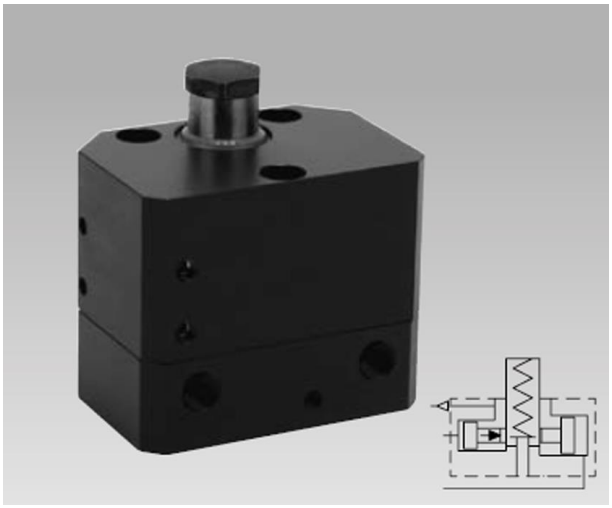
Work support clamp with fail-safe function

with pneumatic position monitoring, double acting



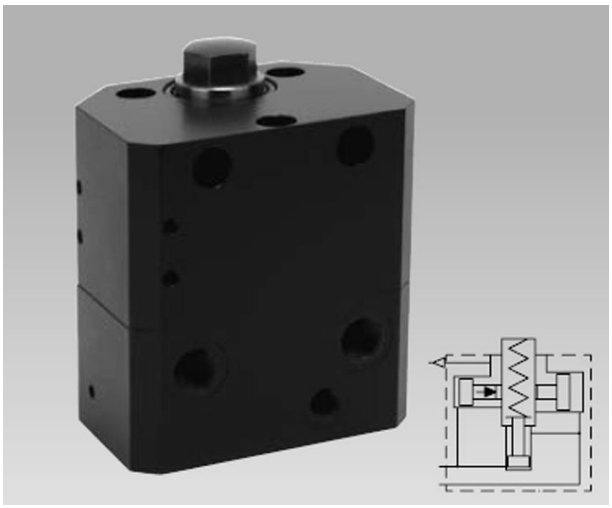


Table of contents

1 Description of the product

Hydraulic work supports are used to provide a self-adjusting rest for the workpiece during the machining operations. They compensate for the workpiece surface irregularities, also deflection and vibration under machining loads.

Hydraulic locking is made together with hydraulic clamping of the workpiece, or independently.

Due to the fail-safe function of the support plunger, these work supports are particularly suitable for:

- Manufacturing systems with pallet store
- Clamping fixtures with workpiece loading via handling systems
- Transfer lines
- Automatic manufacturing systems
- Assembly lines
- Indexing machines
- Special machine tools

2 Validity of the documentation

This document applies to the following products:

Work supports with fail-safe function in data sheet B1930. The following types or part numbers are concerned:

- 1931-005, -025
- 1933-005, -025
- 1935-006, -026

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.

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

Work supports are used for industrial/commercial applications in order to protect workpieces against vibration and deflection. They must only be operated with hydraulic oil.

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

- Use within the capacity indicated in the technical data sheets.
- 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!
Modifications can lead to weakening of the components, reduction in strength or malfunctions.

- Do not modify the product!

⚠ CAUTION

Transverse forces
The products are not suitable to compensate side loads.

The use of the products is not authorised:

- For domestic use.
- For use at fairgrounds and amusement parks.
- In food processing or in areas with special hygiene regulations.
- In mines.
- In ATEX areas (in explosive and aggressive environments, e.g. explosive gases and dusts).
- If physical effects (welding currents, vibrations or others) or chemically acting media damage the seals (resistance of the seal material) or components and this can lead to functional failure or premature failure.

Special solutions are available on request!

7 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 dropping parts!

Some products have a heavy weight and can cause injury when dropping.

- Transport products professionally.
- Wear personal protection equipment!

Weight specifications see chapter "Technical characteristics".

Poisoning due to contact with hydraulic oil.

Wear, damage of the seals, aging 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

Transverse forces and forced states to bolt

Side loads and forced conditions on the plunger lead to premature failure.

- Provide external guides.
- Avoid forced conditions (overdetermination) of the plunger. Do not introduce any torques.

NOTE

Vent connection

- If there is a possibility that aggressive cutting lubricants and coolants penetrate through the sintered metal air filter into the interior of single-acting products, a vent hose has to be connected and be placed in a protected position.
- It is absolutely necessary to follow the instructions for venting of the spring area see data sheet G0.110.

7.1 Design

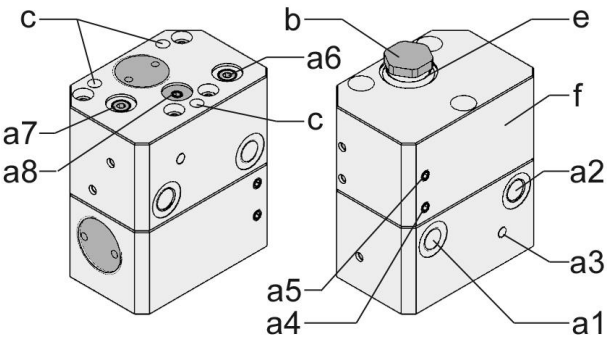


Figure 1: Components

a1 Hydraulic port A pipe thread (locking)	a6 Manifold-mounting type hydraulic port A, bottom side
a2 Hydraulic port B pipe thread (unlocking)	a7 Manifold-mounting type hydraulic port B, bottom side
a3 Venting port B	a8 Venting port B, bottom side
a4 Pneumatic port M1 (support plunger retracted)	b Contact bolt
a5 Pneumatic port M2 (support plunger extended)	c Fixing possibility
	e Plunger
	f Body

Versions:
Contact of the plunger by spring force

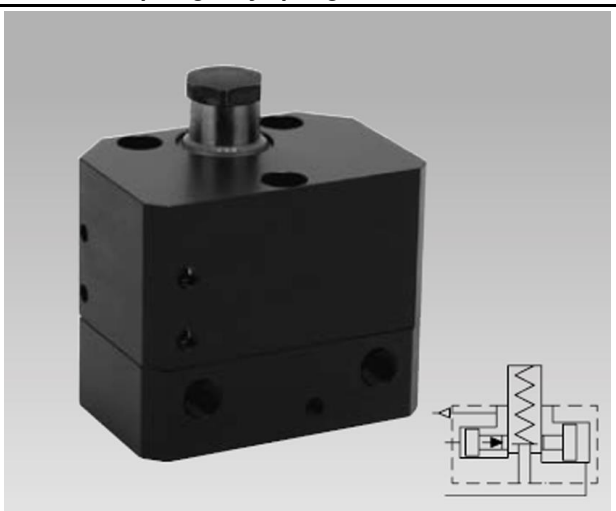


Figure 2: off-position extended

The plunger is extended in off-position.

Contact of the plunger by hydraulic pressure

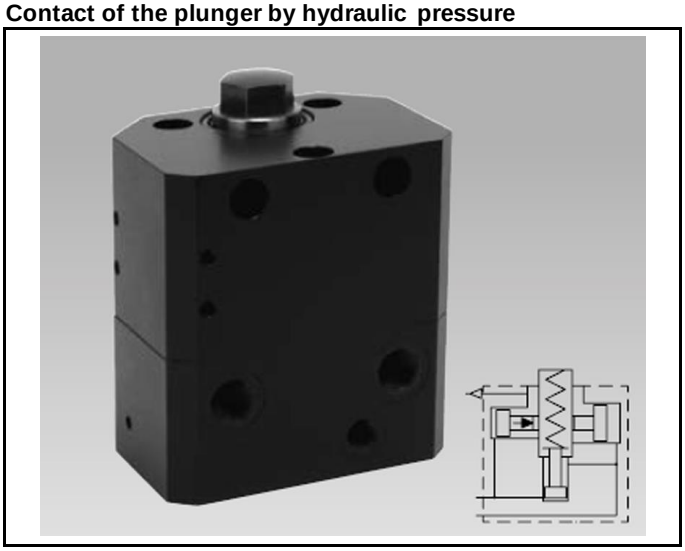


Figure 3: Hydraulically extended

The plunger is retracted in off-position. It moves forward with a light spring force against the workpiece, when hydraulic pressure is applied. With increasing oil pressure, the support plunger locks hydraulically.

7.2 Instructions for safe operation

⚠ CAUTION

Transverse forces
The products are not suitable to compensate side loads.

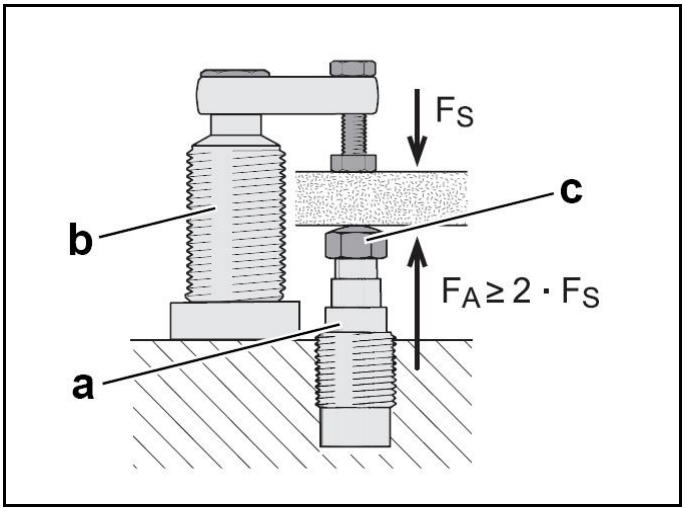


Figure 4: Principle, force flow during support

a Work support b Swing clamp	c Contact bolt

- Design the operating pressure so that support force F_A is more than twice the clamping force F_S. This reserve allows the compensation of machining forces.
- The recommended operating pressure is at least 100 bar.
- Operate the work supports only with mounted contact bolt to avoid damage of the plunger and penetration of liquids.
- Contact bolts and extensions with large weight can influence the functions of the work support.

7.3 Admissible oil flow rate

⚠ WARNING

Injury due to overload of the element
High-pressure injection (squirting out of hydraulic oil under high pressure) or flying components!
- Due to throttling or closing of ports a pressure intensification can occur.
- Connect the ports professionally!

⚠ CAUTION

Malfunction or early failure
Exceeding the max. flow rate can lead to overload and premature failure of the product..
- The maximum flow rate must not be exceeded!

7.3.1 Calculation of the admissible flow rate

Admissible flow rate
The admissible flow rate or the admissible stroke speed is valid for vertical mounting positions in combination with standard add-on parts as clamping arms or contact bolts, etc.
In case of other mounting positions and/or add-on parts the flow rate has to be reduced.
If the pump flow rate divided by the number of elements is larger than the admissible flow rate of one element, the flow rate has to be throttled.
This prevents an overload and therewith an early failure.
The flow rate can be checked as follows:

$$Q_P \leq 0{,}06 \cdot \dot{V}_Z \cdot n \quad \text{and/or} \quad Q_P \leq 6 \cdot v_Z \cdot A_K \cdot n$$

for clamping elements and work supports (indicated on the data sheets)

Maximum piston speed
At specified pump flow rate Q_P and with the effective piston area A_K the piston speed can be calculated as follows:

$$v_m < \frac{Q_P}{6 \cdot A_K \cdot n}$$

Legend

$\dot{V}_Z$ = Admissible flow rate of the element in [cm³/s]
Q_P = Flow rate of the pump in [l/min]
A_K = Piston area in [cm²]
n = Number of elements, same dimensions
$v_Z = v_m$ = Admissible/maximum stroke speed in [m/s]

NOTE

Flow rate
- The maximum oil volume and/or the maximum stroke speed depend on the corresponding product.
  - For clamping cylinders see data sheet A 0.100.
  - For clamping elements, work supports, hydraulic valves, power units and other hydraulic elements indicated on the corresponding data sheets.

Further "things worth knowing about hydraulic cylinders, basics, detailed knowledge and calculations on hydraulic cylinders" see Technical information on the internet!

7.3.2 Throttling of the flow rate

The throttling always has to be effected in the supply line to the element. Only thus pressure intensification and thereby pressures exceeding the operating pressure are avoided. The hydraulic circuit diagram shows flow control valves which allow oil return from the element without any impediments.

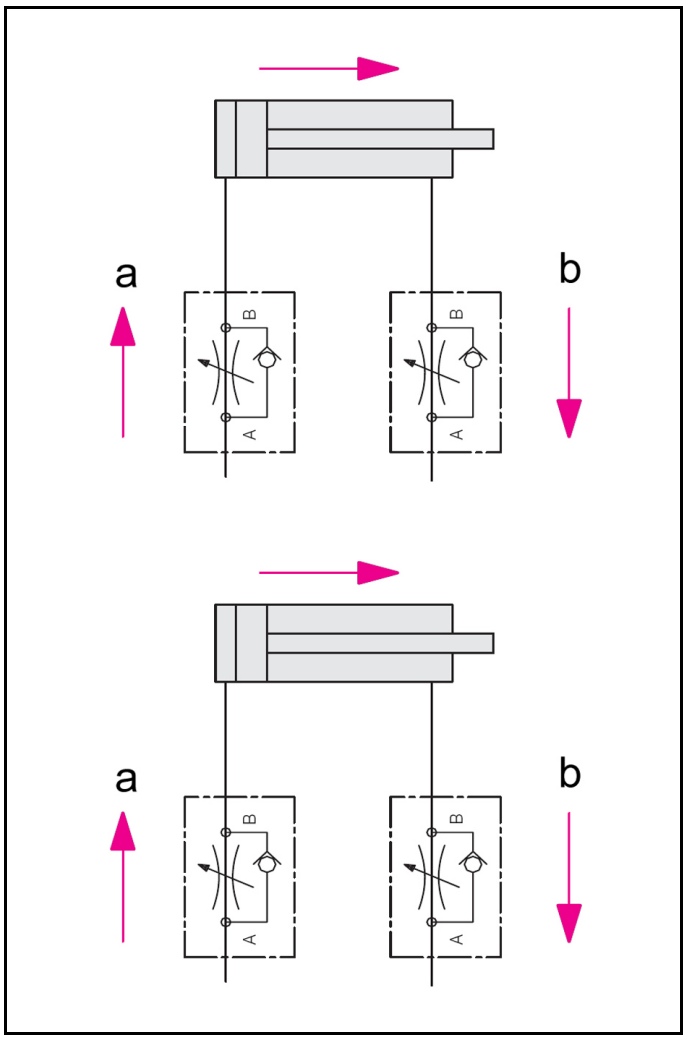


Figure 5: Hydraulic circuit diagram without flow control valves

a Throttling direction	b Free flow

If a return-flow throttling is required due to a negative load, it must be guaranteed that the max. operating pressure (see technical characteristics) will not be exceeded.

7.4 Installation of pipe-mounted types

1. Clean the support surfaces.
2. Fix the element at the support surface (see figure "Mounting types).

⚠ WARNING

Product can fall down

Injury by falling products!

- Safety shoes have to be worn to avoid injuries due to falling objects.

⚠ CAUTION

Product not properly tightened

Product can loosen during operation.

- Fix and/or secure with sufficient tightening torque.

NOTE

Determination of the tightening torque

To determine the tightening torque of the fixing screws a screw calculation as per VDI 2230 page 1 has to be effected. The screw material is indicated in the chapter "Technical characteristics".

Proposals and approximate values for the tightening torques see chapter "Technical characteristics".

7.5 Installation of manifold-mounted types

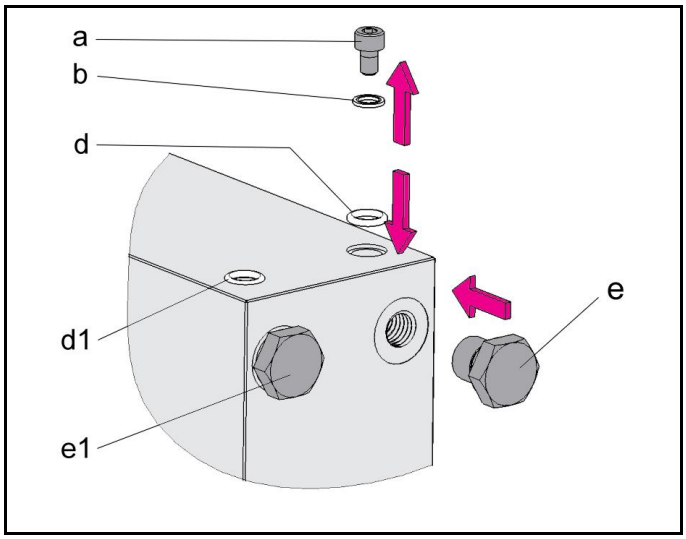


Figure 6: Example of the preparation for hydraulic ports without pipes

NOTE

Arrangement of the ports

- The figure shown is a schematic sketch. 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, according to the version)	e1 Mounted screw plug

1. Drill the holes for hydraulic oil supply and return in the fixture (see also data sheet or installation drawing).
2. Grind or finish mill flange surface (Ra ≤ 0.8 and a flatness of 0.04 mm to 100 x 100 mm. Marks, scratches, shrink holes are not admissible on the surface.)

For some versions:

3a. Remove socket head cap screws and sealing rings. Insert O-rings (accessory, if required).

3b. Seal pipe ports with screw plug (accessory, if required)

4. Clean the support surfaces.
5. Position and fix on the fixture.
6. Install bleeding screws at the upper ends of the piping.

⚠ CAUTION

Product not properly tightened
Product can loosen during operation.
- Fix and/or secure with sufficient tightening torque.

NOTE

Tightening torques
- The tightening torques for the fixing screws have to be designed with reference to the application (e. g. as per VDI 2230).

Proposals and approximate values for the tightening torques see chapter "Technical characteristics".

7.6 Connection of the hydraulic equipment

⚠ CAUTION

Work by qualified personnel
- Works only to be effected by authorised personnel.

1. Connect hydraulic lines to qualifying standards and pay attention to scrupulous cleanness (A = Extend, B = Retract)!

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.

Connection of the hydraulic
Further connection data, plans or similar (e. g. hydraulic, electric circuit diagrams or electrical parameters) see enclosures!

8 Start up

⚠ WARNING

Poisoning due to contact with hydraulic oil.
Wear, damage of the seals, aging 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!
Components of the product make a movement while they are in operation, this can cause injuries.
- Keep parts of the body and items out of the working area!

⚠ CAUTION

Injury due to bursting or malfunction
Exceeding the max. operating pressure (see technical data) can cause the product to burst or malfunction.
- The maximum operating pressure must not be exceeded.
- If necessary, avoid overpressure by using suitable valves.

1. Check tight seat.
2. Check tight seat of the hydraulic ports (check tightening torque of the hydraulic ports).
3. Bleed the hydraulic system.

NOTE

Clamping time
- Without bleeding the clamping time will be considerably prolonged and function problems may occur.

8.1 Bleeding of pipe-mounted types

1. Loosen carefully at low pressure union nut of the pipe at the hydraulic ports.
2. Pump until bubble free oil comes out.
3. Fasten union nuts of the pipe.
4. Check tightness.

8.2 Bleeding of manifold-mounted types

1. Loosen carefully the bleeding screws of the fixture at low pressure.
2. Pump until bubble free oil comes out.
3. Fasten the bleeding screws.
4. Check correct function.
5. Check sealing of the hydraulic connections!

8.3 Start up of the position monitoring

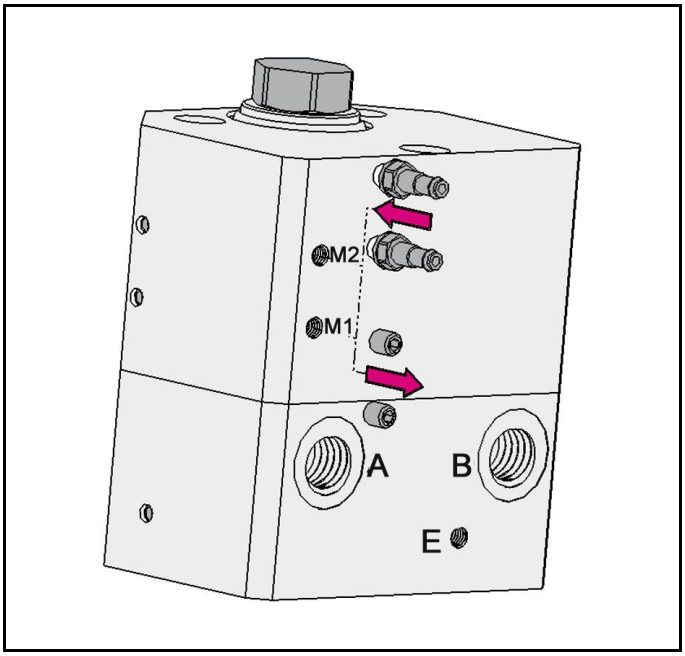


Figure 7: Design

M1 Support plunger retracted	M2 Support plunger extended

1. Remove set screws M1 and M2.
2. Screw in insertion nipple fitting or L-type insertion nipple fitting.
   Important: Do not close venting port!
3. Connect pneumatic ports from the differential pressure switch to the position monitoring.
4. The piston position will be signalled by the pressure build up at the upper or lower pneumatic port:

Pressure build-up	Support plunger is
Upper (M2)	extended (unclamped)
Lower (M1)	retracted (clamped)

The following charts show the signal course during one clamping and unclamping process:

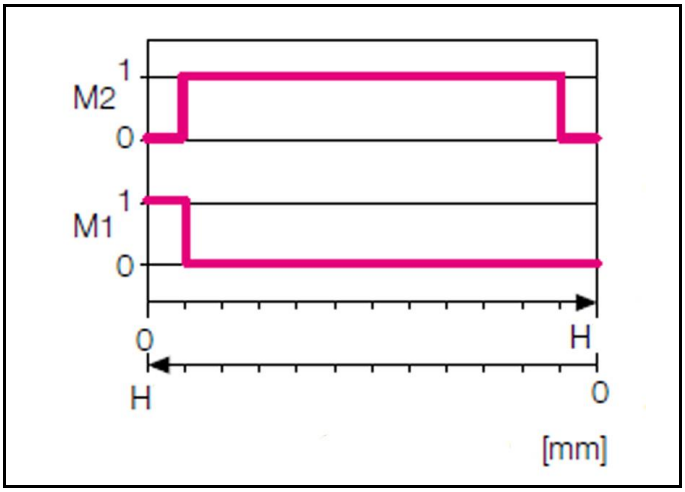


Figure 8: Signal course clamping and unclamping process

M1 Support plunger retracted	0 Passage
M2 Support plunger extended	1 closed
H Stroke of support plunger	

NOTE

After realising the total stroke there will be given just no more signal at M2. So you can realise if a workpiece has been inserted or not. If a workpiece has been inserted, the clamping point is before the total stroke (M2 = 1), if no workpiece is available, the total stroke will be realised ((M2 = 0).

NOTE

Evaluation of the pneumatic pressure

- The dependence between pipe length, jet diameter, leakage, pressure and flow rate determines the measurable pressure differential. In case of a too high flow rate the pressure differential is too low.
- For the interpretation of the pneumatic pressure we recommend to use a differential pressure switch. Parallel connection of up to threer elements is possible.

Impurities in the compressed air

- The pollution of the compressed air can lead to interferences in the measurement .

9 Maintenance

⚠ WARNING

Burning due to hot surface!

During operation, surface temperatures on the product can exceed 70°C.

- Maintenance and repair work should only be performed in a cooled down condition and/or with protective gloves.

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!

⚠ CAUTION

Maintenance and repair work

All maintenance and repair works only to be effected by ROEMHELD service staff.

9.1 Cleaning

⚠ CAUTION

Material damage, damage to moving components

Damage to piston rods, plungers, bolts, etc., as well as wipers and seals can lead to leakage or premature failure!

- Do not use cleaning agents (steel wool or similar) that cause scratches, marks or the like.

Material damage, damage or functional failure

Aggressive cleaning agents can cause damage, especially to seals.

The product must not be cleaned with:

- corrosive or caustic substances or
- organic, solvents such as halogenated or aromatic hydrocarbons and ketones (cellulose thinner, acetone, etc.).

The product must be cleaned at regular intervals, especially the area of the piston or the plunger housing has to be cleaned from swarf and other liquids.

9.2 Regular checks

1. Check tightness of hydraulic connections (visual control).
2. Check running surfaces (of the piston rod or bolt) if there are marks and scratches. Traces of marks can be an indication for a contaminated hydraulic system or an inadmissible side load of the block cylinder.
3. Leakage check at the housing - piston rod, bolt or flange.
4. Clamping force control by pressure control.
5. Check if the maintenance intervals are kept.

9.3 Maintenance intervals

⚠ CAUTION

All work by service personnel only!

- All works only to be effected by ROEMHELD service staff.

If a high availability has to be guaranteed, we recommend a preventive maintenance to be effected by ROEMHELD experts after 100,000 cycles.

NOTE

Exceeding of the load cycle can lead to a reduction of the load force or a failure of the element!

The exchange of the seal kit has to be made in case of external leakages. If a high availability has to be guaranteed, we recommend to change the seals at the latest after 1,000,000 cycles or 2 years.
The seal kit must be changed by ROEMHELD experts.

10 Trouble shooting

Trouble	Cause	Remedy
Plunger does not extend	Oil flow rate too high	Reduce oil flow rate
	Inner parts corroded	Repair required by ROEMHELD
	Penetration of cooling liquids	Repair required by ROEMHELD
	Broken spring	Repair required by ROEMHELD
Plunger does not retract	Inner parts corroded	Repair required by ROEMHELD
	Penetration of cooling liquids	Repair required by ROEMHELD
	Broken return spring	Repair required by ROEMHELD
Plunger moves back	Operating pressure not sufficient	Check the dimensioning of the operating pressure as per catalogue
		Adjust the operating pressure correspondingly
	Load (clamping and machining force) too high	Check dimensioning of the load
		Adjust the operating pressure correspondingly
		Use other elements (work support/swing clamp)

11 Technical characteristics

General characteristics

Types	Maximum operating pressure [bar]	Adm. load force [kN]
1931-0X5	500	**8.0**
1933-0X5	500	**20.0**
1935-006	400	**40.0**

Weights

Types	Stroke [mm]	Weight [kg]
1931-005	8	**1.8**
1931-025	8	**1.4**
1933-005	12	**3.5**
1933-025	12	**2.8**
1935-006	20	**15.3**
1935-026	20	**12.3**

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 µges = 0.14 - not oiled, utilisation of the minimum yield point = 90%.

NOTE

Further information

- For further technical data see ROEMHELD data sheet. B1930

12 Storage

⚠ CAUTION

Damage due to incorrect storage of components

In case of improper storage, the seals can embrittle and resinification of the anti-corrosive oil or corrosion on/in the element can occur.

- Storage in the packaging and moderate environmental conditions.
- The product must not be exposed to direct sunlight, since UV light may cause serious damage to the seals.

The elements are tested by default with mineral oil. The exterior of the elements is treated with a corrosion inhibitor.
The oil film remaining after the test provides for a six-month interior corrosion protection, if stored in dry and uniformly tempered rooms.
For longer storage times, the element has to be filled with a non-resinifying corrosion inhibitor and the outside surfaces must be treated.

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
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

Responsible person for the documentation:
Dipl.-Ing. (FH) Jürgen Niesner, Tel.: +49(0)6405 89-0.

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.

Laubach, 10.03.25