



Hydraulic Accumulator

Nominal volume 13 – 750 cm³, max. operating pressure 250 – 500 bar



Abb. 1: Hydro-Speicher

Table of contents

1	Description - accumulator unit
2	Validity of the documentation
3	Target group of this document
4	Symbols and signal words
5	For your safety
6	Application
7	Installation
8	Start up
9	Maintenance
10	Technical characteristics
11	Accessory
12	Storage
13	Disposal
14	Declaration of manufacture

1

1

1

2

2

3

4

5

6

6

6

6

7

1 Description - accumulator unit

The hydraulic accumulator contained in the power unit is part of Art. 3, Par. 3 DGRL 97/23/EC.

The product of volume and pressure is not larger than 200 (see Art.3 Par.1 No1.1b DGRL).

Thus, the reservoir is not a system requiring inspection in the terms of the German regulations on health and safety at work (BetrSichV),

i.e. paragraph 3 of the BetrSichV "Special regulations for plants subject to inspections" is not applicable. That's the reason why no time limits for periodic inspections are required as per § 15 BetrSichV.

But the reservoirs are work equipment and have to be checked accordingly. Type, extent and periods have to be determined by the employer.

Liquids are more or less incompressible and therefore are not in the position to store pressure energy. For hydraulic accumulators the compressibility of nitrogen is used to store liquids. A gas-tight diaphragm separates the liquid zone from the gas zone.

In the bottom of the diaphragm there is a valve disk that avoids a damage of the diaphragm if the hydraulic accumulator will be completely discharged. Nitrogen is filled in at the screw plug and provided with the required preload. For this purpose an appropriate filling and testing fixture is required.

NOTE

Pressure equipment directive

The offered products correspond to the regulations of paragraph 38 of the directives for pressure equipment 2014/68/EU and therefore do **not** require CE marking.

2 Validity of the documentation

Pressure switches of data sheet F 9.601. The following types or part numbers are concerned:

- 9601 311, 9601 511, 9604 310 and 9604 510
- 9606 102, 9606 109, 9605 610 and 9605 611

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

DANGER

Danger of life / heavy health damages

Stands for an imminent danger.

If it is not avoided, death or very severe injuries will result.

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

DANGER

Danger of explosion due to welding, soldering and mechanical works!

Due to works on the hydraulic accumulator, the stability of the component can be reduced.

- No processing!

Danger of explosion due to the use of incorrect filling media!

Hydraulic accumulators must **only** be filled with nitrogen!

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 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 / burning due to contact with energized parts!

- Before working on electric equipment, the energized parts must be de-energized and secured.
- Do not open protection covers at electric parts.
- All electrical works must only be realised by electricians.

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.

5.2.1 Equipment and safety devices

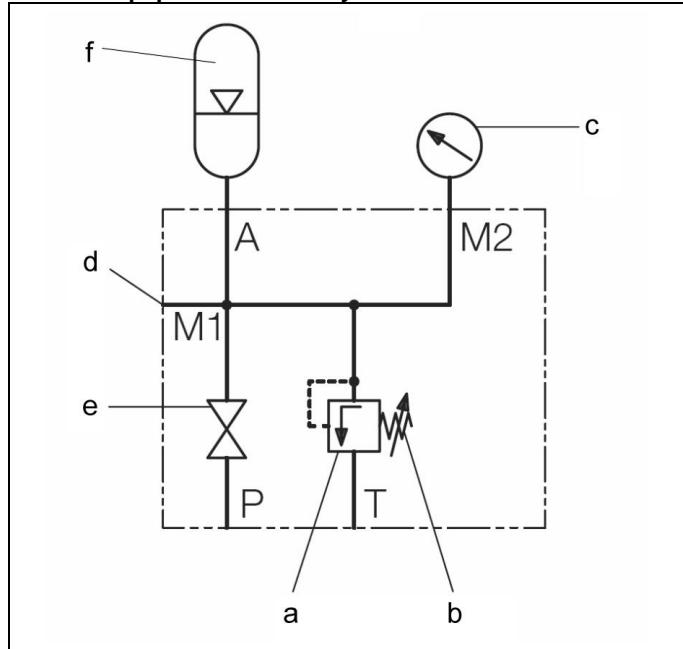


Figure 2: Example for equipment and safety devices

a Pressure relief valve (DBV)	d Test measuring port
b Relief device	e Shut-off valve
c Pressure gauge	f Hydraulic accumulator

Equipment, installation and operation of hydraulic accumulators differ from country to country.

In the Federal Republic of Germany, this is regulated for example by the "regulations on health and safety at work, BetrSichV" and/or EN14359.

For the safe installation of accumulators, it is recommended to follow the specifications of the technical regulations for pressure vessels (TRB).

These demand the following minimum equipment:

- Safety device for protection against excessive pressure (this must be type tested, either by prototypes or by individual approvals),
- Relief devices between hydraulic accumulator and shut-off device,
- Pressure measuring device with marking of the admissible operating overpressure,
- Connecting possibilities of a testing pressure gauge,
- Shut-off device.

Further accessories can be mounted:

- Safety devices for protection against excessive temperature,
- Electro-magnetically actuated relief valve.

5.2.1.1 Device for protection against excessive pressure / pressure relief valve (DBV)

The pressure relief valve shall protect the hydraulic accumulator against a pressure increase by more than 10 % of the maximum operating pressure.

Adjustment has to be effected with the maximum flow rate of the power unit. The reaction pressure of the pressure relief valve should be a little bit higher than the nominal pressure of the hydraulic accumulator.

The valve spindle of the pressure relief valve has to be secured against adjustment in the direction of higher pressure by means of distance plates and/or lead-sealing.

⚠ CAUTION

Damage of the hydraulic accumulator due to too high system pressure

The pressure relief valve of the power unit must not be adjusted above the maximum operating pressure of the hydraulic accumulator. In the case of "small accumulators" with a nominal volume below 100 cm³ pressure safeguard can be realised by the pressure relief valve at the power unit, when the adjusting spindle is secured against exceeding the maximum operating pressure. If "small accumulators" are located on workpiece pallets, that will be uncoupled from the power unit, a pressure relief valve has to be provided on each pallet.

5.2.1.2 Relief device

⚠ WARNING

Danger of injury due to high-pressure injection!

Hydraulic oil in the accumulator is under pressure.

Before working on the hydraulic system or the fixture, the hydraulic accumulator should be completely discharged.

To drain the accumulator, there are two possibilities:

- Completely unscrew the valve spindle of the pressure relief valve towards the lower pressure.
- Open an installed shut-off valve (see example).

5.2.1.3 Pressure gauge / pressure gauge connection

The pressure gauge shall indicate the actual pressure in the hydraulic accumulator. For this purpose a direct supply line has to be mounted. The pressure gauge at the power unit is not suitable for that purpose.

The maximum operating pressure of the hydraulic accumulator shall be indicated by a marking on the pressure gauge scale. Alternatively also a labelled plate or tag can be fixed.

For regular pressure tests a test pressure gauge can be connected to the test measuring port.

5.2.1.4 Shut-off device / shut-off valve

By means of the shut-off valve the hydraulic accumulator can be separated from the power unit and the fixture in order to realise adjusting and maintenance works without danger.

6 Application

6.1 Intended use

Hydraulic accumulators are used in industrial applications as energy accumulator for compensation of internal leakages or to compensate the volume in the case of temperature changes.

Energy storage

With intermittent cycles the rating of the pump and thereby energy can be saved. During the breaks the pump refills the hydraulic accumulator. If required, a higher flow rate is available for a short time.

Compensation for internal leakage

In power workholding most of the pressure generators work in a cycling mode controlled by a pressure switch. If hydraulic devices with internal leakages are connected, e.g. spool valves or rotary valve couplings, this leads to frequent switching on and off of the electrical drive motor.

The use of a small hydraulic accumulator considerably reduces the number of switching cycle and saves the material as well as energy.

Volume compensation in case of temperature changes

If hydraulic clamping systems will be separated from the pressure generator, there are considerable changes of the clamping pressure in the case of temperature variations (reference value ± 10 bar at $\pm 1^\circ\text{C}$).

A small hydraulic accumulator mounted at a protected place on the fixture, causes a volume compensation and reduces pressure variations. In addition a small leakage will not immediately result in a pressure drop. A pressure gauge for pressure control should be installed in any case.

Furthermore the following belongs to possible uses:

- 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!

Modifications can lead to weakening of the components, reduction in strength or malfunctions.

- Do not modify the product!

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.
- In areas for which special guidelines apply, especially installations and machines:
 - For the use on fun fairs and in amusement parks.
 - In food processing or in areas with special hygiene regulations.
 - In mines.
 - In explosive and aggressive environments (e.g. ATEX).
- For other operating and environmental conditions.

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 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.

⚠ 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.

Injury by cutting!

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

⚠ CAUTION

Heavy weight may drop

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

Malfunction or early failure

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

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

7.1 Design

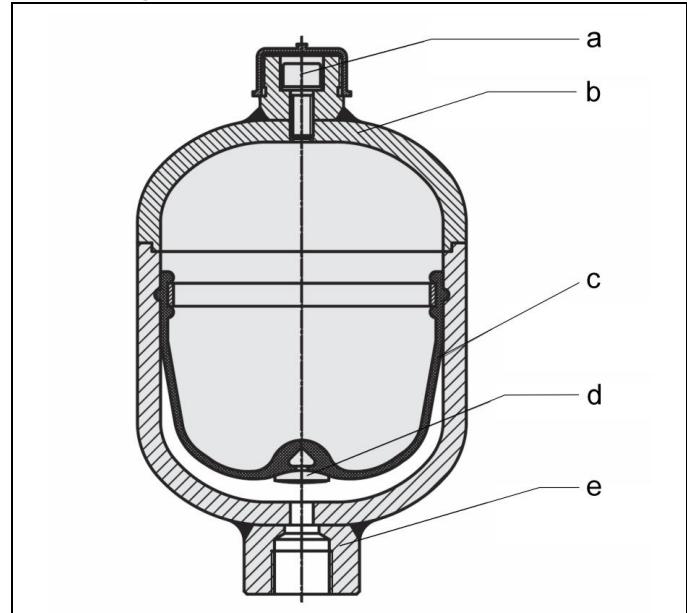


Figure 3: Components

a Screw plug	d Valve disk
b Pressure vessel	e Valve body
c Membrane	

7.2 Mounting types

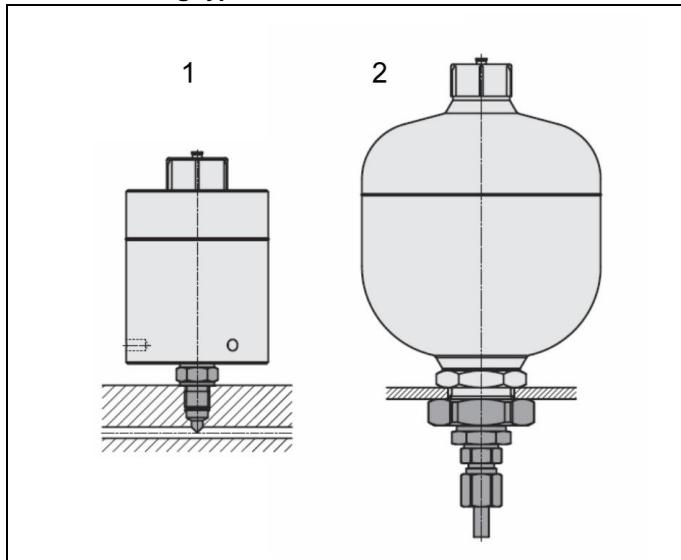


Figure 4: Fixing possibilities

1 Screw-in connection

2 Pipe connection

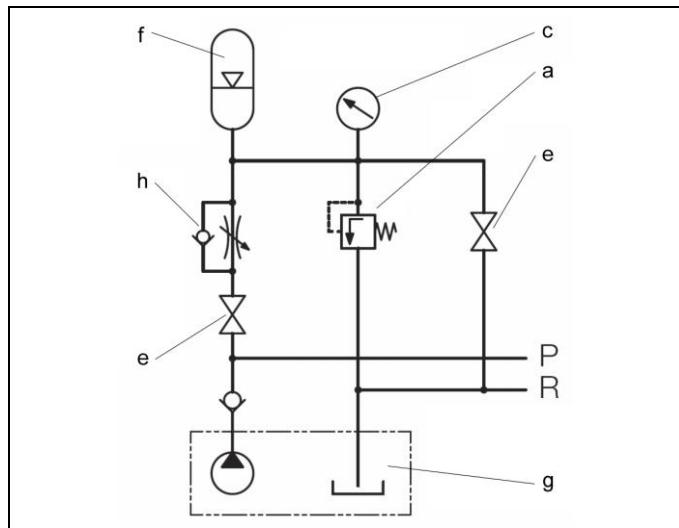


Figure 5: Components

a Pressure relief valve (DBV)
c Pressure gauge
e Shut-off valve

f Hydraulic accumulator
g Pressure generator
h Flow control valve

Mounting position

The product can be installed in any position.

The vertical mounting position is preferred. Other mounting positions can influence the performance.

To avoid accumulations of dirt, the connection of pressure fluids should always be mounted downward.

Keep free a space of approx. 150 mm above the screw plug. This space is required for filling with the filling device.

7.3 Fixing of the product

⚠️ WARNING

Injury by falling products!

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

⚠️ CAUTION

Damage of the product - tension due to fixing screws!

The fixing screws may not lead to tensions on the product.

Up to a nominal volume of 2 l and standard port the accumulators can be screwed directly onto the pipe.

The fixing of the diaphragm accumulator has to be selected, so that in case of operational vibrations or a possible breakage of the connecting pipe a safe support is guaranteed.

7.4 Admissible oil flow rate

Flow control

A hydraulic accumulator is in the position to supply a high flow rate within very short time.

Since this is not required or desired for the most applications, the flow rate should be throttled to save the accumulator diaphragm.

A flow control valve has to be installed so that the outflowing hydraulic oil will be throttled, but a quick charge of the accumulator will be guaranteed in opposite direction (see hydraulic circuit diagram).

8 Start up

⚠️ WARNING

Poisoning due to contact with hydraulic oil.

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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.

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⚠️ CAUTION

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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.

⚠️ CAUTION

Damage due to missing nitrogen filling!

Membrane will be damaged, if there is no counter pressure in the hydraulic accumulator.

Check gas preload!

Damage due to wrong test and filling device!

Use only original ROEMHELD test and filling devices.

8.1 Delivered condition

The hydraulic accumulators are delivered with the desired gas preload and are marked correspondingly.

On request also other preload pressures are available.

8.2 Check preload pressure

The gas preload has to be checked after installation

- one week after installation
- 8 weeks after installation

If no filling loss is observed, yearly checks are sufficient. If no test and filling device is available, the filling pressure can also be checked at the hydraulic side:

- Separate the hydraulically-filled accumulator by means of the shut-off valve from the system.
- Open slowly the relief device for discharge and observe the pressure loss at the pressure gauge.
- At the moment of complete discharge the pressure drops suddenly. This pressure is the filling pressure of the hydraulic accumulator.

8.3 Filling gas

Hydraulic accumulators may only be filled with nitrogen, that corresponds at least to class 4.0.

8.4 Filling / change preload pressure

This is only possible with an appropriate test and filling device. For filling of the diaphragm accumulators the ROEMHELD filling and test device has to be used.

Please contact us.

9 Maintenance

9.1 Basic maintenance instructions

Diaphragm accumulators are in general maintenance-free.

However to allow trouble-free function and a long life the following checks have to be realised:

- Gas preload
- Safety devices
- Pipe connections
- Fixing of the accumulator

9.2 Test intervals prefilling pressure

It is recommended to keep the following test intervals:

- after every installation,
- one week after installation,
- eight weeks after installation

If no noticeable gas loss appeared, the future test intervals can be made

- once a year.

Note

Continuous use at high operating temperatures requires shorter test intervals.

9.3 Service life

The service life of diaphragm accumulators depends on the width of pressure variations and the number of load changes. Similar to high-pressure hoses, you can assume a life of 6 years with conventional use.

With high operational availability, the test intervals should be kept.

10 Technical characteristics

NOTE

Further information

- For further technical data see ROEMHELD data sheet. F9601

11 Accessory

NOTE

Accessories

- See data sheet.

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.

ROEMHELD elements are tested with mineral oil. The exterior of the elements is protected against corrosion.

Is the period of storage up to the start-up not longer than 3 months, it is sufficient to store the preloaded hydraulic accumulator in a dry and cool place protected against direct sunlight.

The hydraulic accumulator can be installed in any position.

In order to avoid a penetration of dirt into the hydraulic accumulator, it should be ensured that the hydraulic port is closed.

If the storage is longer than 3 months, the prefilling pressure has to be reduced to 2 bar in order to prevent a deformation of the diaphragm.

For the storage of diaphragms, the standard DIN 7716 "Rubber products, requirements for storage, cleaning and maintenance" has to be considered.

13 Disposal

For disposal of the hydraulic accumulator the gas pressure must be discharged.

If required, appropriate safety measures have to be taken!

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.



Hazardous to the environment

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

14 Declaration of manufacture

Manufacturer

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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.

14.1 Declaration on design and manufacture in relation to ISO 13849 Part 2: Validation

Their design and manufacture took into account fundamental and proven safety principles of ISO 13849-2:2013.

- Appendix A - Mechanical systems
- Appendix C - Hydraulic systems

The above products are not designed as safety components.

The parameters, limitations, environmental conditions, characteristic values, etc. for the intended operation are defined in the documentation.

Laubach, 18.01.2022