Sequence Valve ND 5

with time-dependent switching sequence, max. operating pressure 250 bar

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1 Description of the product

The adjustable switching delay allows a time-dependent switching sequence of hydraulic elements within a hydraulic circuit, independent of the hydraulic pressure.

On principle the valve has to be preadjusted to the hydraulic conditions with reference to pressure, viscosity and temperature.

Parallel or series connection of several valves is possible. The compact design facilitates the installation directly at the clamping fixture.

2 Validity of the documentation

This document applies to the following products:

Sequence valve ND 5 of data sheet C 2.9545. The following types or part numbers are concerned:

Sequence valve ND 5

- 2954 836

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

6 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.

7 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 250 bar does not exceed

The maximum operating pressure of 250 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.

NOTE

Qualification of personnel

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

8 Application

8.1 Intended use

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

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.

8.2 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.

9 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.

10 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.

⚠ 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".

10.1 Design

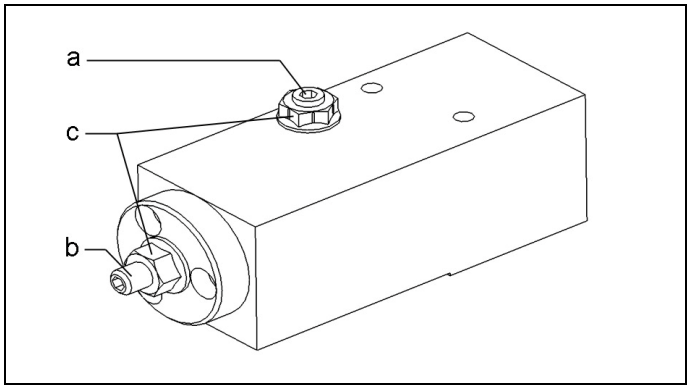

Figure 1: Design

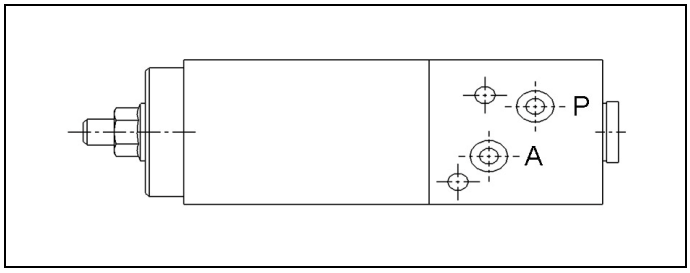

Figure 2: Ports

a	Throttle screw for rough adjustment	c	Sealing nut
b	Adjusting screw for precise adjustment	P	Inlet
		A	Outlet

10.2 Function

A control piston is mounted in the valve body that opens a check valve after an adjustable delay time. As long as pressure is applied to P, this check valve is first closed. The hydraulic oil flows through the flow control valve "rough adjustment" to the control piston, whose return stroke is limited by means of the adjusting screw "precise adjustment".

Adjusting possibilities:

Rough adjustment = Piston speed

Precise adjustment = Piston stroke

When the control piston opens the check valve, the hydraulic oil has free passage and the connected cylinders extend. After pressure relief at port P the hydraulic oil returns through the check valve from A to P and the connected cylinders retract. Also the control piston returns by the spring force to its off-position.

10.3 Installation

⚠ CAUTION

Malfunctions!

Chips, coolants and cutting fluids can cause malfunctions.

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

10.4 Connection of the hydraulic equipment

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

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).

11 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 should not exceed

The max. operating pressure must not be exceeded (see technical characteristics).

NOTE

Reproducibility of the time delay

The reproducibility of the adjusted time delay depends on constant hydraulic conditions. A highly variable oil temperature can change the adjusted delay time. It is therefore necessary to ensure that valve adjustment is always made at operating temperature.

Pressure increase

During the time delay the system pressure can increase to the maximum operating pressure depending on the rough adjustment of the throttle. That is the reason why the pressure switches can give the signal "Clamped" even though the clamping process has not yet been completed.

NOTE

Pressure drop

The application example shows a typical application. As described, when opening this sequence valve the pressure at cylinder 1 will drop completely. Only after cylinder 2 has moved against the stop, the pressure will be built up again. Possible remedies show 3 examples on data sheet C 2.9545.

11.1 Application example

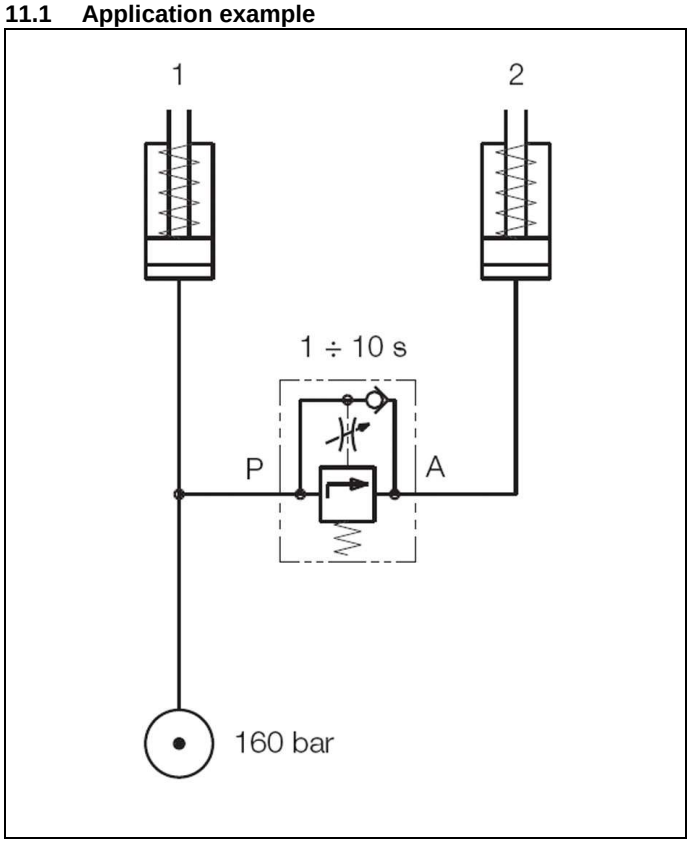

Figure 3: Application example

P Inlet	A Outlet

11.2 Clamping sequence

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 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.

11.3 Adjusting instructions

NOTE

Bleed the hydraulic system

During start up the hydraulic system has to be well bled.

The valve is preset at the factory to approx. 7 seconds at a flow rate of 2 l/min and a pressure of 150 bar. If the adjusted time has to be changed, it is usually sufficient to use the adjusting screw "precise adjustment". Otherwise a basic setting has to be made.

Basic setting

All settings must be made in **depressurised mode** only, otherwise hydraulic oil will escape. When loosening or tightening the sealing nut, hold the set screw (hexagon socket) to avoid changes of the setting.

1. Loosen the sealing nut "precise adjustment" and unscrew the set screw (**b**) up to the stop. Tighten sealing nut (**c**).
2. Operate the hydraulic system several times and measure the delay time. Nominal value 7-10 seconds.
3. If the preset time is longer, loosen the sealing nut (**c**) "rough adjustment" and slightly unscrew the adjustment screw (**a**). Tighten the sealing nut (**c**) and repeat measurement until the nominal value is obtained.
4. Adjust shorter times by the "precise adjustment": Loosen the sealing nut (**c**) "precise adjustment" and screw in the set screw (**b**) (several turns).

⚠ WARNING

Locking function of the check valve is cancelled

If the set screw (**b**) is screwed in beyond a sensible stop, the locking function of the check valve will be cancelled and the valve will switch immediately.

5. Retighten the sealing nut and measure the time.

12 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 bleeded 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.

13 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) or on request!

13.1 Plan for maintenance

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

13.2 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 delay time!

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

13.3 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.

14 Trouble shooting

Trouble	Cause	Remedy
Delay time irregular	Variation of the viscosity (temperature)	Adjustments are to be made at operating temperature
It is not possible to adjust the delay time	Basic setting is not correct	Make basic setting as per 9.3
	Check valve is leaking due to swarf in the hydraulic oil	Clean or replace valve

15 Technical characteristics

Parameters Type

Type	2954 836
Max. operating pressure in (primary side) [bar]	250
Min. operating pressure in (primary side) [bar]	30
Adm. flow rate [l/min]	8
Adjusting range of time delay [s]	approx. 1-10
Weight [kg]	1.5

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 cleanness. 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)

16 Accessory

NOTE

Accessories

- See data sheet.

17 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.

18 Declaration of manufacture

Manufacturer

Römheld GmbH Friedrichshütte
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Fax: +49 (0) 64 05 / 89-211
E-mail: info@roemheld.de
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Declaration of manufacture of the products

Sequence valve ND 5 of data sheet C 2.9545. The following types or part numbers are concerned:

Sequence valve ND 5

- 2954 836

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 and EN 982, 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, 09.04.2014