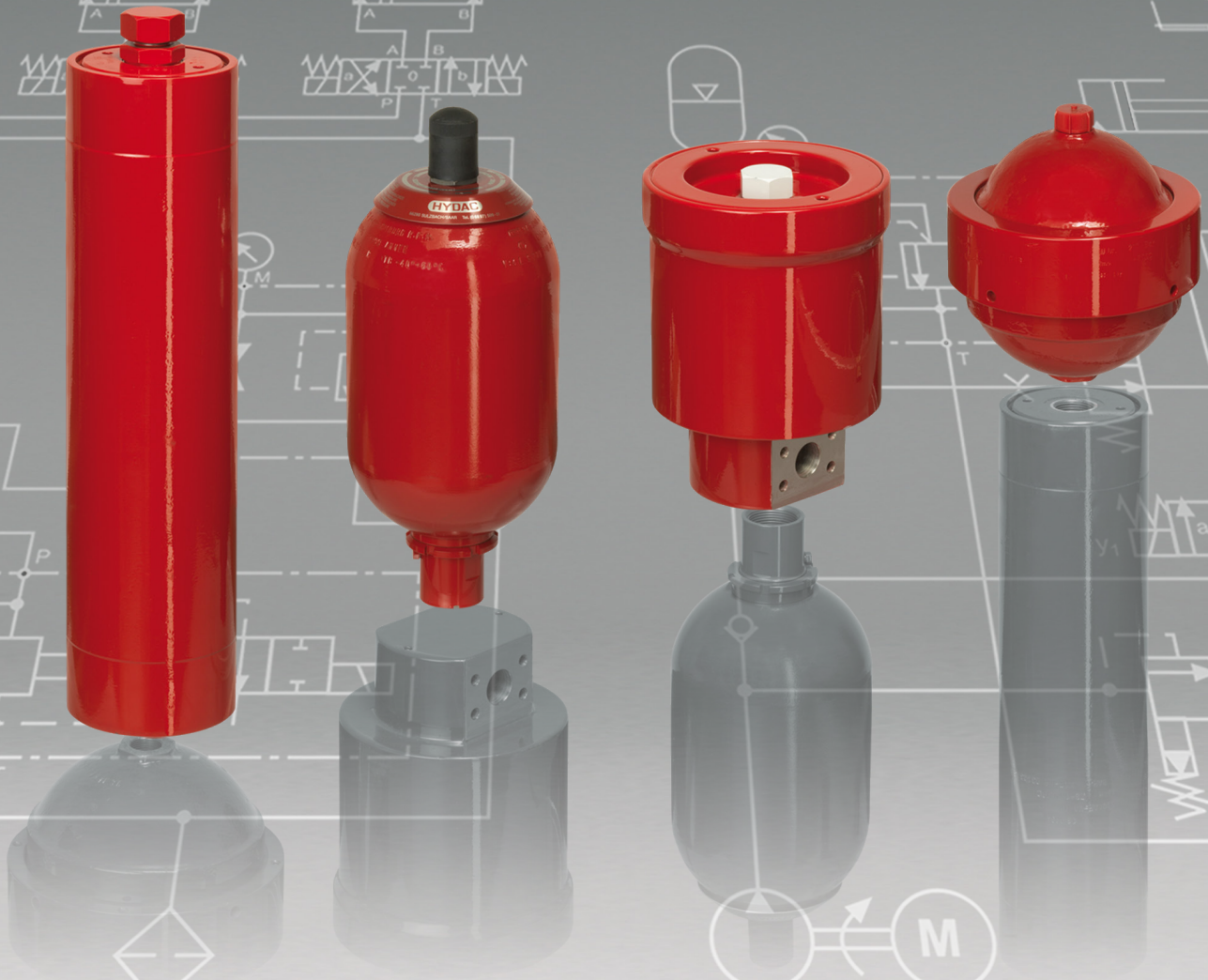
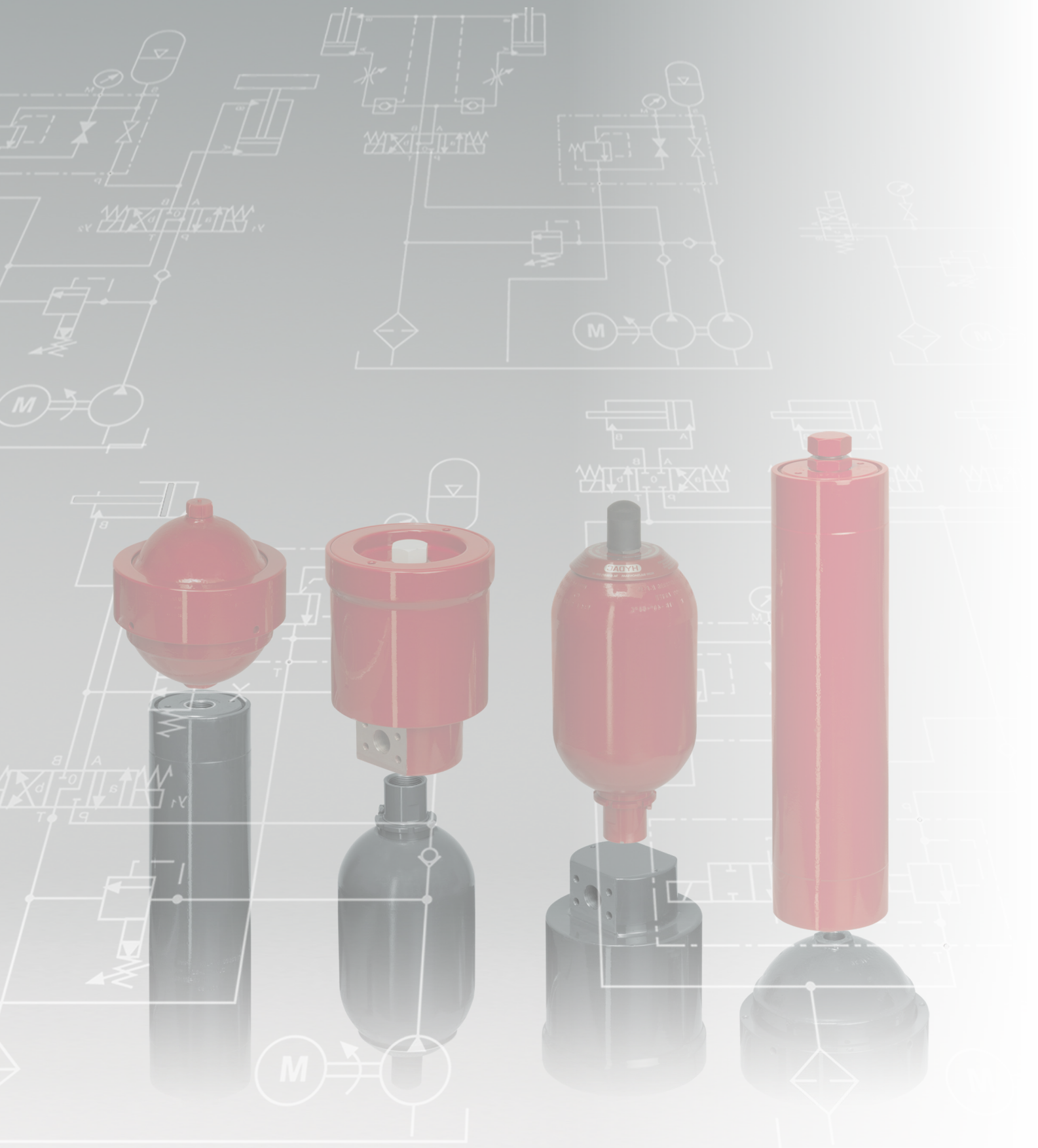


## Accumulator Technology.





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# 1. HYDAC ACCUMULATOR TECHNOLOGY FLUID ENGINEERING EFFICIENCY VIA ENERGY MANAGEMENT

## 1.1. GENERAL INFORMATION

HYDAC Accumulator Technology has many years' experience in the research & development, design and production of hydraulic accumulators.

All of HYDAC's bladder, piston, diaphragm and metal bellows accumulators are part of an unbeatable product range which supports hydraulic systems in almost all sectors at a component or unit level.

## 1.2. APPLICATION

The main applications of our accumulators are:

- Energy storage
- Emergency and safety functions
- Damping of vibrations, fluctuations, pulsations (pulsation dampers), shocks (shock absorbers) and noise (silencers)
- Suction flow stabilisation
- Media separation
- Volume and leakage oil adjustment
- Weight equalisation
- Energy recovery

## 1.3. ADVANTAGES

Accumulators improve the performance of the entire system. Here are some of their advantages in more detail:

- Improved functions
- Increased service lives
- Reductions in operating and maintenance costs
- Reductions in pulsations and noise

On the one hand, this means greater safety and comfort for the operator and the machine.

On the other hand, HYDAC accumulators enable efficient working in all applications.

## 1.4. PARAMETERS

The following parameters are all important parameters which enable the correct accumulator size to be chosen:

- Design pressure
- Design temperature
- Fluid displacement volume
- Discharge / charging velocity
- Fluid
- Acceptance specifications
- Mounting options

Our accumulator specialists will also use their technical expertise to help you select the right type of accumulator. The comprehensive range of HYDAC accessories simplifies installation and maintenance according to the specification.

# 2. QUALITY

Quality, safety and reliability are paramount for all HYDAC accumulator components.

They comply with the current regulations (or standards) for pressure vessels in the individual countries of installation.

HYDAC customers can therefore be assured to receive a high-quality accumulator product which can be used in every country in the world, depending on the certification.

For more details, please turn to section 4.

All the processes involved, from development, engineering and production to approval and delivery are defined by HYDAC's certified management system and the relevant international accreditation for the manufacture of pressure vessels.

In conjunction with the customer service department at HYDAC's headquarters, service is possible worldwide.

Service, repeat testing and repairs can be carried out at the HYDAC head office or at all national and international HYDAC sales and service centres.

HYDAC's worldwide distributor network means that trained staff are close at hand to help our customers.

This ensures that HYDAC customers have the support of an experienced workforce both before and after sale.



### 3. SAFETY INFORMATION

Hydraulic accumulators are closed vessels that are designed and built to hold pressurised fluids. They are charged with nitrogen which is separated from the fluid section by a piston, bladder, diaphragm or metal bellows. Hydraulic accumulators are specifically designed to store and then discharge pressurised fluids.

The regulations for the commissioning and operating of hydraulic accumulators which are in force at the place of installation must be observed. The plant operator is solely responsible for ensuring compliance with these regulations.

Relevant instructions are provided in the operating instructions for our products.

Manufacturers of hydraulic accumulators and products with hydraulic accumulators must observe the following principles:

- Removal or reduction of risks, insofar as this is reasonably possible
- Implementation of appropriate protective measures against risks which cannot be eliminated
- If required, user training regarding any residual risks and the appropriate special measures for reducing these risks during installation and/or operation.

For safe handling and operation, the operator must draw up a risk assessment for the installation site which focuses on the interaction with other components and risks.

The measures which result from this risk assessment must be implemented accordingly.

In the case of fundamental risks affecting hydraulic accumulators, e.g.:

- Excessive pressures and
- Increases in temperature (in the event of fire)

we already have the relevant products available.

On no account must any welding, soldering or mechanical work be carried out on the accumulator. After the hydraulic line has been connected, it must be completely vented. Work on systems with hydraulic accumulators (repairs, connecting pressure gauges etc.) must only be carried out once the fluid pressure has been released.

### 3.1. RISK OF EXCESSIVE PRESSURE

#### Products:

Safety and shut-off block for the fluid side in various sizes and designs.

See catalogue section:

- SAF/DSV safety and shut-off block  
No. 3.551

Gas safety valve and gas safety block for the gas side

Burst discs for gas and fluid sides

See catalogue section:

- Safety equipment for hydraulic accumulators  
No. 3.552

### 3.2. RISK OF RISE IN TEMPERATURE

#### Products:

Safety and Shut-off Block with solenoid-operated valve (open when deenergised) in conjunction with temperature monitoring.

See catalogue section:

- SAF/DSV safety and shut-off block  
No. 3.551 or on request

Temperature fuses

See catalogue section:

- Safety equipment for hydraulic accumulators  
No. 3.552



## 4. REGULATIONS

### 4.1. EUROPEAN PRESSURE EQUIPMENT DIRECTIVE (PED)

The European directive 2014/68/EU came into effect in July 2016. It replaces Directive 97/23/EC and governs the design, fabrication, conformity assessment and placing on the market of pressure equipment and assemblies with a maximum permitted pressure of more than 0.5 bar. It guarantees free movement of goods within the European Community. The EU member states are not permitted to prohibit, restrict or hinder pressure equipment being placed on the market and put into service on the basis of pressure-related risks, provided that the equipment in question meets the requirements of the European Pressure Equipment Directive, has undergone a conformity assessment and is labelled with a CE marking.

Hydraulic accumulators with a capacity of  $V \leq 1$  l and a maximum permitted pressure  $PS \leq 1000$  bar or a pressure capacity  $PS \cdot V \leq 50$  bar • l for gases of fluid group 2 (non-hazardous fluids) are subject to article 4, section 3 of the European Pressure Equipment Directive and do not receive the CE marking.

Inspection, installation, operational safety and repeat testing of equipment are controlled as before by national laws.

The equipment relating to safety is described in AD2000, ISO 4126 and EN 14359.

The repeat testing intervals are stipulated in the new German industrial health and safety regulations.

### 4.2. OTHER REGULATIONS

Pressure accumulators which are installed overseas (outside the EU) are supplied with the relevant test certificates required in the country of installation.

HYDAC pressure vessels can be supplied with virtually any test certificate.

Depending on the authority, different material requirements must be observed.

Details of some selected approvals are as follows:

#### 4.2.1 CERTIFICATE CODE = S (ASME)

Since 1985, HYDAC Technology GmbH has been authorised to label pressure equipment that has been manufactured in compliance with the ASME regulations with the "ASME" certification mark.



Such pressure equipment may be placed on the market in the jurisdiction (application area) of the National Board of Boiler and Pressure Vessel Inspectors.

#### 4.2.2 CERTIFICATE CODE = P (KHK certificate)

For the Japanese market, HYDAC Technology GmbH has had approval as a "Self Inspecting Manufacturer" since the year 2000. Consequently, HYDAC is authorised to manufacture and test pressure vessels for the Japanese market and to import them into Japan.

#### 4.2.3 CERTIFICATE CODE = A9 (MANUFACTURER LICENSING CHINA)

Since 1998 HYDAC Technology GmbH has had approval from the Chinese authority "SELO" as a manufacturer of pressure vessels and valves.

#### 4.2.4 CERTIFICATE CODE = A11 (KGS code)

Since concluding the registration procedure in 2012, HYDAC Technology GmbH is authorised to supply pressure vessels and safety equipment according to the Korean Gas Safety (KGS) code for Korea.

#### 4.2.5 CERTIFICATE CODE = A6 (TR-CU)

Since 2014, the TR-CU 032/2013 regulation (technical regulation of the customs union "on the safety of pressure equipment") has been applied for the countries of the Eurasian Economic Community.

HYDAC Technology GmbH has been certified in accordance with the regulation to supply its product range.

## 4.3. CERTIFICATES

The following table lists the codes recommended for use in the model code for different countries of installation.

The country of installation must be stated at the time of ordering (see code in Model code for the particular product: Certification code = CC).

Countries not included in the list may be possible on request. Alternative test certificates and differing values may also be possible on request.

European member states and EFTA states	Certificate code (CC)
Austria	
Belgium	
Bulgaria	
Cyprus	
Czech Republic	
Denmark	
Estonia	
Finland	
France	
Germany	
Greece	
Hungary	
Iceland	
Ireland	
Italy	U
Latvia	
Lithuania	
Luxembourg	
Malta	
Netherlands	
Norway	
Poland	
Portugal	
Romania	
Slovakia	
Slovenia	
Spain	
Sweden	
Switzerland	

A selection of other countries	Certificate code (CC)
Australia	F <sup>1)</sup>
Belarus	A6
Canada	S1 <sup>1)</sup>
China	A9
Great Britain	Y
Hong Kong	A9
Japan	P
Korea (Republic of)	A11
New Zealand	T
Russia	A6
South Africa	S2
Turkey	U
Ukraine	A10
USA	S

<sup>1)</sup> Registration required in the individual territories or provinces

Others on request

## 4.4. TRANSPORT REGULATIONS FOR PRESSURE VESSELS

The transport of gas-filled hydraulic accumulators must be carried out with the utmost care and in compliance with all relevant transport safety regulations (e.g. on public roads, dangerous goods regulations etc.).

**The operating instructions must be observed!**

## 5. PRODUCT OVERVIEW

The following overview shows the standard product range of HYDAC hydraulic accumulators.  
For other models and sizes, please contact us.

### 5.1. BLADDER ACCUMULATORS



#### 5.1.1 Low pressure

Permitted operating pressure:  
up to 40 bar  
Nominal volume:  
2.5 ... 450 l



#### 5.1.2 Standard design

Permitted operating pressure:  
up to 550 bar  
Nominal volume:  
0.5 ... 200 l



#### 5.1.3 High pressure

Permitted operating pressure:  
up to 1000 bar  
Nominal volume:  
1 ... 50 l  
Other volumes on request

### 5.2. PISTON ACCUMULATORS



#### 5.2.1 Standard design

Permitted operating pressure:  
210 ... 350 bar  
Nominal volume:  
up to 3300 l



#### 5.2.2 Series SK280

Permitted operating pressure:  
280 bar  
Nominal volume:  
0.16 ... 15 l  
Other volumes on request



#### 5.2.3 High pressure

Permitted operating pressure:  
up to 1000 bar  
Nominal volume:  
up to 50 l

### 5.3. DIAPHRAGM ACCUMULATORS



Permitted operating pressure:  
up to 750 bar  
Nominal volume:  
up to 4 l

#### Advantages of HYDAC bladder accumulators:

- High discharge speeds
- No pressure difference between the fluid side and gas side
- Compact, low-maintenance
- High charge and discharge frequencies

#### Advantages of HYDAC piston accumulators:

- Minimal pressure difference between the fluid side and gas side
- Large effective volumes
- Variable installation positions
- Monitoring of the piston position is possible using a variety of systems
- Particularly suitable for back-up configurations
- Extreme flow rates
- No sudden discharge of gas when seals are worn

#### Advantages of HYDAC diaphragm accumulators:

- Function-optimised and weight-optimised design
- Unlimited choice of installation positions
- No pressure difference between fluid and gas side
- Low-maintenance and long service life



## 5.4. METAL BELLOWS ACCUMULATORS



Permitted operating pressure:  
40 ... 210 bar  
Nominal volume:  
0.16 ... 6.2 l  
Other volumes on request

## 5.5. HYDRAULIC DAMPERS



Permitted operating pressure:  
10 ... 1000 bar  
Nominal volume:  
0.075 ... 450 l

## 5.6. SILENCERS



Permitted operating pressure:  
up to 330 bar  
Nominal volume:  
0.4 ... 4.7 l  
Other volumes on request

## 5.7. SPECIAL ACCUMULATORS



### 5.7.1 Weight-reduced accumulators

Over 80 % reduction in weight compared to equivalent carbon steel accumulators. The selection ranges from weight-optimised accumulators, e.g. by using aluminium, through to light-weight and ultra light-weight accumulators.



### 5.7.2 Spring accumulators

Fitted with a spring. The energy is produced by the spring force instead of gas. Further information on request.

## 5.8. ACCUMULATOR STATIONS



HYDAC supplies fully assembled accumulator stations which are ready for operation, complete with all the necessary valve controls, pipe fittings and safety devices

- as an individual accumulator unit or
- in a back-up version with nitrogen bottles to increase the effective volume.

### Advantages of the HYDAC metal bellows accumulator:

- Durable
- Wear-free
- Media resistance over a wide range of temperatures

See also flyer:

- Heavy diesel engines – Metal bellows accumulators No. 10.129.1



### Advantages of the HYDAC hydraulic damper:

- Reduces pressure pulsations
- Improves the suction performance of displacement pumps
- Prevents pipe breaks and damage to valves
- Protects measuring equipment and its function in the system
- Reduces noise levels in hydraulic systems
- Lowering of servicing and maintenance costs
- Increase in service life of the system

See also flyer:

- Weight-reduced accumulators No. 3.305



### Advantages of the HYDAC spring accumulator:

- No gas losses
- Linear p-V characteristic curve
- Functionality is independent of temperature influences

## 5.9. ACCUMULATOR ACCESSORIES



### 5.9.1 Hydraulic accumulators with back-up nitrogen bottles

HYDAC also offers nitrogen bottles which can be used to back up bladder and piston accumulators. Nitrogen bottles used as back-ups increase the gas volume in the accumulator.



### 5.9.2 FPU

#### Charging and testing unit

Charging hose, pressure gauge and pressure reducer for HYDAC and other brands of accumulator, up to 800 bar pre-charge pressure – higher pressures on request.



### 5.9.3 SAF/DSV

#### Safety and shut-off block

Nominal size:

8 ... 50

Permitted operating pressure:  
800 bar

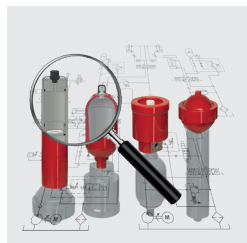
Fluid-side protection, pressure relief valve, unloading to tank and separation of the accumulator from the fluid-side system.



### 5.9.4 Safety devices

- GSV6 gas safety valve
- Temperature fuse
- Burst disc
- Gas safety block

All the above are safety equipment for HYDAC accumulator products.



### 5.9.5 Monitoring systems for hydraulic accumulators

- Bladder integrity system
- Piston position monitoring systems
- Pre-charge pressure monitoring



### 5.9.6 Mounting elements for accumulators

Accumulator mounting sets, clamps and consoles for efficient installation of hydraulic accumulators.



### 5.9.7 ACCUSET-SB

Permitted operating pressure:  
330 bar

Nominal volume:  
1 ... 50 l

### Advantages of HYDAC nitrogen bottles:

- Inexpensive increase in the accumulator volume
- This leads to smaller accumulators with the same gas volume

Further products related to "charging and testing" are available in the nitrogen charging units (N2 servers) section – see catalogue section:

- Nitrogen charging units N2-Server No. 2.201

Portable, mobile and stationary versions are available. We are always happy to give advice.

### Advantages of the HYDAC safety and shut-off block:

- Minimal space requirements and maintenance costs
- Minimal pipework required (as a rule, 1 SAF replaces up to 10 individual pipe connections)
- Considerable reduction in installation time
- Can be adapted to suit various different types and different brands of accumulator
- Can be adapted to additional valves (pilot-operated check valves, flow control valves, etc.)

### Advantages of the HYDAC gas safety block:

- A gas safety block simplifies the operation of the hydraulic accumulator on the gas side and also offers the possibility of installing the above safety equipment using the various ports.

See also flyer:

- Monitoring systems for hydraulic accumulators No. 3.506

Please make use of our online tool **Accu-MOUNT** to help you select the suitable mounting equipment for your hydraulic accumulator.

**[www.hydac.com](http://www.hydac.com) » Service » Online tools » Tools for Hydraulic Accumulators**

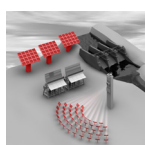
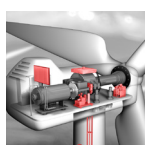
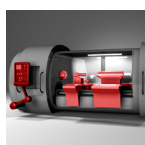
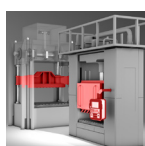
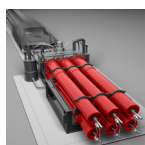
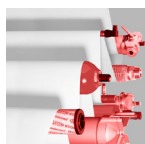
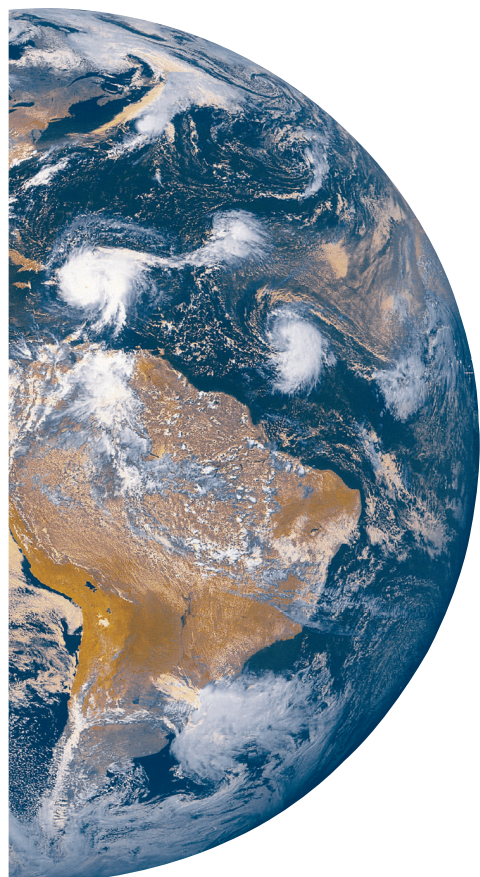
## 6. INDUSTRIES AND APPLICATIONS

HYDAC Technology GmbH is represented in almost all industries of the world which use hydraulic accumulators.

The main sectors are industrial hydraulics, mobile technology and process technology.

Further applications in the oil & gas/offshore industry and energy efficient applications involving hydraulic accumulators are gaining in importance.

The following list summarises the ways that accumulators/dampers are typically used in these industries:



### 6.1. INDUSTRIAL HYDRAULICS

#### Automotive industry

- General industrial hydraulics, e.g. energy storage

#### Mining machinery

- Hydraulic accumulators, e.g. in suspended monorails
- Pulsation damping
- Comfort and safety for mobile machines

#### Iron and steel industry

- Accumulators to maintain the pressure in rolling mills
- Blast furnace hydraulics

#### Plastics machinery

- Accumulator stations for storing energy during the injection moulding process
- Pulsation damping on the hydraulic drive

#### Paper industry

- Energy storage for emergency functions in friction bearing hydraulics
- Energy storage in high/low pressure power units

#### Test rigs and test systems

- Energy storage on crash test systems
- Pulsation damping on servo hydraulic axes

#### Thermal power plants

- Emergency supply for turbine control system
- Pulsation damping on pumps
- Lubrication, control and seal oil supply

#### Forming machines

- Hydraulic accumulators used to store energy to support the pump

#### Machine tools

- Support for the hydraulics for tool drive or tool change
- Energy storage in the compact hydraulics of machining centres

#### Wind turbines

- Hydraulic accumulators in the pitch control system
- Support of the pitch drive
- Accumulators on braking units

#### Solar power

- Support of hydraulic solar tracker (panel adjustment)





## 6.2. MOBILE TECHNOLOGY

### Automotive technology

- Automatic and manual transmission
- Automatic clutch systems
- Engine management systems
- Accumulators for turbocharger emergency lubrication



### Construction machines

- Accumulators in braking systems
- Chassis damping
- Bucket damping
- Boom damping on mobile cranes



### Agricultural and forestry machines

- Front loader damping
- Accumulators in tractor suspension systems
- Stone strike protection for ploughs
- Boom suspension on field sprayers



### Municipal machines

- Energy storage
- Boom damping
- Pulsation dampers
- Chassis damping



### Lifting & material handling technology

- Noise damping
- Energy recovery
- Braking systems



### Shipping

- Water treatment plants (pump support)
- Pulsation damping on diesel engines
- Heave compensation (cranes)
- Emergency function for lifeboats

## 6.3. PROCESS TECHNOLOGY

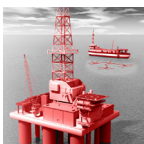
### Chemical industry

- Energy storage and pulsation damping on dosing pumps
- Suction flow stabilisation on the suction side of pumps



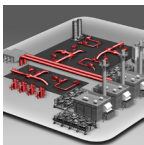
### Loading stations / refineries

- Shock absorption for valve closing
- Pulsation damping on piping



### Offshore / Oil & Gas

- Accumulators to support valve closing systems
- Energy storage for deep sea rams
- Blow Out Preventers (BOP)
- Emergency function for safety systems
- Accumulators on wellhead control systems



### Pipeline construction

- Energy storage for emergency actuation of valve stations
- Compressor stations

## 7. WEBSITE

Please visit us at: [www.hydac.com](http://www.hydac.com)

Browse the **Product catalogue** under **Hydraulic accumulators**.

Download our extensive documentation from our Download Center in the product category **Hydraulic accumulators**. You can find brochures, operating instructions, assembly and repair instructions and further product information in different languages.

CAD models are directly linked to the product and can be downloaded in the appropriate formats.

<https://www.hydac.com/en/online-tools/download-center>

Our online tool **ASPlight** facilitates quick and simple input, calculation and evaluation of the required accumulator parameters – see section 9.3.

Further tools, such as the **p<sub>0</sub>-calculator** or **Accu-MOUNT** can also be found at the same location.

## 8. SPECIFICATION FORMS

The specification forms on the following pages are designed to help you pre-select the right hydraulic accumulator or damper for your application.

You can also do this online: download from the HYDAC product catalogue directly under **Hydraulic accumulators** as an online PDF.

The areas highlighted in green constitute the minimum information required for a response or calculation.

# GENERAL ACCUMULATOR SPECIFICATION FORM (PAGE 1/2)

(Subject to technical modifications, **mandatory field**)

Company:		Location:	
Surname, first name:		Project name:	
E-mail:		Requirement:	_____ pieces / year
Telephone no.:		as	<input type="checkbox"/> spare part <input type="checkbox"/> original equipment

## Accumulator type

- ☐ Bladder accumulator  
☐ Piston accumulator  
☐ Diaphragm accumulator  
☐ Metal bellows accumulator  
☐ \_\_\_\_\_

## System data

Operating pressure

Min. \_\_\_\_\_ bar Max. \_\_\_\_\_ bar

Pre-charge pressure at 20 °C (nitrogen) <sup>1)</sup>

\_\_\_\_\_ bar

Ambient temperature

Min. \_\_\_\_\_ °C Max. \_\_\_\_\_ °C

Operating temperature

Min. \_\_\_\_\_ °C Max. \_\_\_\_\_ °C

Complete cycle time

\_\_\_\_\_ s

## Material of the accumulator <sup>2)</sup>

Accumulator shell

\_\_\_\_\_

Fluid port

\_\_\_\_\_

Elastomer

\_\_\_\_\_

Remarks:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Spare parts/accessories are available at [www.hydac.com](http://www.hydac.com) » All products » Hydraulic accumulators

## Fluids/medium

Fluid

\_\_\_\_\_

Density

Min. \_\_\_\_\_ °C \_\_\_\_\_ kg/m<sup>3</sup>

Max. \_\_\_\_\_ °C \_\_\_\_\_ kg/m<sup>3</sup>

Viscosity at 20 °C

\_\_\_\_\_ cSt

Viscosity at operating temperature

\_\_\_\_\_ cSt

## Additional Information

Installation dimensions (height x Øa)

\_\_\_\_\_ mm

Fluid port

☐ Flange \_\_\_\_\_

☐ Thread \_\_\_\_\_

Gas port

☐ M28x1.5 ☐ 7/8-14UNF

☐ \_\_\_\_\_

Coating/finish

☐ Internal \_\_\_\_\_

☐ External \_\_\_\_\_

## Further information

Industry

\_\_\_\_\_

Country of installation

\_\_\_\_\_

Approval

\_\_\_\_\_

Specification

\_\_\_\_\_

## Fluid demand diagram

- ☐ ONE pump and ONE consumer

Accumulator discharge rate

\_\_\_\_\_ l/min

Accumulator discharge time

\_\_\_\_\_ s

Flow rate of the pump

\_\_\_\_\_ l/min

- ☐ Pump runs continuously

- ☐ Pump starts after discharge

- ☐ SEVERAL pumps and/or consumers  
(see sheet 2, incl. example)

<sup>1)</sup> See catalogue section No. 3.000,  
section on sizing

<sup>2)</sup> Dependent on operating temperature and/or fluid  
resistance

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# GENERAL ACCUMULATOR SPECIFICATION FORM (PAGE 2/2)

(Subject to technical modifications, **mandatory field**)

## Fluid demand diagram for several pumps and/or consumers

$Q_v$  = consumer flow rate [l/s]

$E_v$  = switch-on time of consumer [s]

$A_v$  = switch-off time of consumer [s]

$E_p$  = switch-on time of pump [s]

$A_p$  = switch-off time of pump [s]

Number of consumers \_\_\_\_\_

$Q_{v1}$  = \_\_\_\_\_  $E_{v1}$  = \_\_\_\_\_  $A_{v1}$  = \_\_\_\_\_

$Q_{v2}$  = \_\_\_\_\_  $E_{v2}$  = \_\_\_\_\_  $A_{v2}$  = \_\_\_\_\_

$Q_{v3}$  = \_\_\_\_\_  $E_{v3}$  = \_\_\_\_\_  $A_{v3}$  = \_\_\_\_\_

$Q_{v4}$  = \_\_\_\_\_  $E_{v4}$  = \_\_\_\_\_  $A_{v4}$  = \_\_\_\_\_

Number of pumps \_\_\_\_\_

$Q_{p1}$  = \_\_\_\_\_  $E_{p1}$  = \_\_\_\_\_  $A_{p1}$  = \_\_\_\_\_

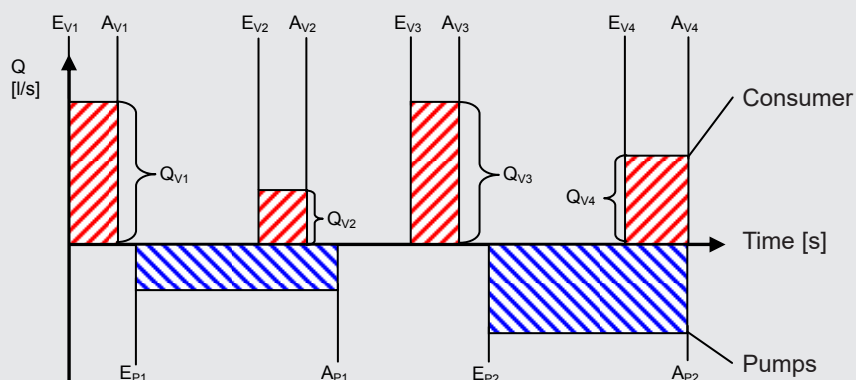
$Q_{p2}$  = \_\_\_\_\_  $E_{p2}$  = \_\_\_\_\_  $A_{p2}$  = \_\_\_\_\_

$Q_{p3}$  = \_\_\_\_\_  $E_{p3}$  = \_\_\_\_\_  $A_{p3}$  = \_\_\_\_\_

$Q_{p4}$  = \_\_\_\_\_  $E_{p4}$  = \_\_\_\_\_  $A_{p4}$  = \_\_\_\_\_



### Example



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# SHOCK ABSORBER SPECIFICATION FORM (SHEET 1/2)

(Subject to technical modifications, **mandatory field**)

Company:		Location:	
Surname, first name:		Project name:	
E-mail:		Requirement:	_____ pieces / year
Telephone no.:		as	<input type="checkbox"/> spare part <input type="checkbox"/> original equipment

## Accumulator type

- ☐ Bladder accumulator  
☐ Piston accumulator  
☐ Diaphragm accumulator  
☐ Metal bellows accumulator  
☐ \_\_\_\_\_

## System data

Operating pressure

Min. \_\_\_\_\_ bar Max. \_\_\_\_\_ bar

Pre-charge pressure at 20 °C (nitrogen) <sup>1)</sup>

\_\_\_\_\_ bar

Ambient temperature

Min. \_\_\_\_\_ °C Max. \_\_\_\_\_ °C

Operating temperature

Min. \_\_\_\_\_ °C Max. \_\_\_\_\_ °C

Complete cycle time

\_\_\_\_\_ s

## Material of the hydraulic accumulator <sup>2)</sup>

Accumulator shell

\_\_\_\_\_

Fluid port

\_\_\_\_\_

Elastomer

\_\_\_\_\_

Remarks:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## Fluids/medium

Fluid

\_\_\_\_\_

Density

Min. \_\_\_\_\_ °C \_\_\_\_\_ kg/m<sup>3</sup>

Max. \_\_\_\_\_ °C \_\_\_\_\_ kg/m<sup>3</sup>

Viscosity at 20 °C

\_\_\_\_\_ cSt

Viscosity at operating temperature

\_\_\_\_\_ cSt

## Additional Information

Installation dimensions (height x Øa)

\_\_\_\_\_ mm

Fluid port

☐ Flange \_\_\_\_\_

☐ Thread \_\_\_\_\_

Gas port

☐ M28x1.5 ☐ 7/8-14UNF

☐ \_\_\_\_\_

Coating/finish

☐ Internal \_\_\_\_\_

☐ External \_\_\_\_\_

<sup>1)</sup> See catalogue section No. 3.000, section on sizing

<sup>2)</sup> Dependent on operating temperature and/or fluid resistance

## Further information

Industry

\_\_\_\_\_

Country of installation

\_\_\_\_\_

Approval

\_\_\_\_\_

Specification

\_\_\_\_\_

## Pump data

Zero-delivery head

\_\_\_\_\_ m

Pressure of the pump at the operating point

\_\_\_\_\_ bar

Flow rate of the pump at the operating point

\_\_\_\_\_ l/min

## Cause of the pressure shock

☐ When pump starts

☐ When pump switches off

☐ When check valves close

☐ \_\_\_\_\_

## Pipe data

Please provide pipe data on the next page.

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# SHOCK ABSORBER SPECIFICATION FORM (SHEET 2/2)

(Subject to technical modifications, **mandatory field**)

## General pipe data

Material of pipe	<input type="text"/>	Total closing time of the valve	<input type="text"/> s
Max. permitted pressure of the pipe	<input type="text"/> bar	Speed of sound in the system	<input type="text"/> m/s

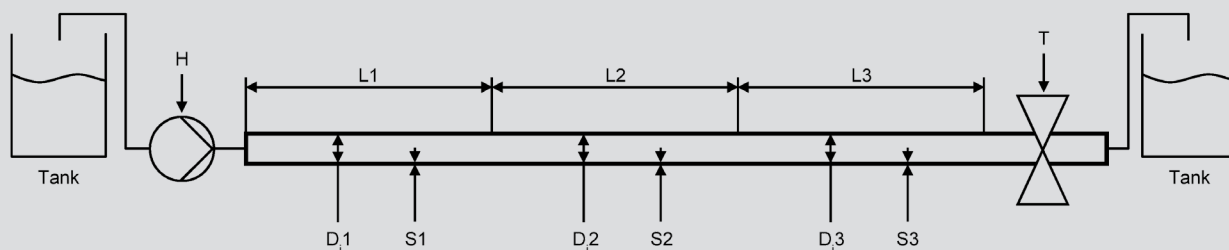
## Information on pipe sections

L = Length of pipe [m]  
 D<sub>i</sub> = Internal diameter of the pipe [mm]  
 S = Wall thickness of pipe [mm]  
 H = zero head of the pump [m]  
 T = closing time of the valve [s] (effective roughly. 30 % of the total closing time)

Number of different pipes

L1 = <input type="text"/> m	D <sub>i1</sub> = <input type="text"/> mm	S1 = <input type="text"/> mm	L4 = <input type="text"/> m	D <sub>i4</sub> = <input type="text"/> mm	S4 = <input type="text"/> mm
L2 = <input type="text"/> m	D <sub>i2</sub> = <input type="text"/> mm	S2 = <input type="text"/> mm	L5 = <input type="text"/> m	D <sub>i5</sub> = <input type="text"/> mm	S5 = <input type="text"/> mm
L3 = <input type="text"/> m	D <sub>i3</sub> = <input type="text"/> mm	S3 = <input type="text"/> mm	L6 = <input type="text"/> m	D <sub>i6</sub> = <input type="text"/> mm	S6 = <input type="text"/> mm

## Example



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# PULSATION DAMPER SPECIFICATION FORM

(Subject to technical modifications, **mandatory field**)

Company:	<input type="text"/>	Location:	<input type="text"/>
Surname, first name:	<input type="text"/>	Project name:	<input type="text"/>
E-mail:	<input type="text"/>	Requirement:	<input type="text"/> pieces/year
Phone no.:	<input type="text"/>	as	<input type="checkbox"/> spare part <input type="checkbox"/> original equipment

## Accumulator type

- ☐ Bladder accumulator
- ☐ Piston accumulator
- ☐ Diaphragm accumulator
- ☐ Metal bellows accumulator
- ☐

## System data

Operating pressure

Min.  bar Max.  bar

Pre-charge pressure at 20 °C (nitrogen) <sup>1)</sup>

bar

Ambient temperature

Min.  °C Max.  °C

Operating temperature

Min.  °C Max.  °C

Complete cycle time

s

## Material of the hydraulic accumulator <sup>2)</sup>

Accumulator shell

Fluid port

Elastomer

Remarks:

## Fluids/medium

Fluid

Density

Min.  °C  kg/m<sup>3</sup>

Max.  °C  kg/m<sup>3</sup>

Viscosity at 20 °C

cSt

Viscosity at operating temperature

cSt

## Additional Information

Installation dimensions (height x Øa)

mm

Fluid port

☐ Flange

☐ Thread

Gas port

☐ M28x1.5 ☐ 7/8-14UNF

☐

Coating/finish

☐ Internal

☐ External

Application

☐ pressure side ☐ suction side

Required residual pulsation  %

Result  l gas volume

## Further information

Industry

Country of installation

Approval

Specification

## Pump and system data

Operating/pump pressure

bar

Flow rate

l/min

Rotational speed

1/min

Number of displacement elements

☐ single ☐ double acting

Pump factor  optional

Stroke volume

for piston pump

d = Ø piston  mm

H = stroke length  mm

for diaphragm pumps, see manufacturer's specifications

<sup>1)</sup> See catalogue section No. 3.000, section on sizing

<sup>2)</sup> Dependent on operating temperature and/or fluid resistance

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# VOLUME COMPENSATION SPECIFICATION FORM

(Subject to technical modifications, **mandatory field**)

Company:		Location:	
Surname, first name:		Project name:	
E-mail:		Requirement:	_____ pieces/year
Telephone no.:		as	<input type="checkbox"/> spare part <input type="checkbox"/> original equipment

## Accumulator type

- ☐ Bladder accumulator  
☐ Piston accumulator  
☐ Diaphragm accumulator  
☐ Metal bellows accumulator  
☐ \_\_\_\_\_

## System data

Operating pressure

Min. \_\_\_\_\_ bar Max. \_\_\_\_\_ bar

Pre-charge pressure at 20 °C (nitrogen) <sup>1)</sup>  
\_\_\_\_\_ bar

Ambient temperature

Min. \_\_\_\_\_ °C Max. \_\_\_\_\_ °C

Operating temperature

Min. \_\_\_\_\_ °C Max. \_\_\_\_\_ °C

Temperature rise time

\_\_\_\_\_ min

## Material of the hydraulic accumulator <sup>2)</sup>

Accumulator shell

\_\_\_\_\_

Fluid port

\_\_\_\_\_

Elastomer

\_\_\_\_\_

## Fluids/medium

Fluid

\_\_\_\_\_

Density

Min. \_\_\_\_\_ °C \_\_\_\_\_ kg/m<sup>3</sup>

Max. \_\_\_\_\_ °C \_\_\_\_\_ kg/m<sup>3</sup>

Viscosity at 20 °C

\_\_\_\_\_ cSt

Viscosity at operating temperature

\_\_\_\_\_ cSt

Volume expansion coefficient

\_\_\_\_\_ 1/°C

## Additional Information

Installation dimensions (height x Øa)

\_\_\_\_\_ mm

Fluid port

☐ Flange \_\_\_\_\_

☐ Thread \_\_\_\_\_

Gas port

☐ M28x1.5 ☐ 7/8-14UNF

☐ \_\_\_\_\_

Coating/finish

☐ Internal \_\_\_\_\_

☐ External \_\_\_\_\_

## Further information

Industry

\_\_\_\_\_

Country of installation

\_\_\_\_\_

Approval

\_\_\_\_\_

Specification

\_\_\_\_\_

## Data on the section of the shut off pipe system

Pipe volume

\_\_\_\_\_ l

Max. shut-off pressure

\_\_\_\_\_ bar

Pipe material

\_\_\_\_\_

Permitted pressure with accumulator

\_\_\_\_\_ bar

Pipe temperature

Min. \_\_\_\_\_ °C Max. \_\_\_\_\_ °C

Remarks:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Spare parts/accessories are available at [www.hydac.com](http://www.hydac.com) » All products » Hydraulic accumulators

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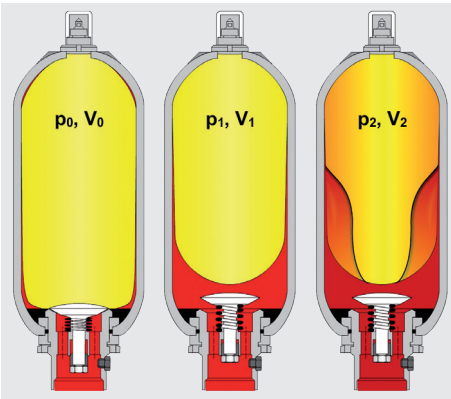
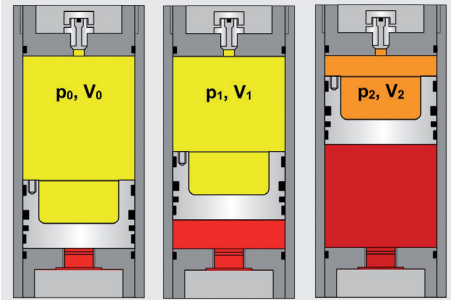
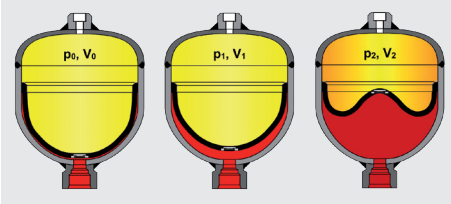
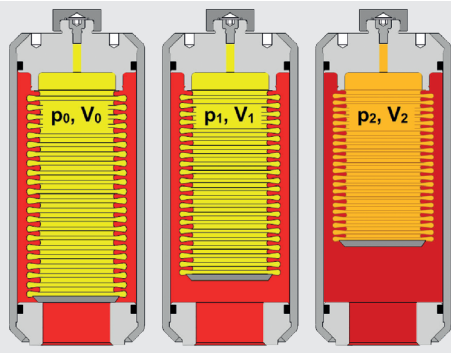
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## 9. SIZING

### 9.1. DEFINITION OF VARIABLES FOR SIZING A HYDRAULIC ACCUMULATOR

Function	Limits for gas pre-charge pressure
<b>Bladder accumulators</b>  <p>1. 2. 3.</p>	$p_0 \leq 0.9 \cdot p_1$ with a permitted pressure ratio of $p_2 : p_0 \leq 4 : 1$  For HYDAC low pressure accumulators, the following must also be taken into account: Type SB40: $p_{0 \max} = 20 \text{ bar}$ Type SB35H: $p_{0 \max} = 10 \text{ bar}$
<b>Piston accumulators</b>  <p>1. 2. 3.</p>	$p_{0, \min} \geq 2 \text{ bar}$
<b>Diaphragm accumulators</b>  <p>1. 2. 3.</p>	a) Permitted pressure ratio: $p_2 : p_0$ <u>Weld type:</u> The pressure ratio of the weld-type diaphragm accumulators is between 4 : 1 and 8 : 1, depending on the design – see catalogue section Diaphragm accumulators, No. 3.100, section 4.2.1 <u>Screw type:</u> All sizes: 10 : 1 Other pressure ratios on request b) $p_0 \leq 0.9 \cdot p_1$
<b>Metal bellows accumulators</b> (e.g. corrugated bellow version)  <p>1. 2. 3.</p>	The max. permitted or optimal pre-charge pressure of a metal bellows accumulator (with corrugated or diaphragm bellows) must be determined for each application and each design version by providing information on the particular operating conditions and consulting with HYDAC.

The specified values are maximum values and must not be considered as referring to a prolonged load. The tolerable pressure ratio is influenced by the geometry, temperature, fluid, flow rate and gas losses caused by physical properties.

1. The accumulator is pre-charged with nitrogen. The separation element (piston, bladder, diaphragm, metal bellows) shuts off the fluid port.
2. Temperature effects must be taken into account when choosing the minimum operating pressure. The minimum operating pressure must also be higher than the gas pre-charge pressure ( $p_1 > p_0$ ). This should prevent the separation element from striking the fluid port every time fluid is discharged.
3. Once the max. operating pressure is reached, the effective volume  $\Delta V$  is available in the accumulator:

$p_0$  = pre-charge pressure  
 $p_1$  = minimum operating pressure  
 $p_2$  = maximum operating pressure

$V_0$  = effective gas volume  
 $V_1$  = gas volume at  $p_1$   
 $V_2$  = gas volume at  $p_2$

$t_0$  = pre-charge temperature  
 $t_{\min}$  = min. operating temperature  
 $t_{\max}$  = max. operating temperature

## 9.2. SELECTING THE PRE-CHARGE PRESSURE

The selection of the pre-charge pressure determines the accumulator capacity. In order to obtain optimum utilisation of the accumulator volume, the following pre-charge pressures are recommended:

### 9.2.1 Recommended values

**For energy storage:**

$$p_{0,t \max} = 0.9 \cdot p_1$$

**For shock absorption:**

$$p_{0,t \max} = 0.6 \text{ to } 0.9 \cdot p_m$$

( $p_m$  = average operating pressure for free flow)

**For pulsation damping:**

$$p_{0,t \max} = 0.6 \cdot p_m$$

( $p_m$  = average operating pressure)

or

$$p_{0,t \max} = 0.8 \cdot p_1$$

(for several operating pressures)

During operation, the separation element (piston, bladder, diaphragm, corrugated bellows) must not touch the fluid-side connection.

Since the volume of the gas increases as the temperature increases, the pre-charge pressure must be determined at the maximum operating temperature using the recommended values. The accumulator must be charged with the pre-charge pressure which corresponds to the charging temperature.

### 9.2.2 Limits for gas pre-charge pressure

See section 9.1.

### 9.2.3 Temperature effect

So that the recommended pre-charge pressures can be maintained, even at relatively high operating temperatures, the  $p_{0 \text{ charge}}$  for charging and testing cold accumulators must be selected as follows:

$$p_{0, t \text{ charge}} = p_{0, t \max} \cdot \frac{t_{\text{charge}} + 273}{t_{\max} + 273}$$

$t_0 = t_{\text{charge}}$  (pre-charge temperature in °C)

To take the temperature influence into account when sizing accumulators,  $p_0$  at  $t_0$  must be selected as follows:

$$p_{0, t \min} = p_{0, t \max} \cdot \frac{t_{\min} + 273}{t_{\max} + 273}$$

## 9.3. ONLINE TOOLS

The following HYDAC online tools are available at:

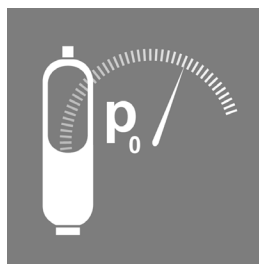
[www.hydac.com](http://www.hydac.com) » Service » Online tools » Tools for Hydraulic Accumulators



### 9.3.1 ASPlight

**ASPlight** is an intelligent application that takes the real gas behaviour into account. It enables you to calculate all the necessary parameters such as pressure, volume and temperature in different units for gases such as nitrogen or helium. Additional information fields help to evaluate the result and determine the type of accumulator.

The **ASPlight** is aimed at users who need to determine the main accumulator parameters in a short space of time.



### 9.3.2 p<sub>0</sub>-calculator

The **p<sub>0</sub>-calculator** is a simple conversion tool for determining the pre-charge pressure ( $p_0$ ) in the hydraulic accumulator at a specific temperature.

All that is needed is the reference pre-charge pressure and the current temperature of the hydraulic accumulator measured on the gas side.

The **p<sub>0</sub>-calculator** takes the real gas behaviour into account. The online tool display is optimised for both smartphones and desktops and is available online around the clock.

The **p<sub>0</sub>-calculator** offers reliability for the inspection and any required correction of the accumulator's pre-charge pressure outside of the reference temperature.



### 9.3.3 Accu-MOUNT

With the **Accu-MOUNT**, the suitable clamps, consoles and accumulator mounting sets can be identified on the basis of the accumulator designation, the part number or its characteristics. These accessories can then be added to the request list.

You can also find links to the corresponding product pages on our website and download 3D models, brochures and other information.

The **Accu-Mount** can find the perfect mounting equipment for HYDAC hydraulic accumulators in an instant.

## 10. NOTE

The information in this brochure relates to the operating conditions and fields of application described.

For applications and/or operating conditions not described, please contact the relevant technical department.

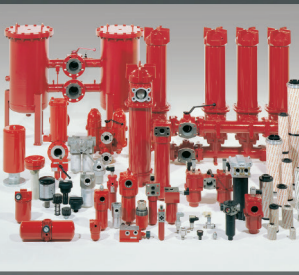
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Accumulators 30.000



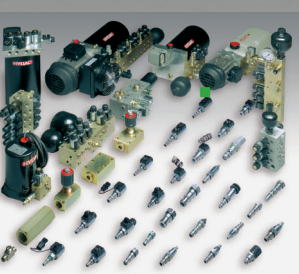
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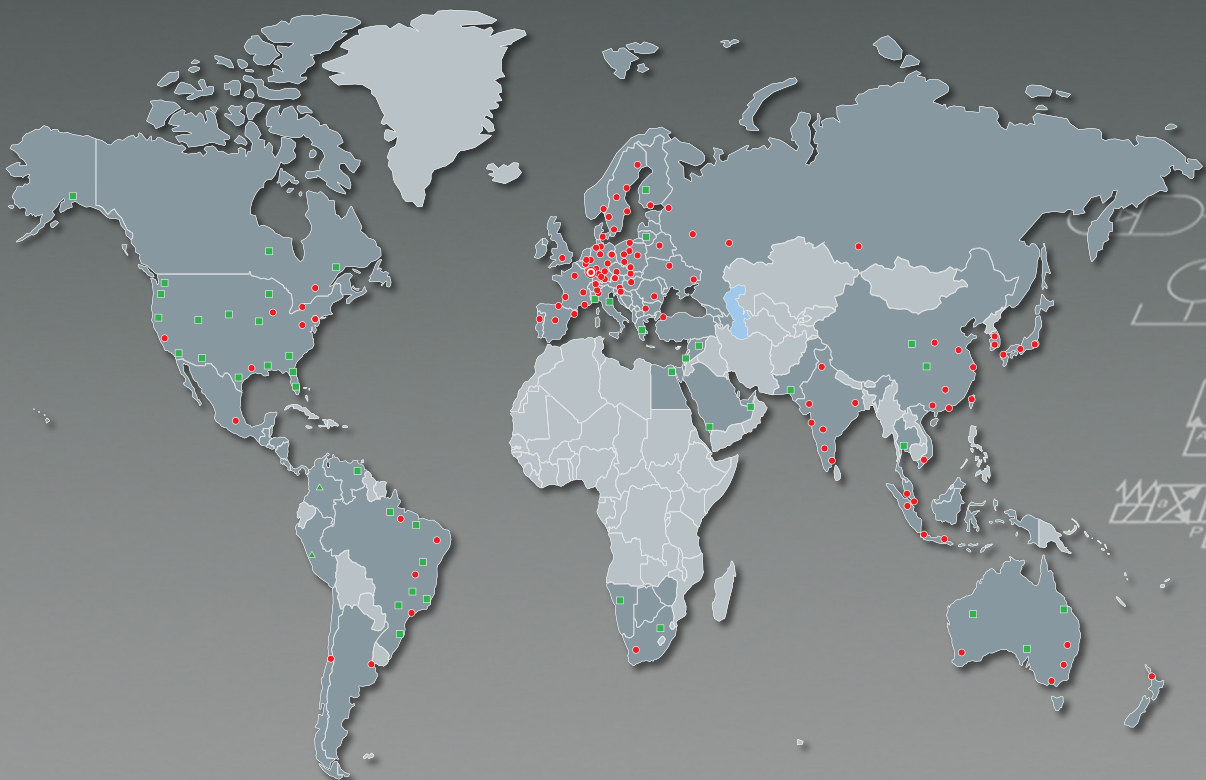


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Cooling Systems 57.000

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