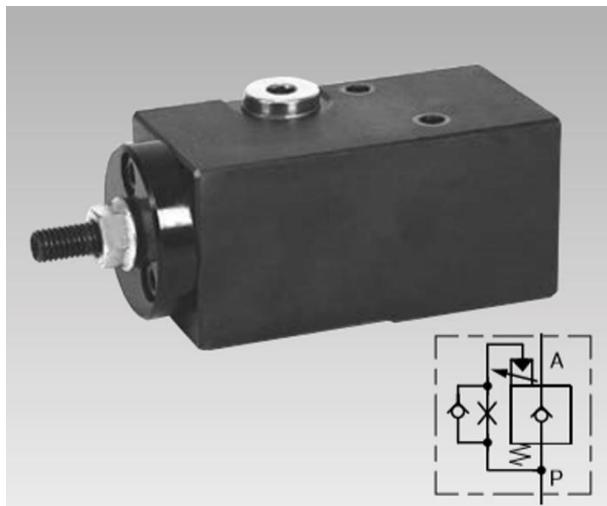




# Sequence valve ND 5

## with adjustable switching time



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## 1 Description of the product

Normal sequence valves open without delay, if the adjusted switching pressure is exceeded. Sometimes it is necessary to slow down the switching sequence for functional reasons. For this reason, this sequence valve does not open pressure-dependently, but by the adjustable stroke of a control piston.

## 2 Validity of the documentation

This document applies to the following products:

Sequence valve ND 5 of data sheet C 2.9546. The following types or part numbers are concerned:

### Sequence valve ND 5

- 2954 620
- 2954 630

## 3 Target group of this document

- Specialists, fitters and set-up men of machines and installations with hydraulic expert knowledge.

### Qualification of the personnel

**Expert knowledge** means that the personnel must

- be in the position to read and completely understand technical specifications such as circuit diagrams and product-specific drawing documents,
- have expert knowledge (electric, hydraulic, pneumatic knowledge, etc.) of function and design of the corresponding components.

An **expert** is somebody who has due to its professional education and experiences sufficient knowledge and is familiar with the relevant regulations so that he

- can judge the entrusted works,
- can recognize the possible dangers,
- can take the required measures to eliminate dangers,
- knows the acknowledged standards, rules and guidelines of the technology.
- has the required knowledge for repair and mounting.

## 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.

**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

The product was manufactured in accordance with the generally accepted rules of the technology.

Observe the safety instructions and the operating instructions given in this manual, in order to avoid personal damage or material damage.

- Read these operating instructions thoroughly and completely, before you work with the product.
- Keep these operating instructions so that they are accessible to all users at any time.
- Pay attention to the current safety regulations, regulations for accident prevention and environmental protection of the country in which the product will be used.
- Use the ROEMHELD product only in perfect technical condition.
- Observe all notes on the product.
- Use only accessories and spare parts approved by the manufacturer in order to exclude danger to persons because of not suited spare parts.
- Respect the intended use.
- You only may start up the product, when it has been found that the incomplete machine or machine, in which the product shall be mounted, corresponds to the country-specific provisions, safety regulations and standards.
- Perform a risk analysis for the incomplete machine, or the machine.

Due to the interactions between the product and the machine/fixture or the environment, risks may arise that only can be determined and minimized by the user, e.g.:

- generated forces,
- generated movements,
- Influence of hydraulic and electrical control,
- etc.

## 6 Application

### 6.1 Intended use

This sequence valve is especially used in hydraulic power workholding with pressure-independent sequence controls or switching sequences with an adjustable time delay.

In addition, use in compliance with the intended purpose includes:

- 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 limits specified in the technical data (see data sheet).
- Use as described in this operating manual.
- Compliance with maintenance 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.

## 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 dismantling 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.

### ⚠️ 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".

## 8.1 Design

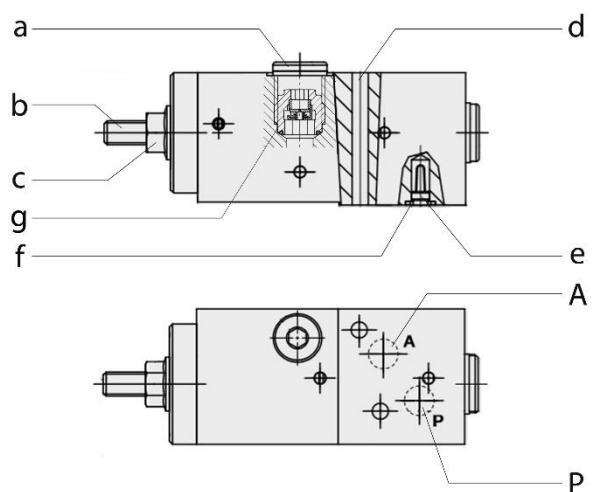


Figure 1: Design

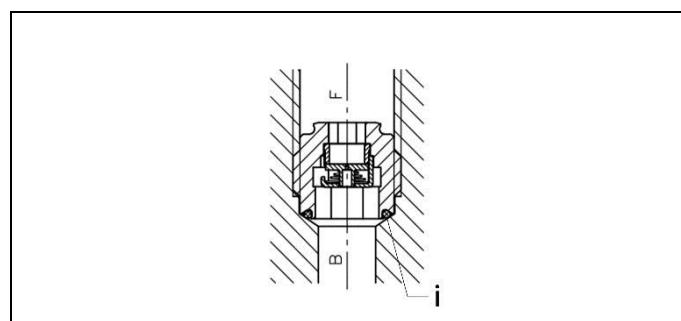


Figure 2: Orifice check valve - installation variants

a	Bleeding screw SW 6	f	O-ring
d	Adjusting screw SW 4	g	Mounting space of orifice check valve
c	Sealing nut SW 13	i	O-ring of orifice check valve
d	Mounting holes (2x)	P	Port P
e	Plug-in filter	A	Port A

## 8.2 Connection of the hydraulic equipment

- 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.

**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.

**⚠ 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).

**9 Start up**
**⚠ WARNING**
**Injuries due to misuse, incorrect operation or abuse!**

Injuries can occur if the product is not used within the intended use and the technical performance data.

- Before start up, read the operating instructions!

**⚠ CAUTION**
**Operating pressure of 250 bar does not exceed**

The maximum operating pressure of 250 bar must not be exceeded.

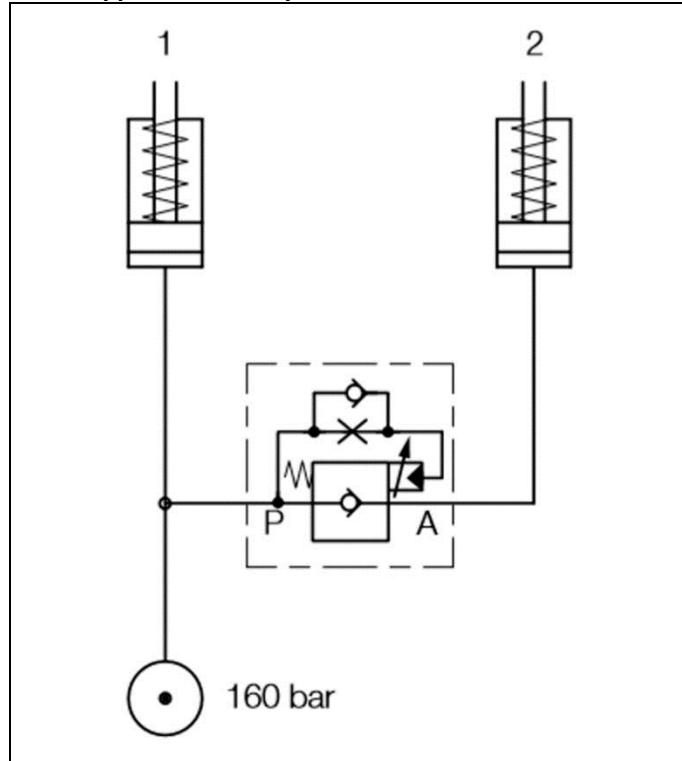
**9.1 Application example**


Figure 3: Application example

P	Inlet	A	Outlet
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**9.2 Clamping cycle**

1. Cylinder 1 moves without pressure against the stop.
2. Oil pressure increases up to 160 bar.
3. After the adjusted switching time the sequence valve opens and cylinder 2 moves almost without pressure against the stop. In the process, cylinder 1 becomes again nearly pressureless.
4. The oil pressure at both cylinders increases up to 160 bar.

**9.3 Adjusting instructions**
**⚠ NOTE**
**Bleed the hydraulic system**

During start up, the hydraulic system must be well bled to ensure a constant switching time. Carefully open the bleeding screw on the sequence valve at low pressure until bubble-free oil escapes. Repeat this procedure after a few operations.

To adjust the switching time it is necessary

- that the intended operating pressure has been adjusted;
- that the hydraulics are at operating temperature.

The adjusting screw is screwed in ex works up to the stop, i.e. to free flow and zero switching time. The lock nut of the adjusting screw is designed as a sealing nut. The adjusting screw may therefore only be adjusted in the depressurised mode.

Adjust the desired switching time:

1. Measure existing switching time.
2. Loosen the sealing nut in depressurised mode. Make sure that the adjusting screw does not move.
3. Extend switching time → Screw out adjusting screw.  
Shorten switching time → Screw in adjusting screw.
4. Tighten sealing nut. Make sure that the adjusting screw does not move.
5. Measure existing switching time. If not ok, repeat the adjustment from point 2.

Drive a few switching cycles after each adjusting procedure and only then measure!

**10 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.

**10.1 Function**

A poppet valve is built into the housing, which can be opened by the hydraulically-operated control piston. When pressure is applied to port P, hydraulic oil flows through an orifice check valve to the control piston. Since the piston stroke is relatively long, it takes a few seconds for the control piston to open the poppet valve. The delay time depends on the piston stroke, which is limited by the adjusting screw.

## 10.2 Troubles of functioning

### ⚠ CAUTION

#### Malfunctions!

Chips, coolants and cutting fluids can cause malfunctions.

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

## 10.3 Special features

When using this sequence valve, some special features must be taken into account which do not occur with pressure-dependent sequence valves:

### 1. Reduction of switching time

When cylinder 1 extends under load, i.e. not nearly pressureless, the pressure at port P increases. Thus, the switching time already starts to run before the cylinder 1 has driven against the stop. The longer this time lasts, the shorter is the remaining delay time.

### 2. Pressure increase in the delay phase

Unlike pressure-dependent sequence valves, the pressure at port P can rise to the maximum operating pressure of the power unit during the delay time. This could trigger the signal "clamped" on pressure switches, even though the clamping process has not yet been completed.

### 3. Pressure drop in front of the sequence valve

Unlike pressure-dependent sequence valves, the pressure at port P drops completely after the delay time has elapsed when the components connected to port A extend almost without pressure. Possible remedies include three "Examples of how to avoid a pressure drop" in the data sheet on page 2.

### 4. Influences on the switching time

Operating pressure	↓		
Oil temperature	↓	=	longer switching time ↑
Oil viscosity	↑		

Operating pressure	↑		
Oil temperature	↑	=	shorter switching time ↓
Oil viscosity	↓		

## 11 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!**

Regular maintenance work on the valve is not required.

Plug-in filters are inserted in ports **A** and **P** to protect the valve against contamination.

If the function of the valve is disturbed, check the permeability of the plug-in filter (**b**). Clogged plug-in filters can be removed by screwing in a metal screw M3.5.

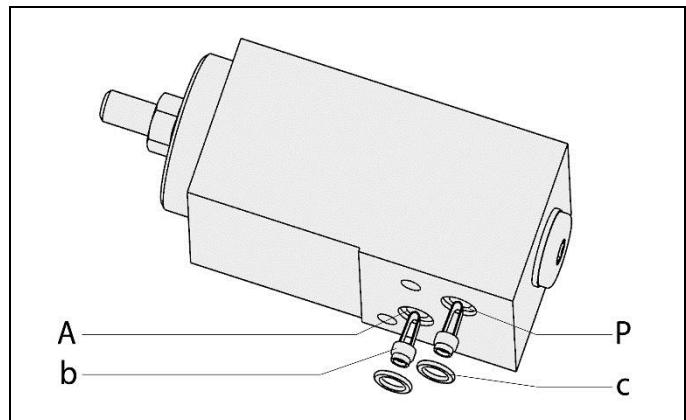


Figure 4: Change filter elements

A Port A	b Plug-in filter
P Port P	c O-ring

### 11.1 Plan for maintenance

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

### 11.2 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 switching time!

The function and the preset switching time have to be checked at regular intervals.

### 11.3 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.

## 12 Trouble shooting

Fault	Cause	Remedy
Irregular switching time	Variation of the viscosity (temperature)	Adjustments are to be made at operating temperature
It is not possible to adjust the switching time	Filter clogged	Check the permeability of the plug-in filter
	Check valve is leaking due to swarf in the hydraulic oil	Clean or replace valve
	Orifice check valve incorrectly installed	Correct installation see chapter "Installation".

## 13 Technical characteristics

### Parameters Type

Type	2954 620/ 2954 630
Max. operating pressure [bar]	250
Min. operating pressure [bar]	40
Adm. flow rate [l/min]	8
Weight [kg]	1.3

### Hydraulic fluids

#### 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)

#### Proposal, tightening torques for screws of tensile strength 8.8, 10.9, 12.9

#### NOTE

The indicated values are approximate values and have to be interpreted according to the user's application!  
See note!

Thread	Tightening torque [Nm]		
	8.8	10.9	12.9
M3	1,3	1,8	2,1
M4	2,9	4,1	4,9
M5	6,0	8,5	10
M6	10	15	18
M8	25	36	45
M10	49	72	84
M12	85	125	145
M14	135	200	235
M16	210	310	365
M20	425	610	710
M24	730	1050	1220
M30	1,450	2100	2450

**Note:** Valid for workpieces and set screws made of steel with metric thread and connecting surface dimensions as per DIN 912, 931, 933, 934 / ISO 4762, 4014, 4017, 4032

In the table values for tightening torques the following is considered:

Design steel/steel, friction value  $\mu_{ges} = 0.14$  - not oiled, utilisation of the minimum yield point = 90%.

#### NOTE

#### Further information

- For further technical data see ROEMHELD data sheet. C29546

## 14 Accessory

#### NOTE

#### Accessories

- See data sheet.

## 15 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.

## 16 Declaration of manufacture

### Manufacturer

Römheld GmbH Friedrichshütte  
Römheldstraße 1-5  
35321 Laubach, Germany  
Tel.: +49 (0) 64 05 / 89-0  
Fax: +49 (0) 64 05 / 89-211  
E-mail: info@roemheld.de  
www.roemheld.com

### 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:  
Dipl.-Ing. (FH) Jürgen Niesner, Tel.: +49(0)6405 89-0.

**Römheld GmbH**  
**Friedrichshütte**

Laubach, 08.01.2020