NOTE

### Operating instructions

- Further operating instructions for individual components are available in the internet ([www.ROEMHELD.com](http://www.ROEMHELD.com)) or on request!

## 10.1 Plan for maintenance

Maintenance works	Interval	Realisation
Cleaning	As required	Operator
Check	Weekly	Operator
Repair		ROEMHELD service staff

## 10.2 Checks

### WARNING

#### Injury by high-pressure injection (squirting out of hydraulic oil under high pressure)!

Wear, damage of the seals, ageing and incorrect mounting of the seal kit by the operator can lead to escapes of oil under high pressure.

- Before using them make a visual control.

- Check hydraulic components for external leakage - retighten fittings, if required.
- Check adjusted pressures.
- Make sure that there is no oil leakage between the sequence valves. If there is an oil leakage, tighten the fittings of the threaded rods, exchange the O-rings, if required.

## 10.3 Cleaning

### WARNING

#### Injury by flying out components or oil!

- For cleaning works always wear safety goggles, protective shoes and safety gloves.

### CAUTION

#### Aggressive cleaning agents

The product must not be cleaned with:

- Corrosive or corroding components or
- Organic solvents as halogen or aromatic hydrocarbons and ketones (cellulose thinner, acetone, etc.), because this can destroy the seals.

The product must be cleaned from dirt, swarf and liquids at regular intervals.

## 11 Trouble shooting

Trouble	Cause	Remedy
Oil emerges at the safety plug	Internal seal damaged. Pressure built-up in the cover.	Exchange seal kit, and press in again safety plug.
<b>For sequence valve battery combinations:</b>		
Oil emerges between the sequence valves	Fitting at the threaded rod has been loosened. O-ring damaged.	Retighten fitting at the threaded rod, if necessary, exchange O-ring.

## 12 Technical characteristics

### Individual valves - characteristics type 2954-410; -420 and -440 (connection by pipes)

Type	2954-410	2954-420	2954-440
Port A	G 1/4	G 1/4	G 1/4
Port P	G 1/4	G 1/4	G 1/4
Max. operating pressure in (primary side) [bar]	500	500	500
Adjustment range [bar]	10-75	10-150	100-450
Minimum pressure difference [bar]	10	25	50
Max. flow rate [l/min]	8	8	8

### Individual valves - characteristics type 2954-429; -419 and -449 (connection by manifold mounting)

Type	2954-419	2954-429	2954-449
Port A	Ø 5	Ø 5	Ø 5
Port P	Ø 5	Ø 5	Ø 5
Max. operating pressure in (primary side) [bar]	500	500	500
Adjustment range [bar]	10-75	10-150	100-450
Minimum pressure difference [bar]	10	25	50
Max. flow rate [l/min]	8	8	8

### Input valves - characteristics type 2954-427 and -441 (connection by pipes/ manifold mounting)

Type	2954-427	2954-441
Port A	G 1/4 Ø 5	G 1/4 Ø 5
Port P	G 1/4 Ø 5	G 1/4 Ø 5
Max. operating pressure in (primary side) [bar]	500	500
Adjustment range [bar]	10-150	100-450
Minimum pressure difference [bar]	25	50
Max. flow rate [l/min]	8	8

### Series valves - characteristics type 2954-428 and -442 (connection by manifold mounting)

Type	2954-428	2954-442
Port A	G 1/4 Ø 5	G 1/4 Ø 5
Port P	G 1/4	G 1/4
Max. operating pressure in (primary side) [bar]	500	500
Adjustment range [bar]	10-150	100-450
Minimum pressure difference [bar]	25	50
Max. flow rate [l/min]	8	8

## Hydraulic fluids

### NOTE

#### Hydraulic fluids

Operation of the products with hydraulic fluids that do not correspond to the specifications is inadmissible. See technical characteristics:

#### Purity of the hydraulic fluids

The admissible contamination (unsolved impurities in the hydraulic fluid) depends on the component of the hydraulic system that is most sensitive to dirt. The indicated purity class is the maximally admissible value that should not be exceeded, with regard to the operating safety (clogging of gaps, orifices as well as the locking of the control piston) and the service life (wear reduction).

### Note

- Please note that a new hydraulic fluid "on tap" does not meet the requirements of cleanliness. If necessary, use cleaned oil.
- By mixing different types of fluid, it can occur under certain circumstances unwanted chemical reactions with sludging, gumming or similar.
- Therefore, the respective manufacturers should be consulted for a change between different hydraulic fluids.
- In any case, the entire hydraulic system is to be rinsed thoroughly.

#### Recommendation:

The use of hydraulic filter is recommended.  
(see data sheet F 9.500)

## 13 Disposal



### Hazardous to the environment

Due to possible environmental pollution, the individual components must be disposed only by an authorised expert company.

The individual materials have to be disposed as per the existing regulations and directives as well as the environmental conditions.

Special attention has to be drawn to the disposal of components with residual portions of hydraulic fluids. The instructions for the disposal at the material safety data sheet have to be considered.

For the disposal of electrical and electronic components (e.g. stroke measuring systems, proximity switches, etc.) country-specific legal regulations and specifications have to be kept.

## **14 Declaration of manufacture**

### **Manufacturer**

Römheld GmbH Friedrichshütte  
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### **Declaration of manufacture of the products**

They are designed and manufactured in line with the relevant versions of the directives **2006/42/EC** (EC MSRL) and in compliance with the valid technical rules and standards.

In accordance with EC-MSRL, these products are components, that are not yet ready for use and are exclusively designed for the installation in a machine, a fixture or a plant.

According to the pressure equipment directives the products are not to be classified as pressure reservoirs but as hydraulic placing devices, since pressure is not the essential factor for the design, but the strength, the inherent stability and solidity with regard to static or dynamic operating stress.

The products may only be put into operation after it was assessed that the incomplete machine / machine, in which the product shall be installed, corresponds to the machinery directives (2006/42/EC).

The manufacturer commits to transmit the special documents of the products to state authorities on request.

The technical documentation as per appendix VII part B was prepared for the products.

Responsible person for the documentation:  
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**Römheld GmbH**  
**Friedrichshütte**

Laubach, 11.03.2020